Maritime economics of the Arctic: legal regulation of environmental monitoring

S Kozmenko¹, A Teslya² and S Fedoseev¹

¹ FIC "Kola Science Center RAS", Apatity, Russia
² Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia

Abstract. The current favorable natural conditions (melting of the Arctic ice) and the advance of innovative technologies used for extraction and transportation of unique natural resources are reasons for the growing economic interest of the international community in the Arctic region. Intensified economic activity leads to increased anthropogenic pressure on the highly vulnerable Arctic environment. Because of this, a study of conservation and restoration of the Arctic ecosystem is of utmost importance. Increased extraction of resources in the Arctic involves developing the transport system, including sea freight. We have found out that increased interest of the global community in the development of the Arctic led to an increase in the number of countries willing to influence the economic activity in the Arctic, including organizing sea freight. The growing number of participants with their expanding range of competing interests hinders the search for coordinated solutions. So far, the unique legal status of the Arctic has not been established at the international level. The paper confirms that the national legislation of Russia does not offer the full opportunities for forming a system of environmental monitoring either, and, therefore, it does not allow to carry out a full economic assessment of the costs of restoring the Arctic ecosystem. We have proposed the key directions for reorganizing the environmental monitoring system, based on recognition of the unique status of the Arctic; these directions can form the future basis for the assessment procedure concerning marginal social costs and benefits of developing the Arctic spaces and making decisions on the scale and trends of its development.

1. The Arctic region

There is currently no unified international legal act establishing the definition of the Arctic region, which engenders certain problems in determining the Arctic boundaries, as well as in creating strategies for the development of the Arctic and environmental protection of its unique land and sea areas. Geographically, the Arctic includes the northern parts of Eurasia and America continents, almost the entire Arctic Ocean with islands, and adjacent parts of the Atlantic and Pacific Oceans. The southern boundary of the Russian Arctic zone practically coincides with the southern boundary of the tundra. The continental part of the Arctic zone of the Russian Federation makes up about 35%, with 2% occupied by islands and archipelagos. Accordingly, the water areas of the Arctic Ocean and inland seas occupy 63% of the territory of the Russian Arctic (65% are taken up by the seas and 35% by the Arctic Ocean). The marginal seas (the Barents, the Kara, the Laptev, the East Siberian, the Chukchi, Beaufort and the Greenland seas, the Baffin Bay, etc.) constitute the shelf region. The United Nations Convention on the
Law of the Sea (UNCLOS) that the Russian Federation signed and ratified in 1997 establishes the total area of the Russian Arctic waters (a 200-nautical-mile exclusive economic zone) to be 4.1 million square kilometers. The Russian Arctic contains all categories of marine areas defined within the UNCLOS: internal waters, territorial sea adjoining the state borders of coastal countries, the contiguous zone, exclusive economic and fishing zones, the continental shelf, the high seas and portions of the seabed areas located outside the continental shelf.

The area of the Arctic region and the size of its population are the subject of substantial controversies. In general (see Table 1), more than 50% of the Arctic territories belong to Russia, with more than 50% of the Arctic population living on these territories. The density of population in the Arctic varies greatly depending on the country, but on average it is low. The density of population on the territory of the Russian Federation also varies considerably. However, in general, according to [1], more than 7% of the world’s population live in the Arctic.

Table 1. Territorial and populations of the Arctic, 2015

| Country, Arctic region | Area, thousand km² | Percentage | Population, thousands of people | Percentage | Population density, people per km² |
|------------------------|-------------------|------------|-------------------------------|------------|-----------------------------------|
| Total Arctic Zone of the Russian Federation | 15,189 | 100% | 4,611 | 100% | 0.30 |
| Total in the Arctic territories of the countries bordering the Arctic | 8,409.3 | 55% | 2,502 | 54% | 0.30 |
| AZ | 6,780 | 45% | 2,109 | 46% | 0.31 |
| Canada | 2,446.9 | 16.1% | 120 | 2.6% | 0.05 |
| Denmark (Greenland) | 2,131.8 | 14.0% | 58 | 1.3% | 0.03 |
| USA | 1,718 | 11.3% | 710 | 15.4% | 0.41 |
| Norway | 188.6 | 1.2% | 466 | 10.1% | 2.47 |
| Iceland | 103.3 | 0.7% | 311 | 6.7% | 3.01 |
| Sweden | 98.2 | 0.6% | 260 | 5.6% | 2.65 |
| Finland | 92.7 | 0.6% | 184 | 4.0% | 1.98 |

The climate of the Arctic largely depends on the dynamics of heat transport from the southern latitudes. According to [2], the average temperatures of the Arctic have almost doubled over the past 100 years. The air temperatures are expected to increase at a faster rate up to 2020. The ongoing decline of the multiyear ice in the East Siberian and Chukchi Seas, the reduction in its thickness and quantity contribute to improved navigation along the Northern Sea Route bypassing coastal routes. These climate changes in the Arctic, along with the advances in new technologies, create favorable trends for socio-economic development of the territories. Over time, these trends will have a serious negative impact not only on the Arctic environment, but also on all aspects of life and evolution of the global community [3]. On the other hand, global warming and the rising sea level impose serious threats, both on island countries and on those with long coastlines. Therefore, the strategies of socio-economic development for these territories and the programs of development of sea areas, adopted by the states bordering the Arctic, will have economic, social and environmental consequences for the entire global community [4].

New industrial facilities emerge due to intensified development of natural resources in the Arctic. Due to complex interaction between industrial marine-based systems and natural marine ecosystems, large sectoral and intersectoral maritime clusters are formed in the zone of contact of marine and coastal areas, new types of activity evolve, along with the social and professional composition of the labor force of oceanic industry branches, while the population in the coastal zones grows [5]. At the same time, intensified economic activity has a strongly negative impact on ocean ecosystems and coastal zones in the Arctic [6]. Therefore, it is particularly important to work out the principles and methods for...
managing the exploitation of natural resources and to generate scientific foundations and practical recommendations for environmental monitoring. Almost all scientific studies related to the economy of the Arctic are aimed at resolving these issues.

The economic interest towards developing the marine space, including the Arctic shelf [7], is largely determined by the relations of the Arctic states with the countries remote from the Arctic [8]. The clash of economic interests in addressing the issues of Arctic development, in particular, using the Northern Sea Route, often arise between strategic partners [9, 10].

While the Arctic countries intend to retain national jurisdiction over sea routes [11], some European Union countries call for considering the Arctic Ocean to be part of the “common heritage of mankind”. This is to say that the countries that are geographically remote from the Arctic state seek to use its economic potential and participate in choosing the strategies for development and exploitation of land and sea areas.

Growing interest in the problems of the Arctic means that an increasing number of countries are involved in solving environmental issues of this region, which allows for a more comprehensive analysis of environmental safety, since the Arctic states are not the only source of environmental issues. For example, studies revealed that the most toxic substances are released into the Arctic from sources other than the industrial enterprises located in the region. Ref. [12] identified the following main sources of pollution:

- radioactive materials from nuclear waste reprocessing facilities in the UK and France carried from the North Sea with the waters of the Gulf Stream;
- pesticides carried into the Aral Sea with the effluents from Amu Darya and Syr Darya and with dust storms through the upper atmosphere and the zone of high-altitude jet streams;
- mercury, lead and cadmium transported by high-altitude air flows from Europe, North America, China, South Korea and Japan.

Thus, not only the interaction between the countries bordering the Arctic but also the interaction with the countries geographically remote from the region is needed to ensure environmental safety in the Arctic. Several international organizations were created with the aim of coordinating the development of Arctic land and sea areas. One of these organizations is the Arctic Council, established in 1996 by a joint declaration of Denmark, the USA, Russia, Canada, Norway, Iceland, Sweden and Finland to promote cooperation in the sphere of environmental protection and to achieve sustainable development of the Arctic territories. As the non-Arctic countries’ interest in the unique resources of the region grew, such countries as the United Kingdom, France, Germany, the Netherlands, Poland, Spain and China joined the Council as permanent observing states. Thus, the environmental problems of the Arctic have become the problems of the entire global community. On the one hand, this allows finding comprehensive solutions for these problems. On the other hand, however, the expanding range of competing interests in the Arctic, caused by a growing number of participants, significantly increases the economic and transaction costs of finding a possible solution.

2. Legal regulation of environmental safety in the Arctic
The unique international status of the Arctic is not currently defined in any law; this is one of the factors hindering the implementation of a unified environmental monitoring system. International legal regulation of environmental safety in the Arctic is enshrined in the following documents: the UN Convention on the Law of the Sea of 1982, the International Convention for the Prevention of Pollution from Ships of 1973, and the International Convention on Oil Pollution Preparedness, Response and Cooperation of 1990.

All types of marine activity in the Arctic (such as ensuring passage through territorial seas, navigation on the high seas, including the existing 200-nautical-mile exclusive economic zone, exploration and extraction of minerals, fishing, environmental protection, scientific research) are carried out in accordance with the existing conventions. We should stress that the international legal regime of the Arctic region is based on the principles and norms common for the whole World Ocean, and the exclusive status of the Arctic is not established by any international documents. The exclusive status of
the Arctic territories is partially regulated by national legislative acts of individual states, or by international agreements on specific activities.

There is also a number of agreements that are not directly related to the Arctic, but are important for environmental control, for example, the 1992 Convention on the Protection of the Marine Environment of the Baltic Sea Area (the Helsinki Convention). As part of intergovernmental cooperation, Russia, Germany, Denmark, Latvia, Finland and other countries of the Baltic Sea participate in the work of Helsinki Commission (HELCOM) coordinating the protection of the marine environment of the Baltic Sea from all sources of pollution.

Important Russian legislation on the subject includes the Federal Law on Environmental Protection of December 26, 2001, the Order on Environmental Impact Assessment of Planned Economic or Other Activities in the Russian Federation (Order No. 372 of the State Committee of the Russian Federation on Environment Protection of May 5, 2000), the Federal Law on the Continental Shelf of the Russian Federation No. 187-FZ of November 30, 1995. These laws establish mandatory environmental impact assessments in order to prevent or mitigate negative impacts and the associated social and economic consequences. State Environmental Expertise aimed at protecting the marine environment and preserving the natural resources has become compulsory for conducting any activity on the continental shelf. State monitoring of the continental shelf is part of the unified system of state environmental monitoring, making regular observations on the marine environment and bottom sediments obligatory. The requirements for the protection of the marine environment in the exploration and extraction of oil and gas of the continental shelf, territorial seas and the coastal zones are established by GOST R 53241-2008 on Marine Geological Exploration.

However, while the legislation is rather extensive, there are no uniform rules regulating the scope, types and methods of environmental monitoring; because of this, the companies extracting the resources tend to use their own assessment methods, developing individual programs for damage assessment and compensation. At present, Russia does not have a single document regulating the entire range of issues related to the development of the Arctic zone and establishing its unique status.

The draft of the Federal Law on the Arctic Zone of the Russian Federation is currently pending approval. Meanwhile, a special approach has to be taken to using and protecting the unique natural resources of the Arctic. So far, the legal regulation of all aspects of the development of the Arctic zone has been based primarily on constitutional, administrative, civil, environmental, land and various other laws. The existing legal norms are incomplete and inconsistent, which hinders the construction of an effective environmental monitoring system and does not allow to fully coordinate the interests of all stakeholders (industrial groups, the state and the population), even within one country.

3. Economic goals and organization of environmental monitoring
Development of the Arctic opens up additional opportunities for intensified extraction of natural resources, which leads to an increase in the volume of traffic (mainly marine), and, consequently, to heavier pressure on the marine ecosystem. The Arctic has vast sea areas, which means that each port involved in local or international trade should minimize the negative impacts on the environment. In this regard, interesting points were raised in [13], proposing the criteria for choosing seaports, which allowed to minimize their number and, accordingly, to relieve the pressure on the marine environment.

An attempt to assess the expediency of developing the sea transport was made in [14], with the conclusion that, due to complex environmental and economic dynamics of the Arctic, close interaction between researchers from various fields of science is needed to carry out comprehensive assessment of all the consequences of developing the territories and to obtain reliable predictions for the future.

The shipping, fishing and travel industries are currently flourishing in a number of Arctic countries. Further development of these sectors should contribute to sustainable socio-economic development of the Arctic [15]. Nevertheless, researchers propose to consider any issues of economic activity in the Arctic not only from the standpoint of economic costs and benefits, but also taking into account the potential impact of the changes on the social sphere, as well as taking into account the pressure on the environment [16].
Some of the most substantial sources of environmental damage to the Arctic territories in Russia include:
- destruction of the active layer in the tundra during construction of roads and pipelines;
- industrial waste disposal and recycling;
- emissions from mining, oil and gas extraction plants into the atmosphere;
- substantial damages due to accidents accompanied by oil spills as a result of depreciation of the main funds, where the consequences cannot be mitigated promptly.

We should note that according to [12], specific emissions from industrial facilities in the Arctic significantly exceed the average emission rates across Russia (Table 2), which means that special standards have to be developed for organizing industrial production.

Table 2. Average specific emissions, % to the average emission rate in Russia

|                         | Russian Arctic | Arctic seas | Zone of atmospheric impact on the Arctic |
|-------------------------|---------------|------------|----------------------------------------|
| Number of industrial facilities | 69            | 577        | 927                                    |
| Emissions into the atmosphere | 1372%        | 941%       | 361%                                   |
| Polluted effluents       | 208%          | 176%       | -                                      |
| Land transformation      | 287%          | -          | -                                      |
| Waste production         | 501%          | -          | -                                      |
| Motor vehicle emissions  | 95%           | -          | -                                      |

Meanwhile, developing the transport infrastructure, organizing the exploration, extraction and transportation of industrial resources are the crucial goals of the Russian Federation regarding socio-economic development of the Arctic region. The priority tasks are developing industrial resource extraction and the transport infrastructure, as well as using the Arctic marine environment while preserving its unique ecosystem or at least minimizing the damage from the development of the region. The volume of cargo traffic is considerably high and remains so throughout the entire year (Table 3).

Table 3. Cargo turnover in the ports of the Arctic Basin (cargo shipped to ports), thousand tons (compiled based on the data available at https://cargo-report.info/stat/ports-arctic/)

| Period | Apr 2018 | Mar 2018 | Feb 2018 | Jan 2018 | Dec 2017 | Nov. 2017 | Oct 2017 | Sep 2017 | Aug 2017 | Jul 2017 | Jun 2017 | May 2017 |
|--------|----------|----------|----------|----------|----------|-----------|----------|----------|----------|----------|----------|----------|
| Murmansk | 1747 | 1631 | 1582 | 1705 | 1968 | 1746 | 1998 | 1725 | 1670 | 1558 | 1735 | 1800 |
| Kandalaksha | 129 | 194 | 147 | 141 | 158 | 164 | 153 | 181 | 165 | 204 | 126 | 87 |
| Arkhangelsk | 19 | 79 | 77 | 85 | 88 | 52 | 61 | 52 | 68 | 41 | 63 | 89 |
| Total | 1895 | 1904 | 1805 | 1931 | 2214 | 1962 | 2211 | 1958 | 1903 | 1803 | 1924 | 1976 |

On average, 89% of the total volume of cargo is transported through the port of Murmansk. Notably, the volume of the cargo shipped to the ports considerably (by 50 times on average) exceeds the volume of the cargo shipped from the ports (Table 4). Cargo is shipped mainly from the port of Murmansk, with insignificant amount of cargo shipped from Kandalaksha and Arkhangelsk.

Table 4. Cargo turnover of the ports of the Arctic Basin (cargo shipped from ports), thousand tons (compiled based on the data available at https://cargo-report.info/stat/ports-arctic/)

| Period | Apr 2018 | Mar 2018 | Feb 2018 | Jan 2018 | Dec 2017 | Nov. 2017 | Oct 2017 | Sep 2017 | Aug 2017 | Jul 2017 | Jun 2017 | May 2017 |
|--------|----------|----------|----------|----------|----------|-----------|----------|----------|----------|----------|----------|----------|
| Murmansk | 37 | 32.8 | 17 | 35 | 33 | 45 | 32 | 38 | 29 | 33 | 31 | 29 |
and 4%, respectively. The rest of the cargo makes up less than 0.3% of the total volume, with 12.04 thousand tons taken up by construction minerals, 0.04 thousand tons — with timber, 0.03 thousand tons with grain, and 0.02 thousand tons with ferrous metals. The cargo shipped from ports is primarily ore, while the volume of other cargo is 0.17 thousand tons (less than 0.1%).

Figure 1. Structure of cargo turnover of the Arctic Basin Ports (cargo shipped to ports), thousand tons (compiled based on the data available at https://cargo-report.info/stat/ports-arctic/)

The current environmental conditions favor the development of the Arctic, while advancing innovative technologies can make resources extraction in the Arctic economically feasible. Most of the resources processed in the Arctic are associated with industries that are harmful to the environment. Developing marine communications also carries environmental risks for the Arctic ecosystem. At the same time, since either industrial corporations or cargo companies are not particularly interested in preserving the natural resources of the region, this task should be undertaken by the state. Sustainable development of the Arctic is impossible without state mechanisms for coordinating the competing interests of various participants. Developing a comprehensive system of administrative and economic measures to compensate for the negative external impacts of the Arctic development is one of the priority goals for the state.

The first step towards this goal may be establishing (at the level of the country, preferably, at the level of the world community) a unique legal framework regulating all types of economic activities, taking into account both natural and climatic characteristics of the region and the specifics of indigenous peoples’ lifestyle. Since the development of the Arctic is inevitable and necessary, it is expedient to work out not only the permissible standards of environmental pollution specific for the Arctic, but also the optimal (i.e., permissible at this stage of economic development) pollution levels. Effort should be made to compensate the marginal social costs from the deterioration of the environmental conditions in the region by the marginal social benefits from developing the Arctic territories. Nowadays various methods exist to assess environmental damage from industrial production. However, there are no uniform methods for assessing the social costs from the rising levels of pollution, as well as the social benefits from developing production or transport in the Arctic. Constructing such methods would make it possible for the state to determine the feasibility of the chosen directions of development and to form economically justified mechanisms to compensate negative external impacts. This could include, for
example, a system of administrative and economic measures aimed at encouraging enterprises to adopt innovative energy-saving and green technologies.

The system of economic and administrative measures cannot be created without restructuring the institution of environmental impact assessment in the Russian Federation, including:
- increasing the number of objects for assessment;
- establishing the types of activities that cannot be carried out without environmental assessment;
- generating unified requirements to the procedure for conducting the assessment;
- developing a unified procedure for assessing the extent of environmental damage;
- ensuring that the methods and results of the environmental assessment are transparent to the public;
- forming a unified assessment procedure based on the results of environmental impact assessment of external and social costs of intensified economic activities in the Arctic;
- forming a unified procedure for assessing the social benefits from intensified economic activity;
- developing a unified procedure for compensation for the damage caused to the Arctic ecosystems, in the event that a decision is made to either maintain the existing level of economic activity or intensify the activity;
- conducting environmental monitoring in the course of economic activity in the Arctic;
- ensuring transparency of the results of environmental monitoring and developing administrative mechanisms of swift responds to environmental standards violation by suspending the economic activity of the culprits;
- developing a mechanism for prohibiting activity in the Arctic region to enterprises with gross or systematic violations of the environmental standards.

The proposed system of measures should be complemented by additional measures granting economic and other preferences to the enterprises that comply with higher environmental standards, increasing their competitiveness in the development of Arctic resources.

4. Conclusions and discussion
To summarize, the exclusive status of the Arctic is not established in any international documents; for this reason, the legislation supporting environmental monitoring in the Arctic as a whole should be worked out taking into account the specifics of national regulation of environmental issues. Since adopting common international standards is an incredibly complex process, its first stages should involve the coordination of the main provisions of environmental monitoring in the zones of national jurisdiction of the countries bordering the Arctic by at least eliminating the inconsistencies between the legislations. The analysis of legal framework of the Russian Federation that we have carried out revealed that the legislation is not yet ready for developing an environmental monitoring system. The proposed approach can be used to determine the economically feasible level of development of the environmental monitoring system.

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