

# CLIMATE CHANGE IMPACT ON ARCTIC REGION

Capt. Mohamed Abdel Fattah Omar and Capt. Omar El-baroudy

Arab Academy for Science, Technology and Maritime Transport

## **GUIDE TO ACRONYMS AND ABBREVIATIONS**

<b>ACRONYM</b>	<b>DEFINITION</b>
ACIA Arctic	Climate Impact Assessment
AMAP	Arctic Monitoring and Assessment Program (Arctic Council working group)
AMSA	Arctic Marine Shipping Assessment
CO <sub>2</sub>	Carbon dioxide
COLREG	Convention on the International Regulations for Preventing Collisions at Sea, 1972
IACS	International Association of Classification societies
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973 as Modified by the Protocol of 1978
NO <sub>x</sub>	Nitrogen Oxide
PAME	Protection of the Arctic Marine Environment (Arctic Council working group)
SAR	Search And Rescue
SOLAS	International Convention for the Safety of Life at Sea, 1974
SO <sub>x</sub>	Sulfur Oxide
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978
UNCLOS	United Nations Convention on the Law of the Sea, 1982

## **ABSTRACT**

The life in the Arctic is very vulnerable and resilient because of the short growing season and the small variety of living things. The rapid rate of climate change poses challenges to the resilience of the Arctic life and now a day an extraordinary transformation in the Arctic region is taking place including the natural resources, environment, economy and the Arctic life style. The reason is the demand for the Arctic development, the creation of new shipping access routes, the increased population, the extra exploitation of natural resources and the impacts of several added activities. These factors when combine threatens the adaptive capacity and natural service provided by the Arctic ecosystem and will in return impact the whole planet in the form of global warming, rise of sea level and the protection of biodiversity.

The paper is discussing the risks from the Arctic shipping which increased due to the diminishing ice and glacier melt, as well as the exploitation of natural resources and economic development which require actions to face the changes in the Arctic ecosystem by the Arctic states. The paper also discusses the Arctic states role and the assigned Arctic council for promoting cooperation, coordination and interaction between the Arctic States to face the Arctic new challenges. Moreover, the convenient approaches to protect and restore the marine environment in parallel with the development requirement, the economic needs, social and cultural demands and the protection of the marine ecosystem by applying MPA network and spatial planning.

### **1. THE ARCTIC REGION CHARACTERISTICS**

The Arctic region has the most extreme cold conditions which accommodate an array of plants, animals and indigenous human societies that survived and adapted themselves with their environment for long time. The Arctic life is vulnerable to resilience, due to the highly variable climate in addition to the close connectivity and dependency on the surrounding environmental conditions. Unfortunately, the adaptive capacity and resilience of the Arctic living communities is strongly affected by the impacts from the increasing rapid rate of the climate change and pose new challenges from the increasing pressure and stresses brought by human activities and the growing human population. The Arctic is part of the territories of eight states, Canada, USA, Russia, Denmark, Norway, Sweden, Iceland and indigenous communities whom shaping and being shaped by the surrounding environment. The eight states have been addressing Arctic

problems through the Arctic council that provides and promotes coherent interaction between them. The council work is conducted by six scientific and technical working groups whom continuously provide the Arctic assessment reports, six non- Arctic permanent observer states and number of observers including the indigenous people whom have the rights of representation and participation in meetings for full consultation.

## **2. CLIMATE CHANGE IMPACT ON ARCTIC REGION**

The earth climate is rapidly changing and the impacts on the Arctic region were taken as a significance of global warming, the average temperature went up and twice the rate than the rest of the world (ACIA, 2004). The climate change resulted from the increased industrial development emissions of CO<sub>2</sub> and number of other pollutant gases beside natural causes and variations. The acidification of the ocean waters as consequence of increased ocean concentration of carbon dioxide disturbs the Arctic ecosystem composition. The ocean chemistry changes in addition to the rise in sea surface temperature led to diminish Arctic sea ice and melting Arctic glaciers which negatively affected the Arctic ecology. The reduction in Arctic sea ice increased various marine activities including the marine access to the region natural resources, the navigation period and opened new routes like the Northern Sea Route and the Northwest Passage. The natural resources exploitation begins to grow, the fishing stock enhanced due to increase productivity of some major marine Arctic fisheries as a result of the warm conditions, but there are also negative impacts over fisheries of some ocean floor species. The climate change effects on fisheries have social and economic impact over Arctic community due to the dislocation of fish sea stocks. Moreover the Arctic climate changes expand new business opportunities such as oil & gas industry, tourism and marine transport of goods. The new activities increased the impacts and the possibility of environmental damages which appeared in harming marine habitat, loss of ice- dependent species, health and social life style of Arctic people. These stresses when combined amplify the impacts over the Arctic ecosystem health and well-being.

The Arctic changes have rebound impact on the rest of the planet as the Arctic ecosystem provides natural services, moderating the global climate and protects marine biodiversity; therefore any changes will definitely affect the whole planet in raising the planet temperature and sea levels. The new Arctic activities and changes introduce new threats and risks which led to call for new governance and management approaches to the region.

### **3. ARCTIC MARITIME REGULATORY FRAMEWORK**

The Arctic waters mainly governed under the United Nations Convention on the Law of the Sea (UNCLOS), which sets out the legal framework for the regulation of shipping according to maritime zones of jurisdiction and provide the only obligations in the Arctic waters. UNCLOS give coastal states the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels (UNCLOS, Article 234). The International Maritime Organization (IMO), the specialized maritime agency of the United Nations who promotes maritime safety, security and protection of the marine environment from shipping also adopt maritime conventions, codes and guidelines aiming the implementation of international maritime rules and standards over ships sailing in the Arctic waters. The IMO specified the polar areas with mandatory requirements, the International Code of Safety for Ships Operating in Polar Waters (polar code). The polar code is an “add-on” Code to SOLAS and MARPOL which sets measures for the polar region including ships Certification, Design, Equipment and systems, Operation, Environmental protection, Manning and training, search and rescue and the protection of the unique environment and eco-systems of the polar regions. Moreover the IMO provides the polar waters with the non-mandatory guidelines for ships operating in polar waters (A 26/Res.1024) and the Arctic Guidelines (A.999 (25)) on Voyage Planning for Passenger Ships Operating in Remote Areas as well as (MSC.1/Circ.1184) for remote area S&R facilities. Non-governmental organization as the International Association of Classification Societies (IACS) unified requirements (polar classes) also in use but not obligatory covering the construction strengthening requirements for the ships operating in the polar areas. There have been a number of binding agreements which have been agreed under the auspices of the Council as the 2011 search and rescue agreement and 2013 Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic. As a result of the Arctic Climate Impact Assessment (ACIA) finding “reduced sea ice is very likely to increase marine transport and access to resources” the Council called the Protection of the Arctic Marine Environment (PAME) working group to conduct a comprehensive Arctic marine shipping assessment which published as AMSA 2009 report. The report focused on ships used in Arctic waters and on their impacts on Arctic environment and humans.

#### **4. THE SHIPPING IMPACTS ON ARCTIC ENVIRONMENT AND HUMANS**

The AMSA reported that 6000 vessels were making multiple voyages in the Arctic region and were destinational, for community re-supply, marine tourism and moving natural resources out of the Arctic and approximately 1,600 were fishing vessels (AMSA, 2009). A significance increase in cruise ships which were reported non polar built and observed their heavy activity in the summer season. Lack of major ports and emergency response capacity and the limited pollution mitigation capabilities raises the threats of oil spills which will have a severe impact over the marine environment and local community practices. The impacts from the increased shipping activities is severe to the Arctic marine environment including the introduction of alien species via ballast water, the interaction between migrating species and ships and the disruption of marine mammals. The ships black carbon, NOx& SOx emissions assists in accelerating the ice melt problem in the Arctic region which will have also a global climate impact. The lack in oceanographic data and hydrographic data of primary shipping routes threatens safe navigation in the ice covered areas besides the lack of systems to monitor and control traffic movements in addition to the limited radio and satellite communication. The current lack of marine infrastructure with the Arctic severe conditions makes conducts of emergency responses very difficult for saving lives and for pollution mitigation.

The risks from the Arctic shipping require actions to avoid changes in the Arctic ecosystem which will have in return global impact as mentioned above. The negatives found in the AMSA report could be a reliable data base for prioritizing the actions required by the national and international maritime communities and stakeholders. The main action is to enhance Arctic marine safety by accelerating the use of the international standards for vessels operating in the Arctic (polar code) by polar states. Protecting Arctic environment and people against shipping pollutants, surveying the Arctic marine use by indigenous communities and other marine users, enhance the engagement and consultation from the concerned parties in order to increase benefits and reduce the impacts. Identifying the Areas of Heightened Ecological and Cultural Significance and encourage implementation of measures to protect these areas from the impacts of Arctic marine shipping. Arctic states should take into account the international special designated areas for the purpose of environmental protection against shipping in the Arctic Ocean.

Finally, building the Arctic marine infrastructure required in order to enhance the protection of marine environment in support of sustainable development. The improvements should include establishment of ports, adequate reception facilities for ship-generated waste and raising the pollution response capabilities in addition establishing of marine traffic systems to improve monitoring and tracking of marine activities. Investing in Hydrographic, Meteorological and Oceanographic Data, communications systems, reliable navigational charts, ice navigation training and systems to support real time acquisition, analysis and transfer of information concerned with meteorological and oceanographic data.

The advantage from the AMSA report is providing Arctic vessel activity database for one year, showing all required information about vessels types, cargo being carried, areas of potential multiple uses and analysis of future growth. The report mapped the data into a Geographic Information System (GIS) therefore facilitate the analysis process and the identification of heavy traffic areas, the incidents locations, distributions and accidents probabilities occurring in the Arctic region that threatens the Arctic environment and all the ecological sensitive areas. The Arctic Council's 2009 Arctic Marine Shipping Assessment (AMSA) recommended "That the Arctic states should identify areas of heightened ecological and cultural significance in light of changing climate conditions and increasing multiple marine use and, where appropriate, should encourage implementation of measures to protect these areas from the impacts of Arctic marine shipping, in coordination with all stakeholders and consistent with international law." (PAME 2009)

The new uses of marine areas complicate the situation and the single-sector management has never solved the user-user conflict. An integrated management system is required to facilitate the interaction between the multiple uses and to coordinates the developing activities in parallel to minimize their impacts on the environment. The presence of Arctic marine protection networks and partnerships of non- governmental actors who have an influence over governmental policies and actions can be used to initiate the integrated management system in the Arctic.

## **5. PAN ARCTIC MPA NETWORK**

The drivers of the changes and pressures on the Arctic marine environment is complex and interconnected therefore requires enhanced cooperation to manage and conserve the marine

environment. MPA network would allow resource users to improve their developing plans in a way to avoid ecological and sensitive areas, adverse effects, and extra costs and reduce user-user conflicts. A well-coordinated Pan-Arctic network will be very beneficiary to ecological resilience strengthening of the Arctic by protecting the natural ecological values, natural bio-physical values, providing refuge for marine species, supporting marine community structure and Connecting and protecting spatially separate habitats (PAME, 2015). Also the MPA network has several benefits in Cultural and Socio-economic values, in Fostering Coordination and Collaboration to improve MPA management effectiveness, Identifying priorities and opportunities as well as Promote the active involvement of indigenous peoples. The effectiveness of the pan-Arctic MPA network is guided by the principals that ensure the achievement of the main network objectives. The principals include the systematic approach, Respect rights and activities of the indigenous people, agreements and international treaty, ensure open and transparent processes meaning partnership, consultation and timely information exchange. Moreover the use of the best available knowledge in the decision making process for the protection of priority areas, adaptation to change for ecological conservation and the protection of marine biodiversity. Finally, the principals ensure applying appropriate protection measures and employing best management practices together with integrating efforts across institutions in managing MPAs for conservation effectiveness.

MPA Network conservation objectives will be achieved when integrated to management practices that are not place-based, a broader Arctic ecosystem management approach. the ecologically or biologically significant areas (EBSA) criteria in identifying similar Arctic areas is to be considered and the Areas of heightened ecological and cultural significance using the International Maritime Organization (IMO) criteria for Particularly Sensitive Sea Areas (PSSA) as recommended by AMSA 2009. Marine spatial planning (MSP) and the ecosystem-based management (EBM) in the circumpolar region are the type of approaches required for the success of the Arctic region recovery.

## **6. WHY MARINE SPATIAL PLANNING**

Marine spatial planning (MSP) is a convenient way to establish a scientific approach to facilitate the interaction between the marine space and the human uses in a future planned way under the umbrella of the political will. MSP satisfies demands for development and protection of marine

environment bearing in mind the social and economic objectives. The presence of Arctic marine protection networks and partnerships of non-governmental actors who have an influence over governmental policies and actions can be used to initiate the MSP in the Arctic and covers the political will for such approach. Most of the new activities in the Arctic region will take place in coastal areas where resources are very sensitive and liable to change by the new activities, impacts and climate changes, therefore spatial planning is strongly required to overcome the user's activity conflicts. The main drivers of the marine spatial planning in the Arctic waters initiated by the pressure from human activities, the threats of the offshore oil & gas development, shipping activities, wind farms development and the over fishing. More initiatives come from the nature conservation requirement like the designation of new marine protected and reserve areas, designation of ecological and biological sensitive areas. The social and cultural initiatives for the designation of cultural areas of importance to indigenous people and their hunting areas, the tourism activities to avoid conflict with nature conservation and vulnerability of nature and wildlife. MSP can be used to avoid or reduce the types of conflicts resulting from the increased activity in the marine environment. The user vs. user conflict which means the adverse effects on each other, for example wind farms in conflict with ship lanes which raises the risks of collisions and loss of cargo. Another is the user vs. environment conflict where number of activities would not be compatible with healthy and sustainable environment as ships pollutants and its impacts over the Arctic environment.

MSP in the Arctic is the transformation from sole reliance on national government benefits towards a pan-Arctic approach to plan the future of the region. The MSP set out priorities for the Arctic area and defines what these priorities mean in time and space through zoning map and regulations, therefore provide the guidance and the means to make decisions confidently in a more comprehensive, integrated and complementary way. Since the Arctic ecological and economical resources are widely distributed in various places and at various times, these spatial and temporal distributions are mapped. Through MSP Arctic ecological and economical resources distributions are examined to understand the effect of climate change and the long term pressures on the marine system. MSP provide solutions for environmental, economic and social interactions beside MSP is able to assist in the identification of biologically and ecologically important areas, supply scientific information for the business investment decisions and providing new opportunities for peoples in the Arctic region.



## **7. Conclusion**

The Arctic region requires international cooperation to overcome the Arctic changes which in return have impacts on the whole planet. The Arctic environmental changes and ecosystem disturbance and the diminishing ice cover areas affected the global warmth and encouraged further marine activities in the area that increases the threats and added more pressure over the Arctic ecosystem. More efforts are needed from all the stakeholders to govern the Arctic region in a way that avoids cultural, social, environmental and economic development conflicts. MPAs and spatial planning is required strongly to protect Arctic marine conservations, both approaches assist in achieving the region objectives and ensures the proper planning for the future of the Arctic. For the pushing forward of such approaches it requires Arctic states to work on establishing regional agreements, a wide approach and cooperation among them and beyond national governments.

## **References**

Ehler, C. (2014). A guide to evaluating marine spatial plans (IOC Manuals and Guides, N°. 70, ICAM Dossier N°. 8), Retrieved August 26, 2015, Retrieved from <http://goo.gl/fONGjg>

Ehler, C. (2014). A guide to evaluating marine spatial plans (IOC Manuals and Guides, N°. 70, ICAM Dossier N°. 8), Retrieved August 26, 2015, Retrieved from <http://goo.gl/fONGjg>.

Charles N. Ehle, marine spatial planning in the arctic: A first step toward ecosystem-based management, A technical report of the Aspen Institute Dialogue and Commission on Arctic Climate Change. Retrieved from <http://www.aspeninstitute.org>.

PAME/Arctic Council 2015. The Framework for a Pan-Arctic Network of Marine Protected Areas (MPAs), Retrieved from [http://www.pame.is/images/03\\_Projects/MPA/MPA\\_Report.pd](http://www.pame.is/images/03_Projects/MPA/MPA_Report.pd).

AMSA/Arctic Council 2009. Arctic Marine Shipping Assessment, executive summary with recommendations, Retrieved from <http://www.pame.is>.

AMAP/CAFF/SDWG, 2013. Identification of Arctic marine areas of heightened ecological and cultural significance: Arctic Marine Shipping Assessment (AMSA) IIc. Arctic Monitoring and Assessment Programme (AMAP), Oslo. 114 pp, Retrieved from

<http://www.amap.no/documents/doc/Identification-of-Arctic-marine-areas-of-heightened-ecological-and-cultural-significance-Arctic-Marine-Shipping-Assessment-AMSA-IIc/869>

ACIA 2004. Arctic Climate Impact Assessment, Cambridge university press, Retrieved from <http://www.acia.uaf.edu>.

Elizabeth Tedsen, Sandra Cavalieri, R. Andreas Kraemer 2013. Arctic Marine Governance: Opportunities for Transatlantic Cooperation, derived from <https://books.google.se>.

Adoption of an international code of safety for ships operating in polar waters (Polar Code), derived from <http://www.imo.org>.