1. Introduction

The International Northern Sea Route Programme (INSROP) was probably the most comprehensive marine transport study ever undertaken. The aim of this 1993-1999 multidisciplinary endeavour was to create a research based knowledge bank covering all relevant aspects of commercial, international shipping on Russia’s Arctic Northern Sea Route (NSR). This objective was pursued through the cooperation of 468 researchers and experts from more than 100 institutions in 14 countries. These carried out 104 projects in addition to an experimental voyage through the NSR and two large international conferences. This work produced 167 peer reviewed working papers and a large number of articles and books governing almost every conceivable, relevant aspect of shipping on the NSR. A total of approximately NOK 56.5 million was used in the course of INSROP, with roughly half provided by the Nippon Foundation/Ship & Ocean Foundation, most of the remainder provided by various Norwegian sponsors, and some additional funding provided by the Russian Federation. The programme was led and coordinated by three principal partners, the Ship & Ocean Foundation (SOF) of Tokyo, Japan, the Central Marine Research and Design Institute (CNIIMF) of St. Petersburg, Russia, and the Fridtjof Nansen Institute (FNI) based in Lysaker, Norway.

As part of policies to open up the Soviet Union, President Mikhail Gorbachev in 1987 announced intentions to give foreign vessels access to Russia’s NSR, sea lanes that could be used both as a shortcut for transit traffic between the northern Atlantic and the northern Pacific, as well as for export of natural resources from the Russian Arctic. This initiative resulted in the formal opening of the NSR to non Soviet vessels on 1 July 1991, only a few months before the U.S.S.R. was dissolved. Russian hopes were high that this new route would attract considerable international shipping, but it was acknowledged that the international shipping industry would probably need more information and analysis prior to committing investments or vessels to a hitherto unknown expanse perceived as high risk. Therefore on the initiative of the Soviet Ministry of Merchant Marine contact was made with FNI in 1988, and agreement subsequently reached to create an international research project governing the NSR. CNIIMF was designated the coordinating institution on the Soviet/Russian side. CNIIMF and FNI produced a pilot study in 1990-1991 which concluded that extensive research was needed, and work continued to develop such a research programme. In 1992 SOF joined the partnership, and in

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1 The overview, comments and editing of this section are carried out by Claes L. Ragner, Administrator at the INSROP Secretariat.
2 All 167 working papers, listed on www.fni.no/insrop, were published without restrictions, and some are still available from FNI where the INSROP Secretariat was located.
3 By 1993-98 exchange rates this equalled approximately USD 8.9 million.
May 1993 the three organizations signed an Agreement for Research Cooperation, together with establishing a Secretariat at FNI to take care of practical coordination.\textsuperscript{5} INSROP was born.

From the start INSROP was designed as a five year research programme, executed in two phases with a review conducted after three years. From early in the process four sub programmes were identified, 1. Natural conditions and ice navigation, 2. Environmental aspects, 3. Trade and commercial shipping factors, and 4. Political, legal and strategic aspects. In August 1995, a summer with exceptionally favourable ice conditions, a successful experimental transit voyage was conducted from Yokohama, Japan to Kirkenes, Norway onboard the Russian ice strengthened cargo vessel, \textit{Kandalaksha}, demonstrating the NSR’s technical feasibility.\textsuperscript{6} Results from the experimental voyage as well as results from INSROP’s Phase I, 1993-1995, were presented at an academic conference in Tokyo, October 1995.\textsuperscript{7} In 1996 an independent evaluation of INSROP’s Phase I was conducted, and while acknowledging the value of the comprehensive database developed during Phase I and recommending proceeding to a Phase II, the main conclusion was that there was a need to integrate and synthesize the many, diverse and multidisciplinary results. Therefore Phase II, 1997-1998, consisted chiefly of four parts, 1. Smaller projects to cover concrete knowledge gaps identified by the evaluation, 2. A simulation project investigating the commercial feasibility of the NSR using historic ice data and various routes, vessel types and tariff models, 3. A geographical information system (GIS) containing all relevant spatial data collected, created and managed by INSROP including ice conditions, routes, meteorology, biology and jurisdiction, and an environmental atlas based on these data; and 4. An integration project to summarize and integrate all the subsequent results.\textsuperscript{8} The final results of INSROP were presented at a NSR User Conference in Oslo, Norway in November 1999.\textsuperscript{9} This also marked the end of INSROP.

The findings current to 1999 along the lines of the INSROP sub programmes, together with projections for each appearing under \textit{visions}, are summarised as follows. At the end appears a section consisting of observations of the personnel indicated reflecting upon the significance of INSROP.

2. \textbf{Considerations of the natural environment, ice navigation and ship technology}\textsuperscript{10}

\textsuperscript{5} INSROP’s early history and organization are described in the \textit{INSROP Newsletter}, Vol. 1, No. 1, November 1993.


\textsuperscript{7} See \textit{Tokyo Symposium ’95}, 722 pp.


\textsuperscript{10} Adapted from L. Brigham et. al., (Chief ed. W. Østreng et. al.), \textit{The Natural and Societal Challenges of the Northern Sea Route – A Reference Work}, pp. 116-20 and 414-8. Comments and editing are added by Professor Hiromitsu Kitagawa, author and editor of this section.
An integration of research governing the natural environment, navigation and operations and ice breaking vessel technology indicated, sea ice covered the length of the NSR in winter with extensive, fast ice prevalent along much of the Russian Arctic coast. The permanent ice extended to the extreme northern points of Severnaya Zemlya and the New Siberian Islands and represented a significant obstacle to winter navigation. By the end of the winter in May all regions of the NSR, 62% - 86% by area, were covered by thick, first year ice. Even during the summer season of minimum extent, ice could be present and could significantly impact vessel traffic. Russian records indicated no NSR region was completely free of ice during summer, and for more than five decades stable, regional ice clusters, ice massifs, had been observed and well documented by specialists in all Russian Arctic coastal seas. The presence of massifs in summer frequently made for difficult ice conditions for navigation in three key regions, the north eastern Kara Sea including the Vil’kitskii Strait, the western Laptev Sea, and the East Siberian Sea and Long Strait. These were obstructed respectively by the Severnaya Zemlya massif, the Taymyr massif and the Ayonskii massif.

Russian records were as well utilised to determine sea ice thicknesses in all NSR regions. Maximum first year thicknesses were observed during April and May, with winter mean thicknesses of 200 centimetre (cm.) observed in the eastern Laptev Sea and western regions of the East Siberian Sea. Mean thickness for the south eastern Kara Sea was 134 cm. and in the Kara Gates Strait 100 cm. January mean thicknesses for all NSR regions was 150 cm. or less. These long term observations of ice thicknesses provided critical information for the design of commercial ice breaking vessels for the NSR.

The Russian Arctic with its broad, shallow, continental shelf presented constraints to marine transportation impacting both transit and regional voyages similarly. Southerly routes traversed numerous shallow straits. Straits through the New Siberian Islands was a trouble spot with shoals of depths of less than four metre (m.) in the eastern approach to the Dmitrii Laptev Strait and less than nine m. in the Sannikov Strait. Least depths of the fairways respectively were approximately 10 - 11 m. and 14 m. Routes north of the islands ran through regions of heavy multi year ice. The geography of the coastal seas and Siberian rivers favoured development and operation of shallow draught vessels. Due to manoeuvrability and routing through an ice covered strait, consideration was required given to the dual constraints of shallow water and ice location, and frequently along the NSR the route of greatest depth was not accessible due to prevailing ice conditions.

Draught and breadth limitations affected vessel design. If a cargo vessel was to call at ports, draught and breadth were limited to 9 m. and 30 m., and cargo capacity necessarily would be limited to 20,000 deadweight ton (dwt.). For more northerly routes without port calls a maximum draught of 12.5 m. and breadth of 30 m. could yield a maximum cargo capacity of 50,000 dwt. This ship design

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11 R. Douglas Brubaker, *The Russian Arctic Straits*, (Leiden, Martinus Nijhoff Publishers, 2005), p. 12. The Dmitrii Laptev Strait in the eastern approach limited draughts to not more than 3.3 m., and the strait was normally not used by loaded vessels.
model tested under INSROP achieved an ice breaking capability of 1.2 m. level ice at three knots (kts.). Such potential NSR cargo vessels were approximately one third the size of vessels sailing the Suez Canal. A breadth of 30 m. was utilised as maximum since the Arktika class nuclear ice breaker with 28 m. breadth was considered likely to remain the primary ice breaker escort conceivably until approximately 2019. Future ice breakers and ice breaking cargo vessels would have larger breadths, thereby increasing cargo capacities. However, comprehensive analyses of construction costs and economic feasibility of larger vessels were required. A proposal included in the near future to design and operate ice breaking vessels under the 30 m. maximum breadth, and once operational and economic successes were established, planning large vessels.

Two ice breaking cargo class ships, the Russian, Finnish built, Norilsk SA-15 vessels and the Finnish Lunami class tankers were to provide benchmarks for future NSR commercial vessels. The tanker Uikku mid September 1997 made the first transit by a Western merchant ship of the entire NSR. Both types were capable of operation without ice breaker escort along regions of the NSR in summer. Comprehensive assessments of ice breaking capability and hull strength of these two types became available in INSROP, and documentation was also available on SA-15 performance in a wide variety of ice concentrations and snow conditions. SA-15 vessels could operate continuously in .8 m. level ice at 5 kts., and when escorted in 2 m. ice, the SA-15 vessels could maintain 2 kts. astern the Arktika class ice breakers.

The Russian Arctic and Antarctic Research Institute (AARI) maintained an extensive, automatic Arctic ice information system as an integral component of the NSR, and Russian and non Russian satellite data were integrated to produce near term and long term ice and meteorological forecasts. The automatic ice classification of satellite synthetic aperture radar (SAR) images including ERS and RADARSAT was predicted likely to become increasingly routine at ice centres and aboard many vessels. The Russian National Sea Ice Data Bank maintained by AARI represented a valuable resource for producing forecasts, analysing climatic changes and impacts on sea ice, as well as planning the future of the NSR.

Improved sea ice monitoring and communications were to continue to enhance operations along the NSR. Demonstrations indicated the value of ERS and RADARSAT SAR images transmitted to Russian escort ice breakers. A new SAR receiving station was required in the Russia Arctic so that SAR images including future ENVISAT data as well as future RADARSAT could be received for the entire NSR. Additionally it was necessary to better merge various satellite SAR, visible and

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12 Respectively, European Remote Sensing Satellite (ERS) and Radar Satellite (RADARSAT) system. The latter was developed by Canada to monitor global environmental changes. In addition the European Environmental Satellite (ENVISAT) launched in 2002 is the largest earth observation spacecraft providing continuous observations and monitoring of the Earth’s land, atmosphere, oceans and ice caps. Professor E. Gold, ‘E-mail,’ 29 March 2008.

13 Professor H. Kitagawa, ‘E-mail,’ 26 March 2008, notes the prediction holds as long as the definition of ice classification was applied to ice age, ie. first year ice, multi year ice or ice extent. Satellite images could not alone provide reliable or satisfactory information of appropriate vessel routings, and captains of vessels needed considerable experience in analysing satellite images for obtaining useful information related to routings.
microwave images to improve ice forecasting and ice charts. More commercial communication satellite systems were soon to be available with data transfer capability for digital ice information. Vessels in the future could also make use of small, low cost, remotely piloted aircraft carrying video or radar capability, launched and recovered by the vessels, providing additional local or tactical ice information. Other vessel technologies potentially enhancing ice breaking performance and operations included the rotating, Azipod propulsion system\(^{14}\) and hull structural standards and improvements able to reduce ice damage. Future escort ice breakers could also include a dual draught design, a single ship designed for effective ice breaking at both 9 m. and 11 m., enabling escort both offshore as well into coastal estuaries and gulfs.

Historical, Russian records of vessel ice damage occurring on the NSR indicated lower class ice vessels operating during the 1970’s and earlier experienced high rates of damage. For cargo vessels 60% - 80% of hull damage was substantial on the fore body and 10% - 20% on mid body. 10% - 12% of ice damage occurred when cargo ships navigated independently of ice escort, however 50% - 60% of damage occurred under ice breaker escort.\(^{15}\) Most hull damage of all cargo vessels occurred in the East Siberian and Chukchi Seas. These data were important to efforts to revise ice classes within the Conference on the Harmonisation of Polar Ship Rules,\(^{16}\) as well as of key relevance to the insurance industry and the design of future vessels for the NSR.

Ice breaker escort of cargo vessels was physically required in selected NSR regions during summer and winter navigation and was mandatory with an ice pilot on board in the Vil’kitskii, Dmitrii

\(^{14}\) For the Azipod propulsion system see http://www.abb.com/cawp/db0003db002698/b4c6f2757969bba6c12571f00410217.aspx, (last accessed 5 March 2008).

\(^{15}\) Professor H. Kitagawa, ‘E-mail’ 26 March 2008, notes statistic data of vessel damage is one of the key factors governing the development of safe vessels, navigations, ship structure, regulations and marine insurance. The INSROP data received was rather ambiguous, and there were problems trusting the published Russian vessel damage data that occurred during the Soviet era. It appeared captains expected a high possibility for ship damage occurring; it was the nature of things. Close-towing which was a particular Russian manner of escorting cargo vessels required much skill of the captains of the escorting and escorted vessels, and this could partly be responsible for the damage occurring under ice breaker escort. However the Russians would not admit to such damage occurring. Further, vessel damage often occurred on the NSR at the end of the summer season. Under INSROP the Russians were requested many times to release reliable statistical data of vessel damage, but the requests were refused

Laptev, Sanikov and Shokalskii Straits, as well as other areas at the discretion of the NSR Marine Operation Headquarters. Most new vessel design would therefore have to take into account ice breaker escort as a probable operation. Escort and towing techniques have been perfected by Russian mariners and documented in INSROP, however additional observations were required regarding cargo vessel captains and other mariners, who have been escorted in a variety of ice conditions. Independent operations of commercial vessels along the NSR were successful during the INSROP period during summer, and independent ice breaking cargo vessel operations on a year round basis were technically feasible in the Pechora Sea and the southern Kara Sea, to the Ob and Yenisey Rivers.

Year round ice navigation was accomplished to Dudinka, on the Yenisei River and port for Nor’ilsk, since the late 1970’s, and it was possible to increase the capacity of this operation in the south western Kara Sea. Recent regional warming of Eurasia and a reduction in the 1990’s of sea ice in the East Siberian Sea could,

‘...allow access to the eastern NSR from the Bering Strait to be extended to 150 days...effective access through the Vil’kitskii Strait may also be increased to 180 days, provided effective ice breaker escort is readily available.’

‘Continued warming in Eurasia and throughout most of the Arctic may in compelling ways change this divided picture of the NSR.’

However the lack of replacement of Russian ice breakers could become a significant factor in limiting extension of the navigation season due to its required utilisation under the Rules of Navigation. Any future plans for increased shipping along the NSR was to give careful consideration to this critical component.

Observations indicated the Nor’ilsk SA-15 class was capable of 11 - 13 kts. average independently in summer, July to October. In some regions of the NSR during summer SA-15 velocities were reduced to 5 kts. even under ice breaker escort. During winter, November to June, SA-15 vessels under escort by Arktika class ice breakers attained average speeds of 6 - 8 kts. Simulation research carried out under INSROP on new ship designs provided realistic, estimated average velocities. These involved a 25,000 dwt. bulk/container ship, a 40,000 dwt. bulk/container ship, and a 50,000 bulk carrier ship, and initial results indicated four to seven kts. average speeds in winter, December to May, for all three vessels operating with substantial escort days. For summer, August to

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17 See § 7.4., Rules of Navigation – Regulations for navigation on the seaways of the NSR, Guide to Navigating through the Northern Sea Route, (St. Petersburg, Head Department of Navigation and Oceanography of the Ministry of Defence of the Russian Federation, 1996), (Rules of Navigation), pp. 80-4. Under § 1.7 the Marine Operation Headquarters is defined as special navigational services of the Murmansk and Far East Shipping Companies, directly performing ice operations on the NSR, under the general co ordination by the Administration. Under § 1.3 the Administration is defined as the Administration of the NSR of the U.S.S.R. (Russian Federation) Ministry of Merchant Marine, established by the U.S.S.R. Council of Ministers Decision No. 683 of 16 September 1971, and having its location at ¼ Rozhdestvenka, Moscow, 103759 U.S.S.R. (Russian Federation).
19 Ibid. p. 120.
October, the first and second vessels showed speeds of nine to 13 kts., the third speeds of nine to 14 kts. Minimal escort days were required for all three vessels during August to November.

Viewing western and eastern regions of the NSR a synthesis of INSROP information and data on sea ice and past navigation revealed the need for a distinction between the two. Confining geography, shallow straits, colder regional climates, more severe ice conditions, greater vessel damage and other factors contributed to make the NSR eastwards from the Vil’kitskii Strait a more complicated system.

‘The damages observed indicate that the design ice loads specified in the ULA class may apply in the western Arctic, but may be deficient for operations in the eastern Arctic. Much higher design ice loads will have to be adopted for ice breaking cargo ships that operate in the eastern NSR and make transit passage of the entire NSR.’

Not surprisingly the length of the navigation season for some years remained fixed at July through October. In contrast were the effective year round operations in the Barents and Pechora Seas outside the defined NSR, and within the NSR across the Kara Sea to the Yenisei River. Continued warming in Eurasia and throughout most of the Arctic could in compelling ways change this distinction, though this environmental change had yet to influence the periods of access into the Laptev Sea and the Lena River. Feasible vessel transits through the Vik’kitskii Strait and the Sannikov and Dmitrii Laptev Straits remained limited and subject to normally challenging ice conditions.

‘Analyses of past climate changes and ice conditions, as well as computer modelling of future scenarios, will be essential to evaluating the future natural conditions for Arctic marine transport along the NSR.’

Visions of this sub programme included with regards to ice conditions and transit speed that the simulation study indicated the three projected new vessel designs could make an average speed in winter, December to May, of four to seven kts. Previous calculations indicated if the ships could maintain an average speed of 11 - 13 kts., this would make the NSR for transit voyages economically competitive with the Suez and Panama Canals. In summer the vessels could average nine to 13 kts. while the largest could average 9 - 14 kts. In the early 1980’s a Japanese design study of a 200,000 dwt. ice breaking super tanker was carried out for transporting crude oil from the Arctic to Japan on a year round basis. This vessel was designed to operate at five kts. in approximately 2 m. of ice.

Kværner Masa Yards considered several designs including a 90,000 dwt. double acting tanker (DAT) with ice breaking capacity offering the same efficiency as any tanker which could be used throughout

ULA is the Russian Registry designation for the highest ice able class of vessel, including the Nor’ilsk.


Ibid. p. 116.

Developments in ship designs suggested velocities approaching what would be required to bring the NSR into competition with the Suez and Panama Canals.

With respect to vessel designs, depth conditions, cargo ships and the ice breaker fleet, to improve on and eventually overcome the ice and depth limitations of the NSR, two options were available. These involved intensified dredging to achieve better depth conditions, or building larger vessels than those anticipated under INSROP with draughts adapted to existing depths. The Japanese Ship Research Institute in Tokyo conducted trials applying available technology to build an ice breaking oil tanker of 200,000 dwt., possessing a cargo capacity of 246,000 cubic m. with a draught of 20 m., corresponding to depth conditions in the Bering Strait, which was possible to build with a draught of 11 m. This vessel was tested to have a breadth at the waterline of 52 m. as opposed to the maximum of 30 m. used as maximum in the above simulation studies. This example provided more promising prospects than that presented so far under INSROP. The end result could be promising regarding engineering inventiveness when it came to producing a shipbuilding technology capable of overcoming obstacles that seemed formidable. Statistics indicated damages to vessels caused by ice were more serious and frequent in the eastern NSR than in the west. This implies the investment costs for new vessels assigned to missions restricted to the western Arctic could be lower than the costs applying in the eastern Arctic. Ships built for transit operations would have to comply with the ice load measures of the eastern Arctic. By differentiation in ice load designs total investments could be cut as compared to where all ships would be required to meet the highest ice loads of the NSR. If however this strategy was implemented and pursued with the aim of cutting investment costs, an element of inflexibility would also be introduced as vessels designed for west Arctic operations could not be used outside of the region.

Concerning sailing seasons and ice conditions, apart from improvements in shipbuilding technology and associated navigational systems the regional warming of Eurasia seeming to have manifested itself in the 1990’s could be of assistance. The warmest water temperatures recorded on the eastern Bering Sea shelf occurred during the summer of 1997, and if the sea ice reduction was in fact caused by global warming which scientifically could not be excluded albeit not yet confirmed,

navigational conditions in the eastern NSR could improve further. At the same time improvements in vessel designs and associated activities represented the safe course of action for extending the sailing season. The greenhouse effect first and foremost was a catastrophe to be counteracted by the means available, but if global warming was a phenomenon to be reckoned with in the Arctic, it would continue to melt sea ice and reduce its extension, and thus could act as an auxiliary phenomenon supporting Russian endeavours to extend the sailing season.

3. Environmental Considerations

From the start the aim under INSROP was to develop a foundation for environmental assessments with regard to activity on the NSR. Faced with the transitional state of Russian environmental management strategies during the 1990’s a need was recognised early for a flexible approach. One off solutions were to be avoided, and re use of the findings was to be emphasised. Efforts focused on two main components, a systemised information base characterising the environment in which the activity occurs - the baseline data in the Dynamic Environmental Atlas; and tailored methods and routines for damage analyses and a systematic process for implementation. The latter included a stepwise approach to the selection of focal natural resources, identification of relevant impact factors of the activity and indication of likely interactions by means of simple and robust assessments and analyses. The integration of these two through the NSR Environmental Assessment & Planning System made the INSROP Environment Assessment complementary to basic elements in the Strategic Environmental Assessment. The results of the study, the baseline of the temporal and spatial distribution of vulnerable natural resources, an integrated information system, and tailored methods for impact analyses, provided a basis for environmental assessment relevant to NSR activities in the short term. They also provided a basis for strategic long term assessments regarding future developments. The ‘toolkit’ was easily implemented for specific case studies, such as assessments of sailing routes, oil spill risk and contingency planning, and reflected the requirements of transparency and stringency important to processes of this kind. If new findings deviated significantly from the initial assessment basis, whether in terms of changes in the baseline, vulnerability or environmental threats, the flexibility of the information technology (IT) system enabled on line adjustment of any individual parameter. The adjusted datasets could subsequently provide updated input to damage estimates, mitigating measures or monitoring strategies. This concept was accepted among scientific communities in Russia and Norway and proven to be in line with Russian regulations governing preliminary environmental impact assessment (EIA).

The main components of the system were selected as cost effective solutions to implement state of the art computing technology. INSROP GIS was developed as an ArcView application for use

%20A%20State%20of%20the%20Arctic%20Environment%20Report, however was not accessible due to restructuring of the AMAP website, (access attempt 27 February, 2008).

Adapted from L. Brigham, et. al., (Chief ed. W. Østreng, et. al.), The Natural and Societal Challenges of the Northern Sea Route – A Reference Work, pp. 210-14 and 421. Comments are added by Environmental Consultant Kjell A. Moe author and programme leader of this section.
on personal computers (PC) running Microsoft Windows.\textsuperscript{30} ArcInfo running on UNIX work station was used to prepare various of the datasets for use by ArcView and to run analyses beyond the capabilities of ArcView on a normal PC.\textsuperscript{31} These were widely used by the GIS community providing the necessary IT tools for handling large volumes of environmental data and developing applications for a wide variety of analytical purposes. The selected software also provided a standardised system for linking textual, tabular and graphic information to digital maps, which facilitated export and import of geo referenced data in formats compatible with the major GIS on the market.

Since the ultimate objective of an EIA was to indicate the most likely consequences of an action, in this case a NSR activity, the challenge was to harmonise the assessment retrospectively as well as to enable glimpses into the future. Environmental impacts were therefore to be addressed through the difference both with and without NSR activity. Consequently, the status of the NSR environment was a function of the load from NSR activities in the past, as well as from other factors having had a significant influence on the NSR environment. Various of the factors were located within the Arctic, others not. The basis for such comparisons however was vague. The resolution of the baseline data was in most cases inappropriate for identification of temporal and spatial trends in key bio chemical parameters, including contaminant levels and population trends. The corresponding comparison of sources and their importance in terms of weighting the load from NSR activities versus other loads within as well as outside the Arctic could not be measured quantitatively by scientific means.

Overall conclusions were drawn on this basis, combined with an awareness of the inherent attributes of the environment and of NSR activities. This was in terms of what was known of the temporal and spatial distribution of the selected verification of valued ecosystem components (VEC’s), their ecological dynamics and vulnerability to the given species specific impact factors.\textsuperscript{32} Conclusions included first that with the exception of local terrestrial, river, harbour and port pollution, and earlier dumping of nuclear waste from the ice breaker fleet, as well as waste and wreck accumulation on shores and neighbouring areas, there was not scientific evidence civilian navigation as such had resulted in significant stress to the NSR environment. Navigation along the NSR had been carried on for decades. Even though significant local contamination of ports and harbours, accumulation of waste and garbage on the shore and proximate areas had been documented, there was no evidence that the large scale trends of some declining ecosystem component populations had been directly caused by navigational activity. Second, increased frequency of navigation would however inevitably increase the risk of ship accidents, thereby increasing the risk of accidental release of oil.

\textsuperscript{30} ArcView is GIS software for visualizing, managing, creating, and analyzing geographic data. Microsoft Windows is the name of several families of software operating systems by the company Microsoft.
\textsuperscript{31} ArcInfo is GIS which adds to ArcView advanced spatial analysis, extensive data manipulation, and high-end cartography. UNIX is a trademarked computer operating system.
\textsuperscript{32} For discussion see K. A. Moe and G. N. Semanov, ‘Environmental Assessments,’ (Chief ed. W. Østreng, et. al.), The Natural and Societal Challenges of the Northern Sea Route – A Reference Work, pp. 178-85.
Large scale oil spills could have deleterious impacts on the marine environment. The most vulnerable period was assumed to be during the most productive season, the late spring to summer, which also corresponds to the most frequent navigational phase. During this time vulnerable natural resources were spread widely over the NSR region. On a spatial scale particular attention was to be given to the protected areas, including the Lena Reserve which had been expanded to include the New Siberian Islands.

From an environmental viewpoint there was also an obvious link between commercial shipping on the NSR via the port, harbour and loading facilities to land based development of industry and infrastructure. These activities have been shown to cause deleterious impacts in regions of the limnic (marshy lakes) and the terrestrial environment of the Russian North as elsewhere in the Arctic. Plans for offshore oil development reflected the introduction of new impact factors in the NSR region, as these were activities providing chronic marine discharges and air emissions. Regular discharges from offshore petroleum production in the North Sea have been shown to affect the benthic (bottom) communities as well as fish resources in the vicinity of installations. Petroleum activities also contributed significantly to increasing the risk of accidental oil spills.

The Arctic environment was currently exposed to contaminants and stress in a variety of modes, and it was the cumulative effect, the sum of the stress from every individual source, that provided the overall impact and significance to the environment. This also included impact factors and loads not assessed in detail within the INSROP Environmental Impact Assessment, including persistent organic pollutants (POPs) which had been a focal item of the Arctic Monitoring and Assessment Programme (AMAP) under the Arctic Council. Arctic pollution was definitely of growing concern among official bodies and the scientific community. The trend towards more frequent low level environment deviations was gradually reducing the common perception of the Arctic as a pristine environment, and increased development of the NSR would involve additional factors that cannot help but contribute to this load.

Particularly important points included the following. Physical disturbances were generated by shipping operations, dredging of harbours and land based developments such as oil and gas production. The latter were known to cause habitat fragmentation and physical barriers which indirectly affected the reindeer herding of indigenous peoples. Release of contaminants such as radio nuclides from nuclear waste; petroleum hydrocarbons from extraction and transport of oil and gas; and POP’s from power stations, mining industry and landfills; were considered among the most pronounced threats to the environment along the NSR. The marine, limnic and terrestrial environment could be expected to suffer significantly from such releases. Accidental oil spills could provide the most serious impact. Should this occur at the wrong place at the wrong time, for example at the ice

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33 Persistent organic pollutants are organic compounds that are resistant to environmental degradation through chemical, biological, and photolytic processes. Because of this they have been observed to persist in the environment, to be capable of long-range transport, bio accumulate in human and animal tissue, bio magnify in food chains, and to have potential, significant impacts on human health and the environment.
edge, in *polynyas*,\(^{34}\) during the high production period, the impacts could be serious. Shallow waters were the most sensitive to such pollution, and these areas were important to organisms of all levels of the Arctic food chain. Adverse effects could easily pass from one level to another ultimately affecting the entire regional ecosystem. The limnic and terrestrial environments had proved to be equally sensitive. The impact could last for decades because the Arctic environment was so slow in recovering. *Chronic, long term, low level pollution* could affect all ecosystem levels within a given area. It was the low dose and long term exposure that represented the most serious threat to the environment, and the Arctic was no exception. In the marine environment the shallow waters of harbours, ports and loading facilities were expected to suffer the greatest impact. However it did not seem likely offshore water organisms would maintain a state of chronic stress generated by regular, low level oil discharges from shipping operations. The limnic and terrestrial environments had been shown to have been subjected to many small oil spills and leakages from land based petroleum developments. Significant impact was widespread in western Siberia. Unless predominant, developmental strategies were changed dramatically, similar patterns could be foreseen in new developmental regions as well. *Interaction between man made noise and the environment* could be temporary or chronic. Temporary noise was considered of less importance unless it occurred at the wrong place at the wrong time, for example near bird cliffs. Exposure to chronic noises could result in higher trophic level\(^{35}\) organisms such as birds and mammals abandoning their habitat, but habituation (acclimatising) would also occur. If habitats or home ranges of vital importance however were permanently lost, damage to the level of population was not unlikely. Finally, *accumulation of contaminants* was facilitated by the ability of many Arctic organisms to withstand food shortage by storing energy as body fat when food was unavailable. Ultimately such contaminated bio accumulations could reach the indigenous and local peoples if the natural resources within their main area of residence as well as subsistence branches were affected.\(^{36}\) These in addition to other activities that could be harmful to the linkage between the environment and local people needed to be assessed in detail prior to implementation of NSR activities. In this respect the *Dynamic Environmental Atlas* was to be considered a central source.

Generally, environmental damage in the Arctic could prove longer lasting than in temperate regions. The transfer of damage in the food chain was facilitated, and such damage was a function of the fate of the impact factor, the resources at risk and their ecological attributes. Consequently, the vulnerability of the Arctic organisms would vary from species to species, as well as between time periods and various geographical regions.

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\(^{34}\) *Polynyas* are stretches of open water surrounded by ice.

\(^{35}\) Trophic level is each of several hierarchical levels in an ecosystem comprising organisms sharing the same function in the food chain and the same nutritional relationship to the sources of energy.

Visions included that despite these warnings there was not scientific evidence with the exceptions noted that civilian navigation as such had resulted in significant stress to the NSR environment. Development in the Arctic thus was offered an opportunity to plan for environmental concerns in advance and thus to avoid much of the devastating and unnecessary impacts accompanying human activities elsewhere globally. Among measures to be applied to fulfil this goal could be mentioned that the *NSR Environmental Assessment and Planning System* be used for environmental screening and *Preliminary Environmental Impact Assessments* be used when considering developments. *Recommendations* derived from the *World Bank’s checklist* on mitigating measures for the most relevant activities and developments on the NSR were to be considered in new developmental projects.\(^{37}\) *Nature conservation areas were to be avoided* to preserve quality, representativeness and biodiversity of nature. *Vessel traffic management systems* were to be carefully considered for ports, and loading facilities constructed or reconstructed for sea borne oil transportation. *Port fees were to be considered reduced, without discrimination*, to any vessel owner proving measures emphasising increasing safety and providing training to crews improving their technical merit and quality. *The use of anti fouling paint containing organotin compounds was to be avoided*. *Vessels in transcontinental navigation were to comply with and Russia to enforce all IMO Guidelines*, including that for preventing the introduction of unwanted aquatic organisms. *Radioactive pollution was to be monitored in line with the international conventions*, and programmes dealing with nuclear power generation, processing and waste disposal made effectual.

4. **Economic Considerations\(^ {38}\)**

The purpose was chiefly to examine the economic viability of the NSR and indicate possible future challenges. However, in the nearly ten years since international commercial navigation was permitted through the NSR, trade flows in the Russian Arctic had remained at best static and had fallen short of expectations. At the same time considering the economic and social turmoil in Russia following the break up of the Soviet Union perhaps this was not so surprising.

In spite of the slow start and rather disappointing performance there still existed support for considering a ‘future potential’ for the region as an origin of exports, a destination for imports and a transport corridor between West and East. For the development of a future origin of exports and designation for imports however it was essential for the Russian government to include the NSR in the

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37 For discussion see K. A. Moe and G. N. Semanov, ‘Environmental Assessments,’ (Chief ed. W. Østreng, et. al.), *The Natural and Societal Challenges of the Northern Sea Route – A Reference Work*, p. 216. For World Bank Projects in Russia see http://web.worldbank.org/external/projects/main?pagePK=217672&piPK=95916&theSitePK=40941&menuPK=223661&category=regcountries&regioncode=5&countrycode=RU&pageview=1&pageid=50&totalrecords=91&sortby=BOARDSORTDATE&sortorder=DESC, (last accessed 18 April, 2008). While mention is made of the checklists, as related to mitigating measures for relevant activities and developments covering the NSR these did not appear to be now available.

38 Adapted from L. Brigham, et. al., (Chief ed. W. Østreng, et. al.), *The Natural and Societal Challenges of the Northern Sea Route – A Reference Work*, pp. 278-80, 419 and 423-4. Comments and editing are added by Professor Edgar Gold, one of the authors of this section.
future expansion plans for its extractive industries. Since Russian regions bordering the NSR were rich in mineral raw materials, particularly energy resources, whether such areas such as the Yamal Peninsula would receive enough financial backing to develop into mineral resource exporters remained an open question. Either way such decision would have a profound effect on any further development along the NSR.

The NSR had been utilised for limited amounts of exports of dry bulk commodities and imports of supplies to the indigenous populations. Transit trade had been of rather marginal commercial significance, although important for observational purposes to improve knowledge of operational aspects of ice navigation. INSROP studies chiefly indicated both the technical and economic feasibility of energy exports along the NSR to the West. Liquefied natural gas (LNG) was a favourite, however other methods explored included as well marine transport of natural gas hydrates in dry bulk form, liquefied petroleum gas exports and crude oil exports.

Such trade flows however could be generated only with the necessary investments allowing exploitation and production of such resources. The initiative rested much in the hands of the Russian State, particularly its large energy trading monopolies. The future of the NSR would only have a solid foundation when a policy governing the destiny of the NSR had been decided, the required domestic or foreign financial resources found and the infrastructure set in place.

“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 understand and support strategic projects. For the Russian State to be able to do so will require considerable time and effort until the economy can emerge strong from its currently turbulent transition phase.”

The marine insurance issue continued to lie at a rather dormant level. There was little indication the shipping companies were considering utilisation of the NSR particularly for high value vessels. Such vessels were generally not constructed for navigation in ice. Additionally the shipping industry had yet to carry out its own economic analyses of the actual economic advantages involved. Although limited low value, bulk cargo operations could be considered, it was unlikely even such operations would take place on a year round basis. At the same time marine insurers were innovative and responsive to demands and requirements of the shipping industry, and in that respect NSR risks would be treated no differently. Marine insurers required their own studies responding to the specific needs and demands of underwriters while taking into account the special risks in navigating Arctic waters. If shipping were interested in utilising the NSR, insurers would provide the necessary risk coverage.

What could thus be accomplished? There were enough private interests outside Russia that could take the initiative to invest in projects along the NSR. It became evident, however, that as a minimum a reliable and stable political and legislative framework was necessary for such initiatives to

materialise. In addition a reliable, operational environment was absolutely essential for the NSR to achieve viability as a transport corridor. These same conditions were elementary prerequisites for success in any transit operations. These results were to be interpreted in a time horizon related context. Any derived conclusions which could be valid for the short to medium term, perhaps two to ten years, would not necessarily hold for the longer term. Nor would points viewed negative then necessarily be an impediment for future prospects. The qualifications indicated could be treated as opportunities to be taken advantage of in the right time. It was possible the NSR would never compete on par with warmer sea routes, however, given the right conditions it could provide a shrewd investor with considerable profit making opportunities.

**Visions** included first the necessity of the Russian government to include the NSR in future plans for its extractive industries, on land and on the shelf, underscoring the significance of the land and sea relationship for increasing utilisation of the NSR. Historically, it was economics that initiated activities for use of the NSR for transport of resources extracted on land. This included sable fur. Second, there were several commodities that appeared well suited for creating a sustainable cargo flow. Ferrous metals were expected to continue to be successfully exported to Asian Pacific States, and an estimated 1.7 - 1.9 million tons could possibly be channelled through the NSR. A further flow of .5 million tons could be created by fertilisers also exported to the Asian Pacific States. Timber products could account for an additional 1.3 - 1.7 million tons, and smaller flows of apatites from Khatanga could be transported to foreign markets. From this an estimate of annual total of 3.5 - 4.1 million tons of cargo could be generated for transport during the period 2005 - 2010. This was excluding oil, gas and condensates that would be the dominant commodity in the future. In a short and medium term perspective of two to ten years transit trade on the NSR seemed likely to increase substantially from its present level, however, its share of world trade would remain insignificant. Third, the necessary investments, domestic and foreign, would have to be provided for. Only when a policy concerning utilisation of the NSR had been found and the infrastructure in place, would the future of the NSR have a solid foundation. Fourth, as had also been historically demonstrated, there was a need for foreign involvement not least in times of national crises to further develop the NSR. Given the state of the Russian economy foreign investments would seem a prerequisite. Fifth there was a pressing need for a Russian State actively involved in regional development. This initiative was the responsibility of the Russian government and its large energy trading monopolies. Though the natural resources were there and the technology available, the remoteness and extremities could only be managed by a State ready to understand and support strategic projects. The Russian Federation pooling resources with regional authorise would have to put the operational frameworks of the NSR in proper order to attract new users. As was the case during the Soviet period a strong and active State was needed that could assume leadership in NSR developments.

A main conclusion concerning marine insurance was that the international insurance market would be willing and able to underwrite NSR risks. Although marine insurers were innovative and
responsive to the demands and requirements of the shipping industry and NSR risks would be treated no differently, the database assembled under INSROP required further development. The International Underwriting Association (IUA), representing almost all aspects of marine insurance interests, required their own, specific studies to be undertaken by the world’s premier casualty surveying group, the Salvage Association. This would respond to the specific needs and demands of underwriters while taking account of the special risks involved in navigating Arctic waters. However, there was no question if the shipping industry wanted to use the NSR, insurers would provide the necessary risk coverage.

5. Military, Political, Legal and Indigenous Considerations

From an objective, operational viewpoint military ramifications were no longer overwhelming, prohibitive obstacles to civil utilisation of the NSR. Indeed, the reverse could well apply in that military interests were being subordinated to economic needs. However, the struggle perceived between and within the relevant Russian sectors governing the security implications of opening the NSR to international usage created in other States a high degree of uncertainty about the state of NSR affairs. In this respect subjective views of a political situation which was unstable, chaotic, changing, uncertain and possibly dangerous would be more important in influencing Western decisions than objective military realities. If the political turmoil was not brought to a halt, the likelihood of involving non-Russian nationalities in NSR operations would be small in the short and medium term. Here as in most other respects objective realities counted, subject perceptions right or wrong decided. In the NSR management system that emerged after 1991 three principal actors played a role, the Federal Government, regional governments and commercial interests. The structure was still in the making; the momentum of change was basically to be found in the tug of war between the centre and periphery, and not in the perceived competition between the sectors. The first order of priority for the Federal Government was to avoid becoming a failed State, which could lead to a long stagnation and drift in which no one really ruled.

Legal issues appearing to arise from a comparison between the comprehensive Russian Arctic legislation and enforcement and the 1982 Law of the Sea Convention (LOSC) Article 234 ice covered areas encompassed various key terms. These included mandatory notification and authorisation, possible application on the high seas, five forms of leading in ice, fees, liability, discharge and safety standards, reporting, inspection if deemed necessary, stopping, detention and arrest, suspension if deemed necessary, removal for violations, criminal liability, design, equipment, manning and construction standards, special areas, and application to State vessels. Due to the inherently vague formulation of LOSC Article 234, other than for six items, it would be difficult to maintain the

40 Both the International Underwriting Association (IUA) and The Salvage Association are based in London. See http://www.iua.co.uk/AM/Template.cfm?Section=Home, (last accessed 31 March 2008).
41 Adapted from L. Brigham, et. al., (Chief ed. W. Østreng, et. al.), The Natural and Societal Challenges of the Northern Sea Route – A Reference Work, pp. 334-6, 362-3 and 422-5. Comments and editing are added by Dr. R. Douglas Brubaker author and programme leader of this section.
unilaterally adopted Russian provisions exceeded intended limits. Russian practice of its regime found support not only from Canadian Arctic practice but also from that of the U.S. as an Arctic coastal State with regards to Alaska. In addition all three States participated in Arctic environmental cooperation and coordination including the Arctic Council at the ministerial level and the Conference on the Harmonisation of Polar Ship Rules at the Coast Guard level. These differing six items were geographic application including the high seas, application to State vessels, mandatory fees, ice breaker assisted pilotage, ice breaker leading and special areas. The weakest point was the attempt by Russia to claim, however vaguely, that the provisions were applicable on the high seas outside the 200 nm. exclusive economic zone. This had no support either from Arctic practice or from conventional or customary international law. Also very weak was the Russian claim of application of its regime governing all vessels including State vessels. Although supported by Canadian practice, this was contrary to U.S. practice and enjoyed no support under international conventional and customary law. Weak but less so was the Russian requirement for fees for passage along the NSR. Though acceptable as payment for specific services rendered for passage through the territorial sea and possibly acceptable under Article 234 as scientifically sound for environmental protection, such charges were required to be non discriminatory and in payment for specific services rendered. Russian provisions were probably discriminatory in fact as well as blanket, required solely for entry and when little or no services were rendered. Russian requirements for ice breaker assisted pilotage, ice breaker leading and closed special areas stood stronger. If compared to the U.S. practice, these were arguably in excess; they were however more consistent with the Canadian practice. Additionally, even though these requirements were not exactly the same as the Canadian, they could plausibly be argued to be justified as part of a sound environmental protection policy required under Article 234, having ‘due regard to navigation and the protection and preservation of the marine environment’ and required through safety considerations.

Looking at navigational practice, it was the U.S. as a maritime power which had most consistently opposed the Russian Arctic regime through official declarations and submarine passages. Actual submarine passages were only vaguely substantiated. U.S. declarations have followed traditional law of the sea positions taken by maritime powers including that of the international straits regime. Little was forwarded by the U.S. clarifying the relation between the Article 234 and the international straits regimes. With the exception of the Vil’kitskii Straits incidents in the mid 1960’s involving U.S. Coast Guard and Navy vessels in the Laptev, East Siberian and Kara Seas and the Norwegian Svedrup II in the Kara Sea in the mid 1990’s, all surface passages appear to have been made in substantial compliance with the Soviet/Russian regime. The Norwegian State vessel, Sverdrup II, carried out several passages in 1995 and 1996 in the Kara Sea, which resulted later in a formal protest by the Russian Foreign Ministry to the Norwegian Foreign Ministry. No other States have been

42 The Russian Arctic straits were not entered by the U.S. vessels.
found clearly opposing the Russian regime. Since unequivocal Soviet or Russian protests were delivered in connection with both the U.S. and the Norwegian incidents, it could be assumed some indication would likely have been given should other similar events have occurred. So far of the known commercial vessels of Finnish, Latvian and German flag, all were apparently navigating in compliance with Russian provisions. A conclusion could thus be drawn that a broad interpretation of Article 234 was being practised through substantial State compliance with and support for the Russian provisions for surface traffic for both commercial and State vessels. The practice included all the key items noted except application to State vessels, application on the high seas and mandatory fees. The U.S. declarations and passages and Norwegian passages were to preserve traditional positions under conventional and customary international law, of the international straits regime and freedom of passage of State vessels subject to innocent passage in the territorial sea. Should utilisation of the NSR become economically feasible, particularly the discriminatory and blanket Russian fees could come under scrutiny particularly with respect to U.S. vessels. Should this compliance continue, it would be difficult to argue that customary international law was not being formed for the Arctic. There continued to be few other interested States. The legal results of occasional foreign submarine passages held secret by all States were indecisive. The passage of submarines also earlier had been an aberration in law of the sea, concerning requirements for surface passage in the territorial sea including international straits. It could therefore be argued this continued abnormality would not hinder the formation of customary law in the Arctic.

Viewing the Russian Arctic indigenous peoples, the NSR was part of a transport complex central in solving a pressing social problem, to supply northern populations with fuel, provisions and consumer goods. This was the main possible effect a commercial opening of the NSR would have on northern Russia. An opening of the NSR could also probably make possible increased industrial activities and cause further improvement and development of the already existing river and road transportation system covering the areas inhabited by the indigenous groups. Improved access could facilitate development of a regular tourist industry which could improve access to markets and distribution networks for native products. Revitalisation of the economy could reduce poaching decreasing tension between the urban and the rural population. An increase in goods transport could help to subsidise such transport to more remote areas. However, these possible positive effects could have just as many negative consequences. The NSR and its industrial customers were primarily non indigenous peoples with little interest or financial ability, without direct government subsidies, to provide the service and goods required in the villages. Developments would occur in areas bordering NSR industry and trade activities. Indigenous communities farther away would have to be content with traditional industries while grants and public amenities would decline. In the event of competition between new industries and more traditional economies, industrial preferences would be likely to

dominate. Dangers connected with the opening of the NSR included contributing to the sometimes serious alcohol problems suffered by indigenous peoples; the increased risk for the release of hazardous cargo or material particularly in the Bering, Chukchi and Barents Seas as well as litter into the sea waters, coastline and delta areas; shipping accidents with long term effects on indigenous subsistence including reduction of productivity and revenues from hunting of sea mammals and fishing; illegal fishing; increased industrial activities with risks of continued and increasing pollution, erosion and reduction of pastures and grazing areas; barriers to migrations of domestic and wild reindeer both on land and over river ice; and changed migration patterns of whale and other marine mammals threatening indigenous sources of stable food as well as social relationships. More effort needed to be invested in terms of time and money to organise and conduct further research covering the probable impacts of NSR related activities on indigenous clusters and livelihoods. The extent of the area and the heterogeneity of the indigenous communities embraced by the NSR were of such dimensions that it was not possible in a short time to chart completely all the cultural effects and impacts of increased navigation. At least two precautionary steps could be taken, new or extended legislation with considerable respect for indigenous land use and an effective enforcement and implementation of environmental regulations. Most important of all was the need for the indigenous societies to be included as part of the process of creating the framework for NSR development, and their premises to be viewed and treated on an equal basis.

Hot spots were found to be aggregated along the NSR including clusters of societal and natural values or interests that needed serious consideration in terms of sustainability. To preserve the socio biodiversity in these sites two pre conditions needed fulfilling. All the individual values or interests clustering needed to be seen as equally worthy of preservation. Even if some of the parameters would be more negatively affected than others by navigation, the ultimate goal needed to be that none were harmed beyond repair and re establishment. Additionally, the first pre condition called for a new kind of navigation, multi value navigation as opposed to single value navigation. The former addressed both the economics involved in navigation and the sustainability of the socio biodiversity of the sites, while the latter basically focused on meeting economic objectives. Modernly, any attempts to apply a 19th century ‘Klondike approach’ to economic utilisation would likely fail and be reported to the outside world by watchdog, partisan organisations. A new breed of ice captains and crews were needed to meet the requirements of modern Arctic multi value navigation.

Visions included with respect to security aspects that the NSR lacked strategic, operation utility and consequently military importance. Military strategic interests could not be evoked as a valid and reliable impediment to increasing civilian and international use of the NSR. The hegemonic features of the Cold War were history and could no longer be allowed to blur reality and produce false perceptions. The NSR held a civilian not a military potential.

Concerning international legal aspects it was expected that with the exception for application on the high seas, the U.S. would require commercial vessels under U.S. flag to follow the Russian
regime including fees, if not discriminatory and particularly if for services rendered. This was based upon the U.S. practice in the Canadian Arctic characterised by compliance by U.S. commercial vessels with the Canadian regime, as well as U.S. State Department declarations, U.S. participation in the Arctic Council and the Conference on the Harmonisation of Polar Ship Rules and U.S. domestic legislation, all implementing Article 234 to a degree. The U.S. would continue to uphold its objections as it had since the mid 1960’s to the Russian provisions related to the sovereign immunity of State vessels and application of the international straits regime under conventional and customary international law. NSR impediments if recognised would encompass global, strategic implications impeding naval mobility including in straits of strategic importance to the U.S. In the Arctic including Russian waters the U.S. presumably navigated its submarines occasionally, chiefly in accordance with traditional law of the sea norms. Non clarification by the U.S. of the relation between the Article 234 and the international straits regimes would likely continue as it had since the negotiation of the former in the mid 1970’s. With respect to commercial vessels other States would likely follow suit, since it was only the U.S. and Norway that protested the Russian provisions. Bilateral relations would be little affected with either the U.S. or Russia, particularly if other State vessels did not navigate these waters.

With respect to indigenous cultures at this first round stage of investigation positive effects of the NSR included supplying northern populations with fuel provisions and consumer goods. However, NSR developments could at the same time have numerous negative consequences that affected indigenous economies and in various cases health and social relationships. Precautionary steps to correct the situation included new or extended legislation exhibiting respect for indigenous land use and effective enforcement and implementation of environmental regulations. Above all indigenous societies needed to be included in creating the framework surrounding NSR development, and their premises to be viewed and treated equally.

Finally, concerning hot spots interest groups formed and acted on the perception that interests of value to humankind were being disregarded or neglected in public decision making. Most issue areas had advocacy organisations to present their case, and the combination of a thoroughly organised globe and the IT revolution brought even the most remote locations into the limelight. The world was becoming increasingly transparent, and misdeeds in management of esteemed values would be revealed to a worldwide public. Given the vulnerability of the Arctic ecosystem and the external pressure put on the survivability of indigenous cultures, there was every likelihood that the value of sustaining the socio biodiversity of the NSR would be picked up and addressed by partisan organisations already involved in cultural and environmental affairs. Multi value navigation could prove a constructive and inexpensive measure having some bearing on influencing such organisation to rest their case or moderate their actions.

6. Significance of INSROP - Observations

Creating and carrying out INSROP was a challenge from beginning to end with respect to administration. It took years of networking, negotiations and lobbying to shape the programme and to
obtain funding, and its eventual initiation was a witness to the strong wills and personalities of the key figures involved. Daily cooperation and coordination also had its challenges, and it was often difficult to bridge language and cultural gaps between the three principal partners, the Japanese, the Norwegian and the Russian. These often maintained different priorities and were from countries with varying business practices. One important point of early, marked disagreement was whether to focus the programme solely on the straightforward, key issues of natural conditions, navigation and economics, or to also include possibly more complex and controversial topics such as the environmental, military, political, legal and socio-economic aspects. In the end the latter view prevailed, and this probably provided INSROP’s results with increased legitimacy and a wider audience. On the other hand this also in part led the main Japanese sponsor to establish the Japanese Northern Sea Route Programme (JANSROP), focusing mainly on aspects of technology and natural science, which operated parallel to and independently of INSROP. A great deal of ‘diplomatic’ considerations were required to uphold the trilateral balance, and in some cases this resulted in a less than ideal distribution of projects and funds, along with a certain inflexibility in adjusting research priorities. In spite of this the sheer quantity and diversity of results, and not least the continued relevance ten years on, indicate on the whole that the complicated organisation worked well.

With respect to the Considerations of the natural environment, ice navigation and ship technology sub programme, statistics of vessel damage data are vital for naval architects and classification societies. To the knowledge of Professor H. Kitagawa however there has never been published reliable data of damage to Russian vessels navigating the NSR, through which analysis could be carried out on the cause and effect of the damage cases and from this establish safer vessel design. Additional research could as well have been carried out, although admittedly probably difficult to achieve, governing political developments within Russia that affected both positively and negatively opening of the NSR, under the Military, Political, Legal and Indigenous Aspects sub programme. This likely would have included as well ramifications for the Economic Considerations sub programme. Similarly, due to the expansiveness of the Russian Arctic and little say the numerous Russian Arctic indigenous groups enjoyed, more research could have been carried out governing expected consequences opening of the NSR would play on these peoples including additional precautionary measures. This likely would have included also ramifications for the Environmental Considerations sub programme.

Overall, the results of INSROP must be said to have been rather discouraging for the international shipping industry. Even though it was demonstrated that navigation along the NSR was technically feasible and that there was a cargo base for export, import and conceivably transit, it became obvious there were challenges involved for the NSR to become a commercially viable option in the short or medium term. It could be viewed as somewhat ironic that INSROP probably due to its rather complicated and inflexible organizational structure failed to adapt underway and include research on the one factor that could eventually enable large scale shipping, climate change and its
impact on ice conditions. At the same time Environmental Consultant Kjell A. Moe notes only in the few years subsequent to the conclusion of INSROP did researchers generally become aware of the significance of the changes taking place. INSROP’s results and impact were considerable given the starting point. A wealth of new and unique knowledge on the Russian Arctic was produced, as well as making available to the international community information that was previously only known internally in Russia. This is information and results that are still being sought and utilised today, ten years later. INSROP also pioneered cooperation between Russian and foreign scientists in Arctic related fields, networks that lived on. Arctic ‘sophistication’ was increased, both East and West were educated in dealing with one another, and data acquisition and analysis were carried out, along with the corresponding development of personnel. This allowed a solid platform to be constructed upon which further Arctic multidisciplinary studies could be accomplished. Following the end of INSROP interest in the NSR subsided for some years, but as awareness increased of the realities of climate change and its impact on the Arctic ice, a rise occurred in interest and demand for INSROP’s results from the shipping industry, the authorities and the media. A number of new projects has been initiated. Therefore, while INSROP could be argued to have been premature, the knowledge it produced could become more relevant, and perhaps there exists a greater potential for its practical utilisation in the future.

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