HORIZON 2020
Research and Innovation action
Grant Agreement No. 730965

ARICE: Arctic Research Icebreaker Consortium: A strategy for meeting the needs for marine-based research in the Arctic

Deliverable 2.1. Identification of Key Stakeholders and Implementation of the ARICE Industry Liaison Panel (ILP) with ToR

Submission of Deliverable

Work Package	WP2
Deliverable no. & title	D2.1. Identification of Key Stakeholders and Implementation of the ARICE Industry Liaison Panel (ILP) with ToR
Version	V1
Creation Date	26.02.2019
Last change	06.03.2019
Status	☐ Draft ☒ WP lead accepted ☒ Executive Board accepted
Dissemination level	☒ PU-Public ☐ PP- Restricted to programme partners ☐ RE- Restricted to a group specified by the consortium ☐ CO- Confidential, only for members of the consortium
Lead Beneficiary	WOC
Contributors	☐ 1 – AWI, ☐ 2 – SPRS, ☐ 3 - NPI, ☐ 4 - ULAVAL, ☐ 5 – UAF/CFOS, ☐ 6 – AP, ☐ 7 – CSIC-UTM, ☐ 8 – CNR, ☐ 9 - WOC, ☐ 10 – IOPAN, ☐ 11 – FMI, ☐ 12 - CNRS, ☐ 13 – NERC-BAS, ☐ 14 – DTU-AQUA
Due date	30.06.2018
Delivery date	26.02.2019

1. Abstract

The World Ocean Council (WOC) has undertaken to identify the key Arctic Ocean industry stakeholders who would be most relevant to the aims of the ARICE Project. These efforts have focused on sectors and companies with operations in the Arctic Ocean, i.e. those who are able to deploy instrumentation or collect environmental data in this region.

As a result of the work to identify stakeholders, the WOC has been able to implement an Industry Liaison Panel (ILP). The list of the initial members of the ILP and the Terms of Reference (ToR) for the ILP are described below.

The work to identify relevant key Arctic Ocean industry stakeholders has proceeded from the macro level analysis of sectors (e.g. tourism) sub-sectors when needed (e.g. expedition tourism), relevant industry associations, and then to specific key companies within each sector.

2. Introduction

This document outlines the effort and results for each of the levels of stakeholder identification, i.e. sector, sub-sector and company level. The report begins with a brief description of each sector and a short indication of the status and trends for each one in relation to the Arctic.

The effort to identify Arctic industry stakeholders has been focused on the most relevant sectors, geographies and time frame. Sectorally, the focus is on industries with vessels and platforms operating in the Arctic. These sectors have the most direct interest in engaging with the Arctic research community and have the infrastructure that could potentially participate in hosting or deploying instruments for data collection. Geographically, the focus is on the European Arctic, and the associated Northern Sea Route (NSR). Temporally, the focus is on recent and current industry activity and the trends and probable patterns for the next 5-10 years, where such information is available.

For each key sector, the WOC also identified sectoral or industry associations, especially when these are directly relevant to the Arctic, and the key individuals in those associations. Within each sector, the WOC has identified specific key companies pertinent to ARICE and has begun to identify individuals to contact in those companies. The work to identify specific companies and individuals is an ongoing process during the ARICE Project.

To reach out more broadly to the ocean and Arctic business community, the WOC has also identified important events for the key Arctic industry sectors. The WOC also worked to contact the ocean and Arctic business community about ARICE by sending out specific ARICE related WOC News Releases to its global network as an additional means to engage industry stakeholders.

3. Methods

The WOC has worked through a variety of means to identify industry stakeholders relevant to ARICE. These include identifying industry representatives: via the WOC network of contacts in the ocean business community, through outreach and engagement at industry

events which WOC participates in, by preparing communications about ARICE and widely circulating these to the global ocean business community.

These efforts have focused on sectors and companies with physical operations in the Arctic Ocean, i.e. those who are able to deploy instrumentation or collect data. There are other private sector components with interests in the Arctic, e.g. insurance, investment. However, they are not industries which are physically present in the region with vessels or other infrastructure important to the ARICE objective to "improve the Research Institutes' services by partnering with maritime industry on a 'ships and platforms of opportunity' programme and by exploring into new technologies that will lead to an improvement of ship-based and autonomous measurements in the Arctic Ocean."

Events

The WOC identifies, communicates with and participates at numerous conferences for identifying, raising awareness with and engaging Arctic Ocean industry stakeholders. Below is a listing of such events for 2018. The events listed are not always specific "Arctic" events, but they do always include the key sectors and companies operating in the Arctic. For many of these events, the WOC participates and is often invited to be a speaker or session chair thus providing the opportunity to communicate on the ARICE Project and reach out directly to relevant industry stakeholders. The events marked with an asterisk (*) included a specific oral and/or visual presentation on ARICE.

Other events have been identified at which WOC was not able to participate in during 2018 but may provide opportunities for industry stakeholder outreach in the future. Efforts are underway to identify important industry events in 2019 which are relevant to ARICE.

The Category A events listed below are those in which the WOC has participated in 2018. At these events, ARICE was mentioned in presentations and/or discussed with industry representatives. These gatherings also provided the opportunity to engage industry members in understanding the ILP and seeking representatives to join the ILP.

Category B events are those for which WOC has been in contact with the organizers with the possibility to present or participate in 2018 and in future years (for ongoing event series), or event series which are additional possibilities for participating in the future.

The wide presence of WOC at numerous industry-related events ensures the awareness within this community of the ARICE Project.

<u>Category A events</u>
(Events marked * included a specific oral and/or visual presentation on ARICE)

- 19 January, BRUSSELS, EC Marine Knowledge Experts Group: Initial Meeting (Expert Group Member)
- 14-16 March, SINGAPORE, Asia Pacific Maritime, Work Boat Conference (Invited Plenary Speaker)
- 17-19 April, HELSINKI, Arctic Shipping Forum (Roundtable Convener: "Data Collection from Ships of Opportunity") *
- 19-21 April, OXFORD, Ditchley Foundation Conference on the Ocean (Invited Participant)

- 23-24 April, HAMBURG, Green Maritime Forum (Invited Session Chair and Speaker)
- 2-3 May, COPENHAGEN, Opening Oceans Conference (Invited Session Chair and Speaker)
- 24-26 May, ST PETERSBURG, Saint Petersburg International Economic Forum (SPIEF) (Invited Speaker for special "Ocean" session)
- 14-16 May, HONG KONG, Asian Shipowners Association (ASA) Annual Conference (Invited Participant)
- 17 May HONG KONG International Chamber of Shipping (ICS) Annual Conference (Invited Participant)
- 17-18 May, BREMEN, ZMT Marine Bio-economy Event: "Science Meets Business" (Opening Keynote Speaker)
- 31 May-1 June VANCOUVER Green Marine (Invited Speaker)
- 19-21 June, BOULDER, USA, International Hydrographic Organization (IHO): Crowd-Sourced Bathymetry Working Group Meeting (Invited Speaker)
- 24-26 June, DAVOS, Arctic Observing Summit (Invited Speaker) *
- 4-7 July, TOULOUSE, Blue Planet Symposium of the Group on Earth Observations (GEO) - "Blue Growth" session, "Maritime Transport: Overview of Industry and Ocean Information Needs" (Invited Speaker)
- 3-4 October, HONG KONG, Global Maritime Forum (Invited Participant)
- 23-26 October TROMSO Women in Shipping and Trade Association (WISTA) Annual General Meeting (Invited Session Chair)
- 3-14 December, KATOWICE, UN Framework Convention on Climate Change (UNFCCC) COP 24 (Participant)
- 5-6 December, HAMBURG, Arctic Shipping Summit (Invited Speaker)
- 7-8 December, PARIS, Silk Road Think Tank Network/Silk Road Forum (Member, Invited Participant)

Category B events

- 21-26 January, TROMSO, Arctic Frontiers
- 15-16 February, SAINT PETERSBURG, International Arctic Summit – ARCTIKA 2018
- 8 March, BRUSSELS, European Ocean Observing System (EOOS) Forum
- 12-14 March, STAMFORD, Shipping 2018
- 13-15 March, LONDON, Oceanology 2018
- 21-23 March, COPENHAGEN, Green Shipping Technology & Shipping 2030 Europe
- 19-20 April, SEATTLE, Arctic Encounter
- 22-24 April, SINGAPORE, Maritime Week
- 4-6 June, ATHENS, Posidonia
- 19 June, COPENHAGEN, Maritime 2020
- 28-30 June, HONG KONG, Belt and Road Summit
- 19 September, SHANGHAI, Trade Winds Shipping China 2018
- 2 October, AMSTERDAM, Green Shipping Summit
- 17 October, OSLO, Arctic Expedition Cruise Organization (AECO) Annual Conference
- 17-18, October, SAINT JOHNS Arctic Shipping Forum
- 18-19 October, ARCHANGEL, Arctic Projects – Today and Tomorrow
- 19-21 October, REYKJAVIK, Arctic Circle Assembly
- 23-25 October, QINGDAO, Oceanology International
- 24 October, DALIAN, 1st Maritime China 2018
- 29 October, HONG KONG, Belt and Road Conference

- 6-8 November, SINGAPORE, Seawork Asia
- 12-16 November, CANBERRA, International Hydrographic Organization (IHO) GEBCO Annual Meeting
- 19-25 November, HONG KONG, Hong Kong Maritime Week
- 20 November, ROTTERDAM, International Energy Event - Offshore Day
- 29 November, BRUSSELS, EUAPA Circumpolar Dialogue Seminar

Communications

The WOC undertook outreach to the global ocean business community via News Releases as an additional means to assist in identifying industry stakeholders.

The WOC News Release is sent to the WOC overall mailing list of more than 32,000 ocean industry stakeholders worldwide. These include many ocean industry media outlets and industry associations, who often recirculate or repost the WOC news through their own websites, newsletters, etc. The WOC News Releases are also posted on the LinkedIn pages of WOC and the WOC CEO, who have over 8,000 LinkedIn connections, primarily from ocean industries.

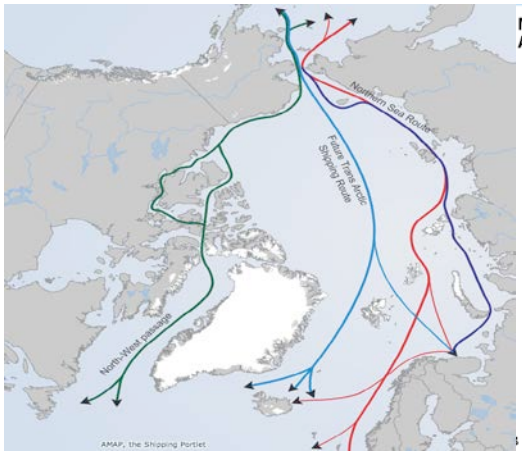
In 2018, the WOC broadcast the following News Releases about the ARICE Project as part of our efforts to identify industry stakeholders:

- 20 February: WOC BRINGS INDUSTRY ENGAGEMENT TO THE INTERNATIONAL ARCTIC RESEARCH ICEBREAKER CONSORTIUM (ARICE) LAUNCHED IN BREMERHAVEN
- 29 June: RESEARCH ICEBREAKERS OPEN TO SHIP-TIME PROPOSALS FOR FULLY FUNDED TRANSNATIONAL ACCESS

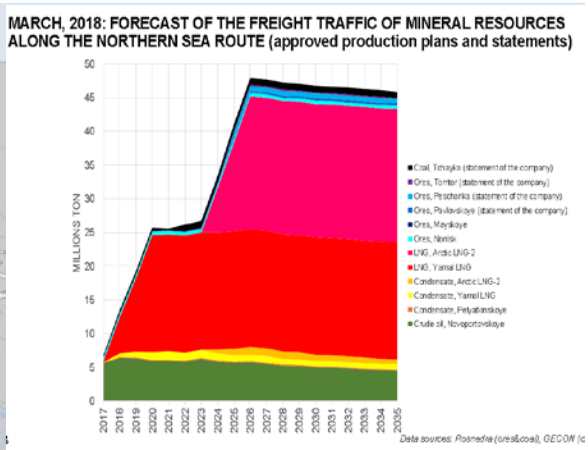
4. Key Sectors

In order to best identify the key industry sectors important to the ARICE Project, the WOC undertook a review and evaluation of the major industry and business sectors operating in the Arctic and important to research and the collection of data. A synopsis of the status and trends in these sectors is included below as the basis and context for identifying specific industry associations and companies related to each sector.

Shipping



Arctic Shipping Routes



Arctic Export Shipping Forecasts to 2030

Diminishing sea ice coverage is enabling greater maritime traffic in the Arctic. The northern routes are a significantly shorter distance (approximately 4,700 nm) from Northern Europe to East Asia with 12 to 15 days decreases in transit time if weather conditions cooperate. Yet of the primary identified shipping routes through the Arctic – the NSR, Northwest Passage (NWP), and Transpolar Route (TPR) – only the NSR will have extended periods of opening through approximately 2025. Russia already maintains at least 16 ports along the 3,000-mile route.

In 2017, the Northern Sea Route Administration (NSRA) issued 662 permissions to vessels for navigation along the NSR, though only 107 of these for non-Russian flagged vessels. That year, 9.74 million tons of various freights were transported by vessels, though mostly between ports located along the NSR.

The main growth in Arctic shipping will be to transport exports out of the region and bring materials and supplies to the growing coastal settlements associated with these developments. Historically, much of this has been related to mining, as there are significant mineral resources throughout the Arctic, including gold, silver, graphite, nickel, copper, titanium, iron, lead, coal, diamond, uranium and rare earth metals. While some new deposits are being revealed as Arctic ice melts, it is likely that near term development will continue to focus on existing mines. As extraction increases and infrastructure to these mines and areas is improved, e.g. at the Baffinland iron mine, the number of vessels carrying ore out from the region will increase.

The major change and growth in export shipping emanating from the Arctic will be related to oil and gas. The amount of shipping with fossil fuels originating from the Arctic is now growing significantly with the opening of the Yamal LNG project, which is 50.1 % owned by Novatek, 20 % by Total, 20 % by China National Petroleum Company, and 9.9 % by the Chinese Silk Road Fund. Production began in December 2017, with predicted annual production of up to 360 billion cubic meters of gas. A new class of icebreaking LNG carriers have started gas deliveries from Yamal to Asia. In addition, there is now significant transshipment of LNG in northern Norway, to transfer the gas from ice class vessels to non-ice class vessels which can transport the gas more economically in ice free areas to European ports.

Although much attention has been focused on Arctic transit shipping, in 2016 there were just 19 voyages between Europe and Asia through the NSR and in 2017 only 24 vessels and 194,364 tons of cargo transited the NSR. This is lower than average since Russia opened it to other nations in 2009, and much less than in 2013 when China's COSCO and others sent cargos through to explore the possibility of a maritime route. That year, with exceptional weather conditions, 71 vessels and 1.36 million tons of cargo transited the NSR.

However, the trend accelerated significantly in 2018, with more than 17 million tons of cargo on the NSR, nearly doubling the volume of the previous year, and with at least 500,000 tons from transit traffic, the highest figure since 2013. The growth in traffic primarily comes from the export of LNG, crude oil, and coal. Output from Yamal increased 17% in 2018, to nearly 20,000 tons a day, and an additional increase to 8 million tons is expected by 2020. The company exported oil to nine countries during 2018, including Norway, the UK, France, and the Netherlands. Up to 30 million tons per year of high-quality

coal coming from the Taymyr Peninsula by 2025 will soon become the largest growth factor of NSR traffic.

Weather and vessel size limitations – due to reduced water depths and widths limited to icebreaker accompaniment – reduce the efficiencies of the commercial shipping industry, which values economies of scale and the just-in-time shipping model. Arctic shipping in its current state is not yet reliable enough to adhere to these requirements, although when the Transpolar Route opens it may become more appealing. China has already included the "Polar Silk Road" in its broader One Belt One Road Initiative. Weather and ice conditions will remain a constraint to the growth in shipping, with unpredictable ice flows moving into vessel routes, harsh storms, and cold operating temperatures.

Shipbuilding

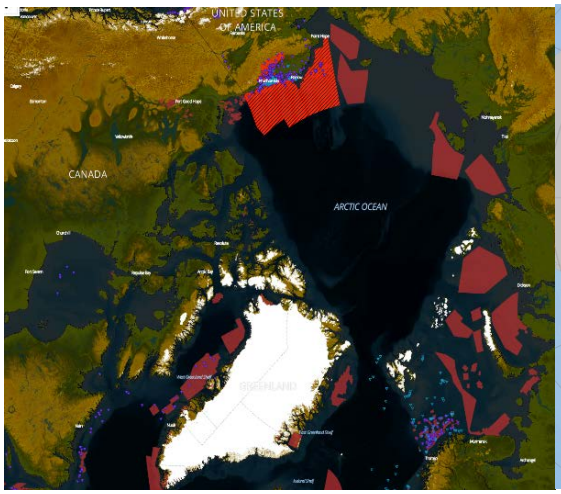
The shipbuilding sector is also a key stakeholder as the growth in Arctic shipping is being made possible by: 1) the construction of more ice breakers, to accompany vessels moving into and out of or across the NSR or NWP and 2) the construction of ice class carriers for Arctic export commodities or for Arctic transit.

Russia is scaling up the construction of ice breakers to scale up the use of the NSR, with the number of ice breakers to be increased from 4 to 13 vessels up to 2030.

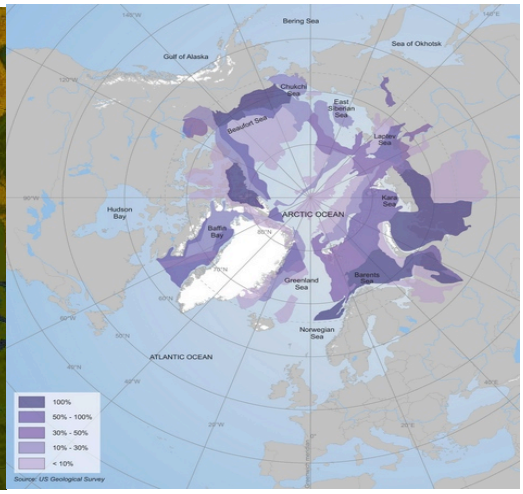
At the same time, more ice class vessels are being built to make their own way through the region. Of the new class of icebreaking LNG carriers which have started gas deliveries from Yamal to Asia, 15 such vessels are projected to be in operation soon. At least 4 ice class supply vessels are being built in Russia designed for work in the offshore oil industry and to provide a wide set of services, such as delivering cargo to offshore drilling platforms. These vessels also pass through ice, tow ships and offshore facilities, and participate in rescue operations. Maersk has ordered 7 ice class container ships to operate in the Baltic.

For the tourism industry, in 2017, order books showed that there were more than 30 polar expedition cruise vessels on the order books for construction for the 2018-2021 period alone. Of these, 25 % were to be delivered in 2018, 55 % (over 10 vessels) were planned for 2019, 13 % planned for 2020, and 7 % planned for 2021. This building spree involves 13 shipyards in 9 countries: China (1), Canada (2), German (1), Norway (4), Portugal (1), Spain (1), Netherlands (1), US (1), Vietnam (1). Among these, the 1st ice class (and LNG powered) expedition cruise ship is under development by Ponant.

Oil and Gas



Arctic Oil and Gas: Recent Activity



Arctic Oil and Gas: Reserves

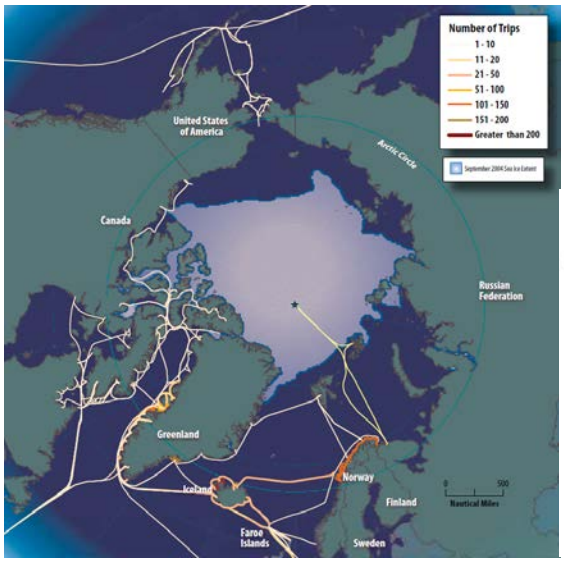
It is estimated that the Arctic may hold nearly one-third of the world's natural gas and 13 % of global oil reserves, with most of these resources offshore in less than 500 m water depth. The costs of exploring, developing, and extracting these resources are very high given the harsh environment, limited infrastructure, and difficulties posed. Given the current market prices, there is limited interest in pursuing these reserves in North America, though Norway and Russia are continuing development in the Barents, Kara and Laptev Seas.

The Barents Sea is little different from the rest of the Norwegian continental shelf, where oil exploration has been developed safely for nearly 50 years. 130 wells have already been drilled in the Barents Sea. In Norway, a group of operators established the Barents Sea Exploration Collaboration (BaSEC). The initial participants Statoil (now Equinor), Eni Norge, Engie, Lundin and OMV were joined by 13 additional members, including Chevron, ConocoPhillips, Petoro. In 2017 the Barents was found to have 80% more oil than the 2015 estimate concluded, with good discoveries that have hundreds of millions of barrels.

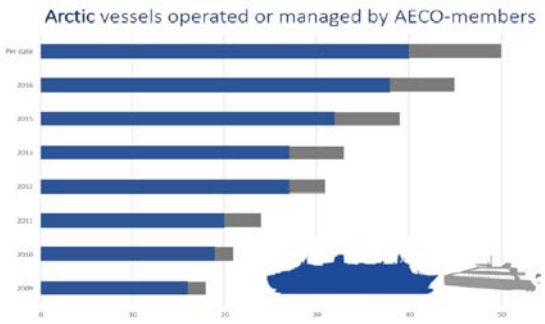
In 2017 Rosneft found oil in the northernmost well on the Russian Arctic shelf, in the Laptev Sea. Gazprom is active in the Pechora Sea, in the Barents Sea, in the East Siberian and Chukhchi seas, and the Okhotsk Sea.

Drilling opportunities may be opening up in the North American Arctic, in Alaska's Arctic National Wildlife Refuge and in the Chukchi and Beaufort Seas. In 2017, Eni SpA recently received an exploratory-drilling permit for Alaska state waters, the first since Royal Dutch Shell pulled out of its Chukchi Sea venture in 2015. Production drilling in U.S. Arctic federal waters is currently limited to the Northstar facility in the Beaufort Sea, which began producing in 2001. In Canada, although the Beaufort Sea contains an estimated 56 trillion cubic feet of natural gas and 8 billion barrels of oil, exploration is indefinitely on hold.

Tourism



Arctic Cruise Tourism



Arctic Expedition Tourism

Cruise Tourism

Marine tourism to and within the Arctic is expanding rapidly. On the eastern side of the Atlantic, cruises to the high Arctic usually involve travel to and around the Svalbard archipelago, where there were 41,000 marine cruise visitors to the archipelago in 2016. Typical itineraries depart from either a Norwegian port or Longyearbyen on Spitsbergen, and last for around 1 to 2 weeks. In some cases, itineraries may stop at along Greenland's eastern coast.

More cruises now go to Iceland and Norway's North Cape as part of a wider itinerary. Most of these cruises are by Hurtigruten, which has 12 ships and Viking. Among the other major cruise lines with summer itineraries to Norway are: Seabourn, Ponant, MSC, Holland America, Costa, Royal Caribbean, Princess, Crystal, Azamara, P & O, and Cunard. As an example of growth and expansion, Hurtigruten, which traditionally sailed along the Norwegian coast between Bergen and Kirkenes, will in 2019 continue its Arctic expansion to include sailing the NWP as well as between Tromsø and Murmansk.

In the western Atlantic, there are a variety of itineraries that incorporate Greenland and Arctic Canada. Most of the itineraries that head into the high Arctic depart from or include Kangerlussuaq, Greenland's most important maritime transport hub. In Greenland in 2016, 26,000 cruise tourists visited on 41 cruises by 31 ships.

In Canada specifically, the Arctic has a much smaller number of cruise passengers, at about 3,000 per year. As with Svalbard many air visitors were going elsewhere, embarking on cruises to the Canadian Arctic. In 2016, the NWP was transited for the first time by a large non-ice class cruise ship, the Crystal Serenity, which was accompanied by the British Antarctic re-supply vessel Ernest Shackleton. This was repeated in 2017, but the company decided not to offer another NWP cruise opportunity until their first expedition ship, the Crystal Endeavour, will be available in 2020.

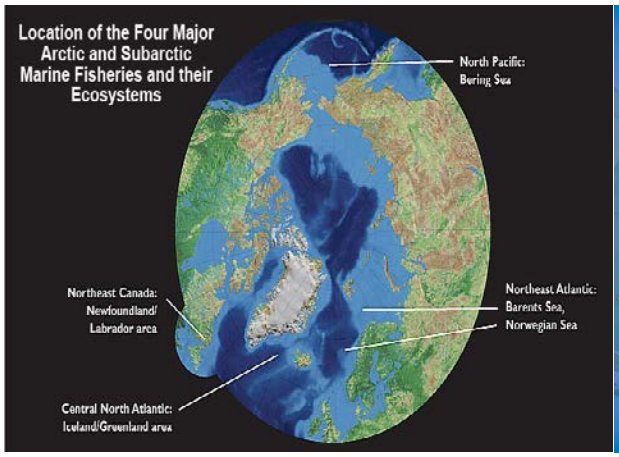
Expedition Tourism

The Arctic Expedition Tourism sub-sector is growing rapidly, building on the nearly 80 expedition ships already sailing in the region. Four new ships were launched in 2018, 11 new ships are planned for 2019, with the total number of 28 or more to be added by 2022. Most of the new-built vessels have a higher ice-class and will offer tours deeper into Arctic far-away destinations than the current fleet. Some of the new ships has Polar Class 5 and one even has plans to be the first to offer nonnuclear powered voyages to the North Pole.

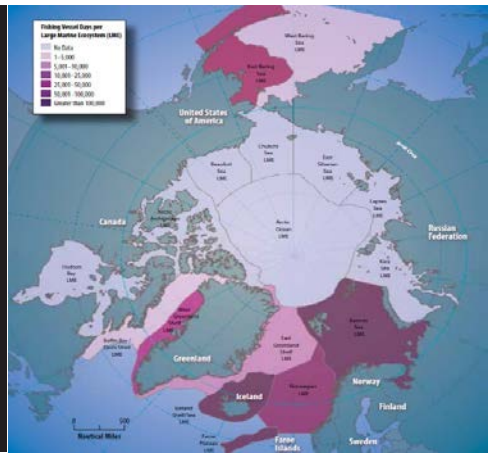
With a relatively short sailing season, lasting from June to late August, Arctic ports like Longyearbyen on Svalbard will likely be very crowded by 2022. Other destinations in the fast growing expedition markets are northern Norway, Russia's Franz Josef Land, Iceland, Greenland, Canada and Alaska. Voyages along Russia's NSR by international expedition operators are still yet to be announced.

Expedition ships have ice-strengthened hulls and are especially suited to the conditions, pushing farther north than their mainstream rivals. Companies include G Adventures, Quark Expeditions, Lindblad Expeditions and luxury companies with expedition ships, such as Silversea and Compagnie du Ponant. All of the key companies are members of the Arctic Expedition Cruise Organization (AECO). The sub-sector is growing rapidly, with up to 30 vessels being built between 2018-2021.

Fishing



Arctic Fisheries and Ecosystems



Arctic Fisheries: Activity Areas

The waters of the Arctic national waters of five Arctic countries: US, Canada, Russia, Norway, and Denmark support four major Arctic and Subarctic marine fisheries and ecosystems: 1) the Northeast Atlantic (Barents and Norwegian Seas), 2) the Central North Atlantic (waters around Iceland and off East Greenland), 3) Northeast Canada (Newfoundland and Labrador Seas) and 4) the North Pacific (Bering Sea).

Beyond this, the 2.8 million-square-kilometre area of international waters that compose the central part of the Arctic Ocean, where the five Arctic countries, joined by a handful of other nations with economic interests in the region, agreed in December 2017 to temporarily ban fishing.

Fisheries are one of the most important industries in the Arctic representing large shares of GDP in some countries. For the fisheries above the Arctic Circle, the dominating Arctic fishing areas are the Norwegian Sea, the Icelandic Grounds and the Barents Sea. The Barents Sea is one of the most productive oceans in the world, with about 13% of the total world catch in 2014. The economically most important species are the Northeast Arctic cod, haddock and capelin, the latter being the main prey species of cod. Russia and Norway share these fish stocks. Catches from East and West of Greenland (including the Arctic Sea) are marginal in comparison; however, fishing in these areas constitutes important livelihoods for many small-scale operators. North-eastern Pacific fisheries take place south of the Arctic Circle.

In Norway, the number of registered fishing vessels decreased from 13 000 to 6000 during 2000 to 2014. About 80% of the fleet in 2014 consisted of small vessels below 11 meters and this vessel group experienced the largest reduction in the number of vessels (approx. - 56%). The group of larger offshore vessels (cod trawlers, purse seiners, etc.), above 28 m, comprised about 250 vessels in 2014—a 30% reduction from 380 in 2000. The larger vessels were responsible for the largest share of the total catch (80% in 2014).

Russia's part of the Arctic can be divided into two zones, with a significant part of the Barents Sea and the waters of the Norway and Greenland seas having proven fisheries, while the East Siberian, Laptev, Kara, and Chukchi Seas are rarely fished and poorly known. The Northwest Russian fishing fleet is focused on large trawlers supplying large seafood processing units on land. With limited fish resources near the coast, a coastal fleet never developed in Northwest Russia (like it did in Norway, Iceland and Greenland). The industrial fleet is located mainly in the Murmansk and also in Arkhangelsk, with 207 vessels, including 11 extra-large vessels, 11 large vessels. In addition, there are about 100 vessels of different types active in coastal fisheries.

The Icelandic fishing fleet consists of 1700 fishing vessels in 2013. Many are open vessels and smaller decked vessels, in addition to trawlers and larger decked vessels. In recent years, the number of open vessels and medium-sized decked vessels decreased by 40–50% while the number of the largest vessels increased from 12 to 26. Pelagic catches dominate the volume (64%) and constitute about 30% of catch value.

Fishing is Greenland's primary industry and shrimps are the most important species. In 2013, the fishing fleet consisted of 384 vessels, but with only 23 larger than 30 m in length. Shrimp trawlers were either larger offshore trawlers or inshore trawlers. The former operate outside three nautical miles from the baseline and in open waters.

Aquaculture

Arctic aquaculture has in the last two decades grown significantly and is today dominated by Norwegian Atlantic salmon farming. Arctic aquaculture makes up about 25% of global marine aquaculture production.

Norway is the world's largest producer of Atlantic salmon and also has a significant production of rainbow trout and a smaller production of several other marine and freshwater species. A considerable part of this production takes place in the Arctic region.

Russia is planning to develop coastal aquaculture industries in the Murmansk Oblast where there is interest in growing high-value species such as salmon, trout, and scomber and have aquaculture production double by 2020, with up to 250,000 tonnes projected to be produced per year. In 2016 this progressed, with revenues from salmon farming in Murmansk Oblast of 4,680 tons of salmon, an increase of 136 % from 2015. At the end of the year, Russian Aquaculture had 9,196 tons of salmon in its cage nets, almost three times more than the previous year.

In Iceland, only a limited part of coastline is protected against waves and suitable for aquaculture, and hence production is relatively small.

5. Key Sector/Industry Associations

Shipping

- International Chamber of Shipping (ICS)
- INTERTANKO – International Tanker Owners Federation
- Oil Companies International Marine Forum (OCIMF)
- Society of International Gas Tanker and Terminal Operators (SIGTTO)
- National Shipowners Associations (for each Arctic country)

Shipbuilding

- Asian Shipbuilders Experts Association (ASEF)
- Association of European Shipbuilders
- Chinese Association of Shipbuilding Industry (CANSI)
- EuroYards

Oil and Gas

- International Oil and Gas Producers Association (IOGP)
- International Petroleum Industry Environment and Conservation Association (IPIECA)
- Association of Oil and Gas Suppliers Sozvezdye
- Norwegian Oil and Gas Association

Tourism

- Cruise Line International Association (CLIA)
- Arctic Expedition Cruise Organization (AECO)

Fishing

- European Fisheries Alliance (EUFA)
- Europeche
- Norwegian Fishermen's Association (Norges Fiskarlag)
- All-Russia Association of Fishing Industry, Businessmen and Exporters (VARPE)

Aquaculture

- Global Aquaculture Alliance (GAA)
- Federation of European Aquaculture Producers (FEAP)
- Fish and Seafood Suppliers in Norway
- Norwegian Fish Farmers Association

6. Companies and Individuals

The WOC has identified an initial set of key companies most relevant to ARICE in each of the key sectors. We are also identifying key individuals to contact in these companies. The efforts to identify additional key companies and individuals is an ongoing process throughout the ARICE Project.

Shipping

- Arctia (Finland)
- COSCO (China)
- Grieg (Norway)
- Maersk (Denmark)
- MSC (Switzerland)
- Murmansk Shipping Company (Russia)
- Norlisk Nickel (Russia)
- Northern Shipping Company (Russia)
- NYK Shipping (Japan)
- Royal Arctic Shipping (Denmark)
- Stena Bulk (Sweden)
- Tschudi Shipping (Norway)

Shipbuilding

- Aker Arctic (Finland)
- Arctech Helsinki Shipyard (Finland)
- China State Shipbuilding Corp (CSSC) (China)
- Daewoo Shipbuilding and Marine Engineering (DSME) (S Korea)
- Fincantieri (Norway/Italy)
- Hyundai Heavy Industries (Japan)
- United Shipbuilding Corporation (Russia)
- Vard (Norway)
- Zvezda Shipbuilding (Russia)

Oil and Gas

- Eni SpA (Italy)
- Eqinor (Norway)
- Gazprom (Russia)
- Lundin (Sweden)
- OMV (Austria)
- Rosneft (Russia)
- Total (France)

Tourism

Cruise Tourism

- Celebrity (US)
- Costa (US)
- Crystal (US)
- Cunard (US)
- Hapag Lloyd (Germany)

- Holland America (US)
- Hurtigruten (Norway)
- MSC (Switzerland)
- Norwegian (Norway)
- P&O (US)
- Princess (US)
- Ponant (France)
- Royal Caribbean (US)
- Silversea (Monaco)
- Viking (US)

Expedition Tourism [Arctic Expedition Cruise Organization (AECO) members}

- Aurora Expeditions (Australia)
- G-Adventures (Canada)
- Hurtigruten (Norway)
- Lindblad Expeditions (US)
- Oceanwide Expeditions (Netherlands)
- Origo Expeditions (Sweden)
- Quark Expeditions (US)
- PolarQuest (Sweden)
- Hurtigruten Svalbard (Norway)
- 69 Nord (Norway)
- Silversea (Monaco)
- Tallship Company (Netherlands)
- Albatros Expeditions (Denmark)
- Hanse Explorer (Germany)
- Grands Espaces (Switzerland)
- Abercrombie & Kent (US)
- One Ocean Expeditions (Canada)
- Poseidon Expeditions (Russia)
- Algol Oceans (France)
- Noble Caledonia (UK)
- EYOS Expeditions (UK)
- Seabourn (US)
- Boreal Yachting (Norway)
- Aztec Lady (France)
- Ponant (France)
- Polar Kreuzfahrten (Germany)
- Adventure Canada (Canada)
- Zegrahm Expeditions (US)
- The World, Residences at Sea (US)
- Arctic Sailing Escape (France)

Fishing

- Alinco AS (Norway)
- Arctic Catch AS (Norway)
- Arctic Fisheries (US)
- Arctic Fishery Alliance (Canada)
- Lerøy Seafood Group (Norway)

- Norwegian Crab AS (Norway)
- Qikiqtaaluk Corporation (Canada)
- Royal Greenland (Denmark)
- Royal Norway AS (Norway)

Aquaculture

- Cermaq (Norway)
- Grieg Seafood (Norway)
- Lerøy Seafood Group (Norway)
- Marine Harvest (Norway)
- Russian Aquaculture (Russia)

7. Industry Liaison Panel Members

GENERAL

The European project ARICE "Arctic Research Icebreaker Consortium" was launched on the first of January 2018, bringing together a team of 15 partners from 13 different countries from Europe, USA and Canada. The main objective of this four-year project is to improve the capacities for marine-based research in the ice-covered Arctic Ocean.

A central aim of ARICE is to establish a regular dialogue with the maritime industry to identify opportunities for cooperation between business and research.

The panellists represent a diversity of key sector and company stakeholders as identified in the Identification of Key Stakeholders deliverable. Over the period of the ARICE project, other additions may be made to the ILP as the need and opportunity arises, especially in order to comply with a gender balance and to address additional sectors.

PANELLISTS

Company	Name	Position	Sector
SINTEF	Karl Johan Reite	Research Scientist	Technology
Oceanwide Marine Expeditions	Mark van der Hulst	COO	Expedition Cruise
Fincantieri Oil & Gas	Marko Keber	Head of Special Projects	Shipbuilding, Oil and Gas
Total	Michael Borrell	Senior VP, North Sea & Russia	Oil and Gas
Ponant	Nicolas Dubreuil	Director of Sustainability	Cruise
Stena Bulk	Patrik Svahn	CEO	Shipping
Northern Shipping Company (NSC) Archangelsk	Yakov Antonov	General Director	Shipping

Karl Johan Reite, Research Scientist, SINTEF

Mr. Reite holds a PhD in marine cybernetics at the Norwegian University of Science and Technology (NTNU) and has experience as mate onboard a Norwegian fishing vessel. He is employed by the Norwegian research company SINTEF Fisheries and Aquaculture (SFA), a research institute within the SINTEF group. The SFA finds solutions to challenges along the entire marine value chain, from the biological basis for marine production, through aquaculture and capture fisheries technology to processing and distribution. Today the SFA has project activities in the region of 150 million NOK, all of which contribute to an increasingly advanced and technology-driven ocean industries.

Mark van der Hulst, COO, Oceanwide Marine Expeditions

Mr. van der Hulst worked most of his life aboard ships or in the maritime industry, e.g. in the Royal Netherlands Navy for over 13 years and in shipbuilding. He served as Project Manager for the rebuilding of the Oceanwide Expeditions' vessel Plancius, after which he became Oceanwide Expeditions' Managing Director of Oceanwide Marine Services. He currently serves as COO of Oceanwide Expeditions. He is involved in the development of the Polar Code and related polar maritime issues and has participated in various sessions at the International Maritime Organization (IMO) Polar Code meetings in London. Mr. van der Hulst has been active in the AECO and the International Association of Antarctic Tourism Operators (IAATO), currently as Chair of the Marine Committee.

Marko Keber, Head of Special Projects, Fincantieri Oil & Gas

Mr. Keber is Head of Special Projects at Fincantieri Oil & Gas, which is a wholly owned subsidiary of Fincantieri SpA. Headquartered in Trieste, Fincantieri is the fourth largest shipbuilder in the world and the first for diversification and innovation. It is a leader in the design and construction of cruise ships and a key player in all areas of high-tech shipbuilding, from offshore to naval vessels, special ships and ferries, to highly complex mega-yachts, as well as in ship repair and conversions, production of systems and components and after-sales services. In offshore the company is specialized in the design and construction of vessels for the Oil & Gas and Renewables sectors ranging from large drillships, multi-purpose platforms and special vessels for marine construction to medium sized offshore support, crew and subsea construction vessels.

Michael Borrell, Senior VP, North Sea & Russia, Total

Mr. Borrell, a graduate of Cambridge University in Chemical Engineering (MSc 1993, BA 1984), joined Total's Exploration & Production in 1985. He has held several positions in the Group, especially in the UK and Argentina. In 2015 he was appointed Senior Vice President, Europe & Central Asia which comprises the former Continental Europe & Central Asia Division and Northern Europe Division. In September 2017, Mr. Borrell was appointed Senior Vice President of the new geographical division, North Sea & Russia Division. Total is a French multinational integrated oil and gas company founded in 1924. Its businesses cover the entire oil and gas chain, from crude oil and natural gas exploration and production to power generation, transportation, refining, petroleum product marketing and international crude oil and product trading.

Nicolas Dubreuil, Director of Sustainability, Ponant

Mr. Dubreuil's first expedition was from Vancouver to Anchorage at the age of 18. Since then, he has been spending more than eight months a year near the poles, which he has travelled across by kayak, on skis, on sleighs, on foot, and underwater. From Alaska to South Georgia, via Nunavut, Spitsbergen, Siberia, Iceland, the Antarctic Peninsula and Greenland, he accompanies and guides expeditions for athletes, scientists, film crews, and the mobility-impaired. Mr. Dubreuil has been a PONANT expedition leader, guide and ethnologist for 12 years. Ponant is a French cruise ship company, operating five ships, all under the French flag, with a significant level of activity in the Arctic. The company currently has the first ice-class cruise vessel under construction.

Patrik Svahn, CEO, Stena Bulk

Mr. Svahn became Stena Bulk CEO after serving as the company's Manager of Commercial Operations. He has a seagoing background and sailed on tankers as an Officer before going ashore to work on the commercial side of the shipping industry. He holds a Bachelor degree in Shipping and Logistics Program and a Masters from Mariner Program at Chalmers Technical University. Stena Bulk, founded in 1982 and based in Gothenburg, Sweden, owns and operates a fleet of tankers/vessels. The company provides sea transportation of crude oil, refined petroleum and chemicals, and liquid natural gas worldwide. Its services range from developing and building tankers to manning and chartering them , as well as fleet management consulting.

Yakov Antonov, General Director, Northern Shipping Company (NSC) Archangelsk

Mr. Antonov has been General Director of JSC NSC Arkhangelsk since 2016. Prior to this he served as First Deputy of General Director and Head of Fleet Operation Department at JSC Murmansk Shipping Company. He has been a Director of JSC NSC Arkhangelsk since May 2008. Northern Shipping Company OJSC is among the largest shipping companies in the North-West Region of Russia. The company is engaged in maritime transportation of cargo all over the world including the Northern Sea Route. The Company's fleet consists of multi-purpose dry cargo carriers that carry all types of dry cargo including radioactive and hazardous cargo.

8. ILP Terms of Reference

GENERAL

The European project ARICE "Arctic Research Icebreaker Consortium" was launched on the first of January 2018, bringing together a team of 15 partners from 13 different countries from Europe, USA and Canada. The main objective of this four-year project is to improve the capacities for marine-based research in the ice-covered Arctic Ocean.

A central aim of ARICE is to establish a regular dialogue with the maritime industry to identify opportunities for cooperation between business and research.

MEMBERSHIP

The ARICE Industry Liaison Panel (ILP) is comprised of representatives of the Arctic maritime industry. The chair of the ILP will be elected by the ILP Members and recommended to the ARICE General Assembly (GA) for approval.

ILP Members will be appointed to ARICE for the full duration of the project.

PURPOSE

The ILP will be a group of 7 industry representatives who will provide guidance and advice to the ARICE Project. Future additions to the original panel will be considered as the need and opportunity arises.

The role of the ILP is to stimulate the connection between science and industry and to give recommendations and support to the strategic vision of ARICE on scientific cooperation with industry.

The ILP will also act as liaison between the ARICE project and the Arctic/ocean business community, maintaining communication and coordinated actions with business and other industry organisations.

DUTIES OF THE ILP

Develop joint industry and science community priorities for Arctic research and observations
Identify:

- Opportunities for technology transfer and innovation to address industry challenges e.g. to reduce environmental impacts (noise, emissions etc.) of ships in Polar Regions
- Opportunities for collaboration and innovation to develop specialised technology of mutual value, e.g. under-ice sensors

Link the ARICE consortium of polar vessel operators, major European research institutions and the Arctic oceanographic fleet with the private sector operators of research and survey vessels:

- Those collecting and using marine and ocean data for various use applications
- Those engaged in design and outfitting of icebreakers and scientific equipment

COMMUNICATION CHANNELS

This interaction will take place via a few calls per year, via emails, and via one physical meeting. A chair of the ILP will be elected within its members to coordinate the actions of the ILP.

MEETINGS

The ILP meeting with the SLP will be held in conjunction with the annual WOC Sustainable Ocean Summit, once a year

- The 1st ARICE ILP meeting with the scientific community will take place at a dedicated industry-science session, to be organized at the Arctic Circle Assembly in Reykjavik, Iceland, October 10-13, 2019.
- The second ARICE ILP meeting with the SLP is expected to take place in the second half of 2019 at the Sustainable Ocean Summit in Paris.

The Chair of the ILP will be invited to take part at the annual ARICE GA meetings to advise on industry issues.

Travelling expenses to the ILP meetings will be covered by the ARICE consortium.

