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ARICE: Arctic Research Icebreaker Consortium:

**A strategy for meeting the needs for marine-based research
in the Arctic**

Deliverable 1.7. Recommendations from the joint
scientific and operational workshop on implementation
of shared European cruises

Submission of Deliverable

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Abstract

The study of the Arctic Ocean has become a priority area of research and innovation in Europe and internationally during the past decades. This report reviews the input from an international virtual workshop during ASSW 2021 and a follow-up online survey initiated during ASSW 2022 about the bottlenecks and possible suggestions for how joint or shared European or international research cruises on research icebreakers (or polar research vessels) can be conducted to facilitate transnational Arctic research. While the challenges for typically national assets like research icebreakers are multiple and multi-level, the input from the workshop and survey describes possible ways to access research icebreakers and also identifies typical obstacles faced by scientists for such access.

1. Introduction

ARICE is a European Union Horizon 2020 integration action with the aim of improving the use of existing Polar Research Vessel (PRV) capacity at European and international levels by improving coordination and avoiding duplication of efforts and by working towards an International Arctic Research Icebreaker Consortium.

ARICE Work Package 1 (WP1) “Towards an Arctic Research Icebreaker Consortium” contributes towards these efforts by organizing workshops, conducting desktop analyses, providing guidelines and suggestions and Terms of References, as well as by linking researchers and PRV operators.

This deliverable is the fifth desktop analysis out of the total of five deliverables in WP1 that together aim at presenting a coherent and complete picture of the resources and potential of enhanced collaboration between PRV fleet operators as a basis for the further multinational co-operation.

The previously conducted desktop analysis, Deliverable 1.2. *Guidelines on the conditions to access European PRVs* reviewed the status of the European Arctic Research Vessel fleet and their accessibility (ARICE, 2019a). Deliverable 1.3. *Map of potential beneficiaries of a coordinated PRV fleet* identified four overarching categories of beneficiaries and explained how improving European coordination of PRVs would require significant, but mutually beneficial to all these four groups, changes in the ways the funding of research on and access to PRVs is organised (ARICE, 2019b). Deliverable 1.4 *Identification report on contribution of a coordinated PRV fleet to fulfilling EU member states’ research interests in the Arctic Ocean* (ARICE, 2020a) showed how a coordinated research ship fleet could better contribute to the transnational scientific and societal needs in the Arctic, including the European needs for improved knowledge and management of the Arctic Ocean. Deliverable 1.5 *Report on the global and future resources’ investments in Arctic icebreaker capacity to research* mapped the current and future investment to the polar research fleet internationally, showing that only few research icebreakers are operated in Europe, despite a few recent investments in new vessels (ARICE, 2020b). While ARICE Deliverable 1.6 *Modalities of European PRVs’ ship-time collaborations and exchanges* discussed ways to improve transnational access and optimise use of PRVs (ARICE, 2020c).

This report synthesises information from an international workshop and an additional online survey to map experiences with transnational access, typical bottlenecks that are present, and suggestions and recommendations for improved access.

2. Workshop and surveys on international access to research infrastructure in the Arctic

Due to the travel restrictions associated with the COVID-19 pandemic, an in-person workshop could not be conducted as originally planned. The materials used in this report include:

1. The input from the participants of the online/virtual ASSW 2021 *Workshop on International Access to Research Infrastructure in the Arctic* (<https://faro-arctic.org/news/nyhed/artikel/workshop-during-assw-2021>).

This workshop was jointly organised by the Forum of Arctic Research Operators (FARO), the Association of Polar Early Career Scientists (APECS), the Arctic Research Icebreaker Consortium (ARICE), and the International Network for Terrestrial Research and Monitoring in the Arctic (INTERACT). In order to complement the workshop discussions, a digital survey was shared with the participants. The 17 participants at the 2021 workshop that took part in the interactive online survey identified themselves as following: Ship operators 24%, Funding agency 12%, Research 59%, Other 24%.

2. Results from a survey distributed at targeted ASSW/AOS 2022 meetings
In order to reach a larger audience a follow-up online survey (with the same questions as digitally shared at the ASSW 2021 workshop) was shared with participants of ASSW/AOS 2022 at targeted ASSW/AOS business meetings (e. g. H2020 Arctic Passion workshop and Synoptic Arctic Survey workshop) as well as disseminated through the ARICE website and ARICE newsletter. In the additional 28 responses from the 2022 survey 85% were representing research, funding by 4% and operators by 4% and the remaining as “other”.

The results of both surveys have been merged in the discussion below.

3. Survey questions

The primary questions that were asked attempted to capture the current avenues for achieving transnational access to PRVs, bottlenecks that have been faced in transnational access, and invited suggestions for solutions to improve transnational access to PRVs.

The following specific primary questions were posed to scope for current/recent experiences in transnational access (although in part the issues could be similar for national access to PRVs); the same questions were posed at the workshop in 2021 and at the purely online survey in 2022.

- If you have accessed PRVs transnationally, how was the access arranged?
- In your opinion, what is the most significant obstacle for such access?
- What are possible steps or solutions for improved transnational access to PRVs in the Arctic?

4. Results in brief

Typical ways of gaining access to PRVs

1. Personal connections

The most common way of obtaining PRV access was through personal connections or contacts (i.e. low-level person-to-person, uncoordinated access). This is due to the lack of formal open options for multilateral access to PRVs, except for the current case of ARICE, EUROFLEETS and, to some extent, the Ocean Facilities Exchange Group (OFEG) barter.

2. Bilateral agreements

Several participants listed different forms of bilateral agreements to access international research vessels, either through participation in projects together with PRV operators/institutions with PRV ship time, or through agreements or memorandums of understanding between institutions. However, these typically allow access to very specific expeditions.

Thus, it seems that rather informal connections on personal level are used to provide access to PRVs, which is obviously a disadvantage for those who do not have such connections, i.e., typically early career scientists with less extensive international networks.

Common obstacles in obtaining access to PRVs

1. Lack of funding

Many participants indicated the “lack of funding” as the primary obstacle to gain access to non-national vessels, which includes the lack of national funding for polar research in general, and for ship time in particular. Specifically, the lack of funding for ship time as well as for travel expenses to access the vessel and to cover other direct expenses connected to participating in a cruise (such as logistics, extra salary, etc.) were noted.

2. Lack of information

The second-most often cited obstacle was “lack of information about cruises/expeditions”, including lack of information on potential availability of space on board upcoming expeditions.

3. Lack of connections/collaborations with scientists from countries with access to PRVs

Several respondents said they lacked collaborators with access to PRVs, implying that the most common way of achieving access (as per the responses to Question 1, above) does indeed not provide open or equal access for individual scientists to PRVs.

4. Other

Other obstacles cited were lack of possibility to co-design cruise plans (i. e. that one could join a planned expedition but not lead and design an expedition), (geo)political issues, and lack of personnel (where the latter could be linked to lack of funding).

Additionally, it was noted that PRVs are nationally operated, and as such also often fully booked for national users or demands, which are not all geared towards research (e.g. use of PRVs for logistics).

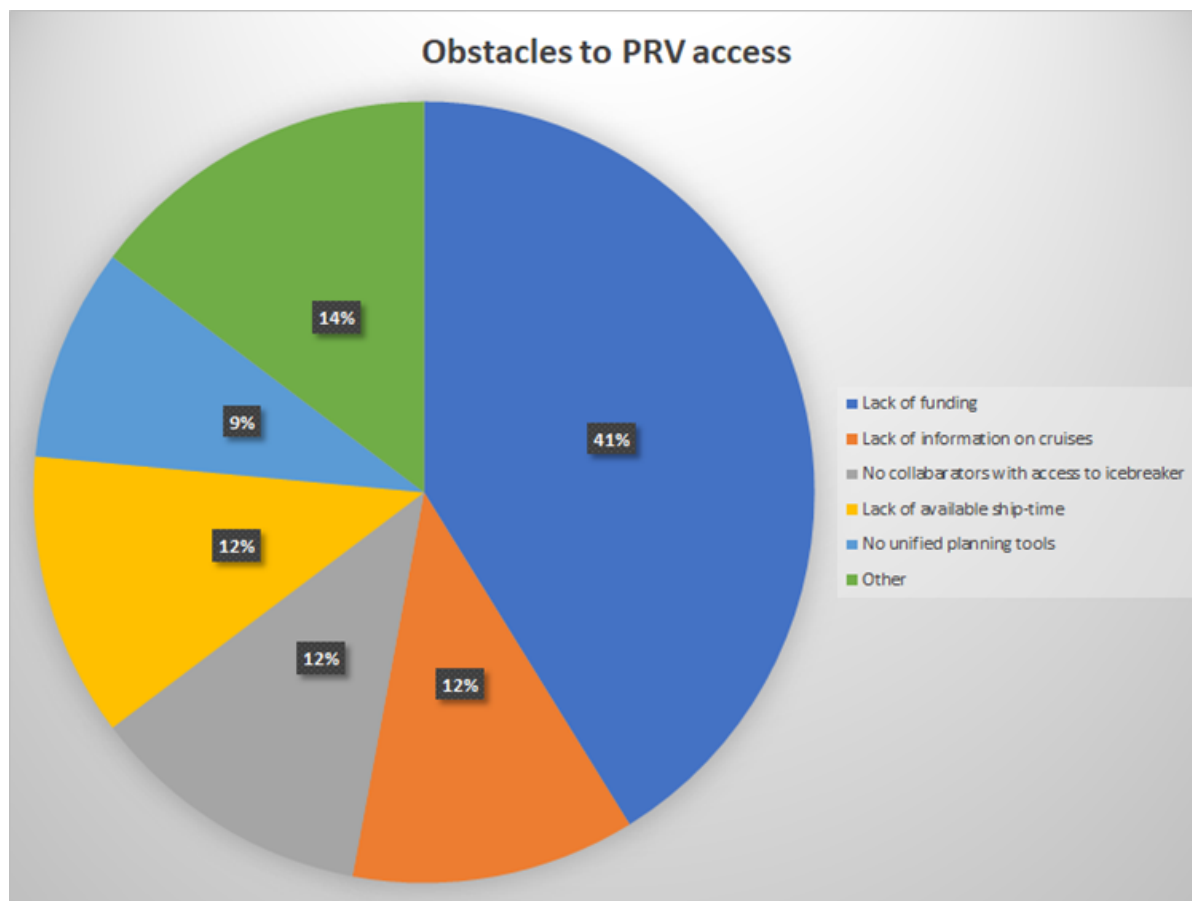


Figure 1. Responses on obstacles to PRV access grouped in broad categories.

In the discussions during the workshop other obstacles were mentioned, such as: the lack of incentives for operators to facilitate international berth sharing, the difficulties in the integration of individual projects into the overall scientific programme of an expedition, the lack of time to plan for funding, logistics, language (especially for Russian expeditions), transportation of samples, and permits.

From the point of view of the funding agencies, it was noted imperative to fix the berth costs well in advance, as planning with a hypothetical berth fee is not possible. However, this is difficult from the point of view of the operators, as berth fees fluctuate with the operational area of the vessel and the cost of fuel (among others).

Recommendations for improved access to PRVs

1. Increase international cooperation

Enhanced international cooperation is needed to address topics that are the responsibility of many nations. Such is the cases of building knowledge on climate change and understanding the ongoing changes in the Arctic Ocean. Cooperation among PRV operators and funding agencies is needed to ensure access to these infrastructures.

2. Improved information

Many respondents listed “better information” in various forms as a means of improved access to PRVs. Suggestions include the creation of an information portal with all upcoming cruises, meetings,

guidebooks on how to access national PRVs. It was also highlighted that expedition plans should be made public well in advance.

3. Sustained funding opportunities

Improved funding opportunities, both for participating in expeditions and for making more PRV ship time available for trans-national access, were commonly listed recommendations. For improved access in general, different ways of improving sustained international funding agreements were suggested, such as a country “membership” for multi-year funding to access ship time/berths, the continuation of transnational access EU funded projects such as ARICE. Another common suggestion was to increase the number of available PRVs presumably by building more of them and/or ensuring that the existing ones spend more time in the high Arctic and/or allot more space and time for TNA.

4. Standardisation of application procedures

Standardisation of application procedures and protocols, and establishment of a cross-national cruise committee, were also suggested to improve access to PRVs; several responses highlighted that a unified international system of evaluating proposals and allotting funding is required if the goal is to make sure the best science teams and plans are given access to PRVs. It was also noted that long planning horizons are needed for scientists to be able to find funding and plan expedition participation. A number of initiatives to this aim have recently been developed, e.g. for research vessels with operations in Alaskan waters (<https://www.iarpccollaborations.org/research-expeditions.html>) and software development that many ship operators can plan expeditions in the same platform (<https://www.marinefacilitiesplanning.com/>). However a challenge is the lack of interoperability of these initiatives.

It was suggested that, in addition of the regular calls for ship time for transnational access, with co-designed research cruises, a second type of access could be established to take advantage of opportunistic access to spare berths on already planned expeditions available at short(er) notice.

Also, there is probably great potential for more widespread use of remote access to vessels, which would increase the scientific value of expeditions at low additional cost and at the same time foster new scientific collaborations.

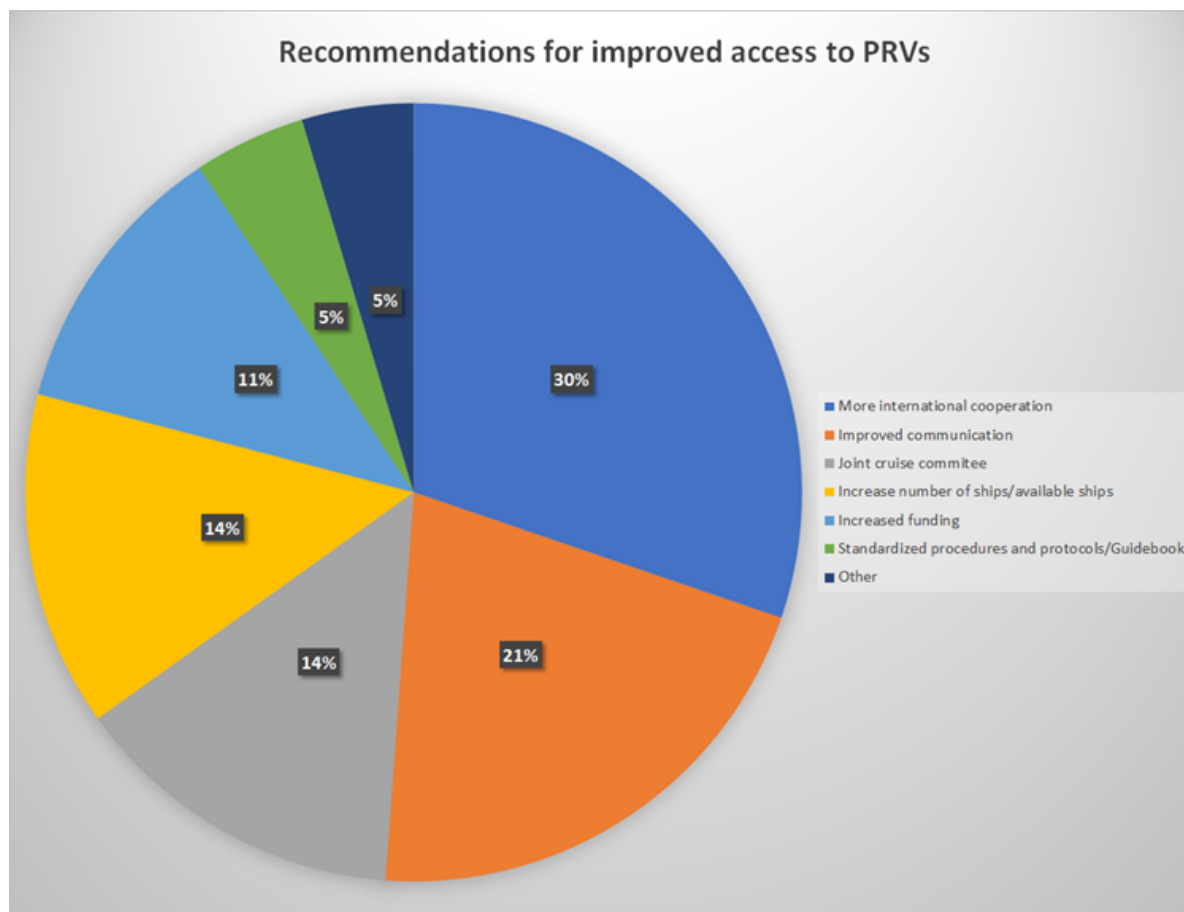


Figure 2. Recommendations for improved access to PRVs grouped in broad categories.

The full results from the virtual workshop and online survey are given in Appendix 1.

5. Conclusions and recommendations

The fact that the most common way of accessing PRVs outside of the national pools is through personal-level contacts, showcases the fundamental lack of open and formalised ways of obtaining transnational ship time or to join planned international Arctic PRV cruises.

Particularly:

- There is no system in place for proposing/applying for TNA to PRVs, and information about upcoming cruises is not sufficient or easily available well in advance
- There is no generic or cross-national funding system in place, neither for ship time nor for direct costs associated with cruise participation.
- There is generally not enough PRV ship time available for Arctic science, also noted in earlier ARICE deliverables. The demand is high, the number of such vessels is limited - especially in Europe - and the existing ones are not exclusively used for science expeditions in the Arctic, but as well for logistic operations elsewhere.

The key recommendations to improve this situation, based on the outcomes of the ASSW 2021 and ASSW 2022 workshop and surveys, are to:

- Establish a sustained international PRV access programme, either through an expanded ARICE model or through a similar system to the IASC stewardship, funded through commitment of national and (e.g.) EU resources.
- Improve the access to information on planned cruises and berth availability and cruise planning procedures. An information system or joint portal of PRV operators should be used by all PRV operators with a multi-year planning horizon to allow for funding and science plans/personnel to be coordinated. An example of this kind of initiative exists in Alaska as the IARPC Collaborations(<https://www.iarpcollaborations.org/research-expeditions.html>).
- A system with two levels of transnational access calls could be beneficial. One for joint planning of full cruises and a second for opportunistic offers of spare berths on already planned expeditions publicly available.

References

ARICE D1.2 (2019a) Deliverable 1.2. Guidelines on the conditions to access European PRVs. Available at: https://arice-h2020.eu/wp-content/uploads/2021/07/arice_d1_2_guidelines_on_the_conditions.pdf

ARICE D1.3 (2019b) Deliverable 1.3. Map of potential beneficiaries of a coordinated PRV fleet. Available at: https://arice-h2020.eu/wp-content/uploads/2021/07/arice_d1_3_map_of_potential_beneficiaries.pdf

ARICE D1.4 (2020a) Deliverable 1.4. Identification report on contribution of a coordinated PRV fleet to fulfilling EU member states' research interests in the Arctic Ocean. Available at: https://arice-h2020.eu/wp-content/uploads/2021/07/arice_d1_4_identification_report_on_contribution.pdf

ARICE D1.5 (2020b) Deliverable 1.5. Report on the global and future resources' investments in Arctic icebreaker capacity to research. Available at: https://arice-h2020.eu/wp-content/uploads/2021/07/arice_d1_5_report_on_investments.pdf

ARICE D1.6 (2020c) Deliverable 1.6. Modalities of European PRVs' shiptime collaborations and exchanges. Available at: https://arice-h2020.eu/wp-content/uploads/2021/07/arice_d1-6_modalities_of_european_prvs_final.pdf

Appendix 1. All written survey responses from 2021 workshop break-out and 2022 online survey.

| Who do you represent? | Do you represent or reside in an EU country - can select multiple | Icebreaker | EU | Arctic | Do you have experience in participating in or facilitating transnational access to polar research vessels - can select multiple | If you have accessed PRVs trans- nationally, how was the access arranged, how was it funded? Bilateral or multilateral agreements? Personal contacts? Other? (free text comments). | Here are some examples of possible obstacles for trans- national access to research icebreakers, in your opinion what is the most significant obstacle? | To follow-up on the previous question, in your own words, what are the specific obstacles you have phased? (free text). | On what level of society or research community are these obstacles? I.e. where do we need to look for solutions? (free text) | What are possible steps or solutions for improved transnational access to research icebreakers in the Arctic? (free text) |
|-----------------------|---|------------|-----|------------|---|--|---|--|--|---|
| Ship operator | outside EU, with an icebreaking research vessel, non-Arctic nation | yes | no | non-Arctic | Yes, as operator | Research Institute own budget based on bilateral agreement | Lack of information on cruises/expeditions | related information access is limited. | The official discussion between NPOCs level NOT researcher level necessary. | Setting up standard procedure and protocol to increase accessibility |
| Research | in the EU, without an icebreaking research vessel, Arctic nation | no | yes | Arctic | Yes, as scientist | Have not accessed. | Lack of funding | National research focus on commercial fish stocks relevant to country. Limited governmental interest in supporting research outside National EEZ except for commercial fish stocks. | Governmental level as they provide most of funding for research institutes and mandate areas of research. | Governmental commitment to Arctic research outside national EEZ and on other aspect of ecosystem beside commercial fish stocks. |
| Other | outside EU | | no | | Not in any capacity | I have not used this opportunity. | I am not into it. | I am not into it. | I am not into it. | You could cooperate with a project like INTERACT. They have a lot of experience on these topscorer and are quite successful in their administration of Transnational Access. |
| Research | in the EU, with an icebreaking research vessel, non-Arctic nation | yes | yes | non-Arctic | Not in any capacity | no | Lack of funding | Lack of funding | Funding agencies | Increase fundings |
| Funding agency | in the EU | | yes | | Yes, as funder | OFEG barfers, see: https://www.ofeg.org/np4/13 | No collaborators with access to research icebreaker | programs such as ARICE do facilitate access to countries that lack icebreaker access through own infrastructure | More collaborative international programs will further increase transnational access | Increase number of ships taking part in ARICE beyond the current fleet |
| Research | in the EU, without an icebreaking research vessel, Arctic nation | no | yes | Arctic | Yes, as funder, Yes, as scientist | ARICE on year, and personal contacts other years | Lack of funding | With sufficient national funding we could lead expeditions and invite others. For joining existing cruises it is at time difficult to know what is available. Finally there is a catch 22: need to secure berth for the research grant application, but can be difficult to fulfill promises in the collaboration (and berth allocated) if the research grant is not funded. | A potential solution is an EU funding pool for ship time. So EU projects can have joint cruises. Also better use of the tools available for advertising which vessel is going where. | Sustained funding arrangement similar to those in ARICE and EUROFLEETS. This offers scientists (in particular early career with more limited network), to lead cruises even if own institution does not have a vessel. |
| Research | in the EU, without an icebreaking research vessel, Arctic nation | no | yes | Arctic | Not in any capacity | no | Lack of information on cruises/expeditions | no communication, no visibility | Decision committee? Tender opportunities for research? circle of privileged decision-makers? | Transparent communication / federate polar community |
| Research | in the EU | | yes | | Yes, as scientist | Personal contact | Lack of funding | xx | xx | xx |
| Research | in the EU, with an icebreaking research vessel, Arctic nation | yes | yes | Arctic | Yes, as scientist | Personal contacts | Lack of funding | Lack of funding or limited scientific networks as early career researcher | All levels of society and scientific community. | More widespread and frequent information about possibilities and opportunities of ARICE, or corresponding, to the national vessel operators, funding agencies, and academic institutions. The earlier an opportunity is presented and identified, the more time is available for preparations for scientific collaborations or proposals. |
| Research | non-Arctic nation | | | non-Arctic | Yes, as scientist, Yes, other | tendering process | No collaborators with access to research icebreaker | availability of PRV | no idea | hiring with many research institutions |
| Research | outside EU, without an icebreaking research vessel, non-Arctic nation | no | | non-Arctic | Yes, as scientist | multilateral | missing option to co-design route needed for specific research | missing option to co-design route needed for specific research | ship operators, process of designing research program | creation of larger multinational interdisciplinary programs with early input by researchers |
| Research | in the EU, with an icebreaking research vessel, non-Arctic nation | yes | yes | non-Arctic | Yes, as scientist | Agreements on cooperation / MoU and personal contacts | political issues (e.g. Russia) | Political issue for accessing Russian EEZ, including use of Russian icebreakers / joint expeditions | High-level political | Ask more icebreakers to join the consortium |
| Research | in the EU, with an icebreaking research vessel, Arctic nation | yes | yes | Arctic | Yes, as scientist | Through ARICE (proposal unsuccessful unfortunately) as well as personal contacts (with e.g. AWI) | Capacity to send personnel | Limited man/woman power was the main limitation which is linked to limited funding and institutional resources/personnel (personnel already committed to cruises by the home institution). In addition, it is hard to get a good overview of what is going on in the Arctic in terms of cruises and also how to best advertise one's own cruises to the international community. | Funding agencies, research networks, national ship coordination entities | Cross-national cruise committee's to coordinate cruises and an easily accessible database/info portal to gather cruise information and contacts |
| Research | in the EU, with an icebreaking research vessel, non-Arctic nation | yes | yes | non-Arctic | Yes, as scientist | I should have accessed through ARICE programme, but the planned activity was cancelled, and I have also accessed through Eurofleets and personal contacts. | Lack of available ship-time | the main obstacle is adequate ship time coverage accompanied by regular opportunities allowing easy access to rvs, especially to support long-term monitoring programmes. ARICE and Eurofleets certainly help a lot, but often a greater exchange of information between the main actors in the Arctic would facilitate access to infrastructure and data. | solutions should be found at the level of institutes and countries operating polar research vessels, and then at the level of the European community for the funds available to support their use for an enlarged scientific community | Regular meetings (twice per year) that can inform research groups about annual cruises and possible opportunities to access them also from external partners, would help to optimize the use of research vessels. And moreover, EC funds to support european programmes such as ARICE and EUROFLEETS are also very important. |
| Research | non-Arctic nation | | | non-Arctic | Yes, as scientist | Personal contact to PI. I had to cover only for my own travel fee to the ship. Others covered by the PI's project. | Lack of information on availability | If I know that there is an opportunity to join the expedition in the region of my interest, I will try to join. | IASC MWG? | Make a guidebook on how to access/join icebreakers in each country. |
| Research | in the EU, without an icebreaking research vessel, non-Arctic nation | no | yes | non-Arctic | Not in any capacity | Our researchers have accessed PRVs transnationally within the scope of international campaigns of international projects, as members of the projects' teams. | No collaborators with access to research icebreaker | Lack of funding invalidates access to research icebreakers, plus lack of available ship-time and lack of collaborators with access to research icebreaker are obstacles. | At the levels of the national funding agencies providing financial support to scientific research that needs ship time for the scientific activities to be carried out in the Arctic, in general. Directed national Calls for research in the Polar regions would help to solve the problem. | Increasing available ship-time and reduced costs for scientists would improve transnational access to research icebreakers in the Arctic |
| Research | in the EU | | yes | | Yes, as scientist | Personal contact, long term collaboration | Lack of available ship-time | The actual ship time allows only limited research activities | I have the feeling that research in the Arctic or Antarctic is "territorial" to some extent, also having ship time per se doesn't give you access to certain areas (e.g. Russia economical waters) | Probably we need more vessels, this as general comment |

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|----------|---|-----|-----|------------|-------------------|-------------------|---|--|--|--|
| Research | outside EU, with an icebreaking research vessel, Arctic nation | yes | | Arctic | Yes, as scientist | personal contacts | Lack of information on cruises/expeditions | better coordination to make opportunities available | scientist to scientist all the way up to agency to agency | better communication among countries operating icebreakers |
| Research | in the EU, with an icebreaking research vessel, non-Arctic nation | yes | yes | non-Arctic | Yes, as scientist | ARICE Call 2019 | None in my opinion. The application rules for EU members are sometimes not clearly stated and also the contact with cruise leaders should be fostered to optimize the application process. However I do not see this as a major obstacle. | See comment above | Scientific coordination | See comment above |
| Research | in the EU, without an icebreaking research vessel | no | yes | | Yes, as scientist | Personal contacts | Lack of available ship-time | Existing icebreakers are already very overbooked by national priorities. | Basically, we need more icebreakers to properly reflect the increasing significance of Arctic science. | More icebreaker availability is needed, then transnational access would be easier to justify for the operators. One suggestion would be the construction of an EU-operated vessel. |

| Who do you represent? | Do you represent or reside in an EU country - can select multiple | icebreaker | EU | Arctic | Do you have experience in participating in or facilitating transnational access to polar research vessels - can select multiple | If you have accessed PRVs trans- nationally, how was the access arranged, how was it funded? Bilateral or multilateral agreements? Personal contacts? Other? (free text comments). | Here are some examples of possible obstacles for trans- national access to research icebreakers, in your opinion what is the most significant obstacle? | To follow-up on the precious question, in your own words, what are the specific obstacles you have phased? (free text). | On what level of society or research community are these obstacles? I.e. where do we need to look for solutions (free text) | What are possible steps or solutions for improved transnational access to research icebreakers in the Arctic? (free text) |
|-----------------------|--|------------|-----|--------|---|--|---|--|---|--|
| Research | in the EU | | yes | | Yes, as scientist | I had accesses PRVs (from Argentina, China, UK) , the access was arranged : i) with China (Xuelong) thanks to an EU project (DAMOCLES), and my participation to the first cruise. This cooperation started in 2008 and is going on. ii) with Argentina (Trizar) : I was in an ocean laboratory-university in Argentina for a sabbatic period. This period allowed me to obtain a cooperation project including to installate french instrument on board the argentinian ice breacker and to perform a capacity building project to transfer our expertise on Carbon biogeochemistry. The contract was signed for 10 years. The financial support for the French Argentinian cooperation project (ARGAU) came from JGOFS France Program and Université Pierre et Marie Curie and in Argentina from IAA (Instituto antartico argentino) and DNA (Departamento Nacional de la Antartida) and CONICET National Scientific and Technical Research Council - Argentina iii) UK, James Clark Ross, funded by an ERO-EU, and was arranged by a french scientist who worked in England several years before to joint our laboratory in Paris. | Lack of funding | Transportation and customs became so expensive, so complicate and we need technician and eng. with a large experience on polar cruises. short-term science hires are a big hassle to maintain the high-level expertise needed for polar research | Private company, but also in the research system in Europe. We need specific regulation for transportation and customs. We need also "light" financial support from European countries and also from EU to allow us to joint more easily the available time of the icebreaker . | To get EU MOU (Memorandum of Understanding) with all countries having icebreaker . Distribute schedule times in all the laboratories but also in the financial agency in each country. To propose financial support to use the icebreaker. |
| Research | in the EU, without an icebreaking research vessel | no | yes | | Yes, as scientist | personal contacts with China | easier access through personal contact | Easier access to ship time for nonestablished arctic scientist to explore new research topics and approaches. | Communities tend to work in silos. It might take years for someone not being part of the community to get in (understand how it operates, how to get funds, ship time, etc...) and bring new expertise and research insights. I found this flexibility and reactivity with China to develop new research including innovation in just a couple of years through bilateral collaboration programs. | ? |
| Other | in the EU, without an icebreaking research vessel, Arctic nation | no | yes | Arctic | Not in any capacity | no | No collaborators with access to research icebreaker | Not knowing how and when | dont know | more openness |
| Research | in the EU | | yes | | Not in any capacity | no | Lack of available ship-time | Lack of access to ships or related calls | Not sure - requires national coordination | International platforms available to the international scientific community beyond national programs |
| Research | in the EU, with an icebreaking research vessel, Arctic nation | yes | yes | Arctic | Yes, as scientist, Yes, other | I am not certain, but I think that it was multilateral and participant funding was from the respective nation (excepting the primary host with the PRV, which paid a majority of costs) | Lack of funding | Significant bureaucracy was a big challenge for potential participants. It was also difficult to have adequate information ready ahead of the opportunities so that potential participants could get their funds in order, many could not because information was circulated too late. | Scientists generally move fast, I think that the problem in part relies on being too "team oriented" in taking all decisions, it would be better to have smaller committees. Also, often the people who are best able to lead the projects are pushed out by those less capable and too ambitious for themselves, this is particularly true of many French researchers. | Closer collaboration with institutes in Russia. |
| Research | in the EU, without an icebreaking research vessel | no | yes | | Not in any capacity | NA | Lack of funding | Difficulties to combine finding funding for research and ship time | Funding agency | European assesment of projects with proposal submitted to the different national agencies |
| Research | in the EU, without an icebreaking research vessel, Arctic nation Above line from 2022, below line | no | yes | Arctic | Yes, as scientist | It was funded through ARICE. | Lack of information on cruises/expeditions | To have a platform that provide information on how to access those ships. | N/A | N/A |
| None | from 2021 | | | | | | | | | international cooperation |
| None | in the EU; with an icebreaking research vessel | yes | yes | | | | | | | |
| Research | | | | | Not in any capacity | | | | | |

| | | | | | | | | | | |
|---------------|--|-----|-----|------------|-------------------------------------|--|--|--|--|--|
| Ship operator | | | | | Yes, as operator | | | | | |
| Research | outside the EU; with an icebreaking research vessel; Arctic nation | yes | | Arctic | Yes, as scientist | Personal contacts often pave the way for accessing across countries | National priorities outweigh international access | | | |
| Ship operator | in the EU; with an icebreaking research vessel; Arctic nation | yes | yes | Arctic | Yes, as operator; Yes, as scientist | Nationally funded projects with international collaborators. | No unified planning tools - different countries and vessels have different planning schemes and time horizons.; Few/limited funding mechanisms, few incentives for operators to invite people. | | | Those IASC countries that want to, can commit multi-year funding to get time and berths on icebreakers. Such as mechanism would allow both for smaller parties to join planned cruises but also larger joint projects with participants from several countries. Of course based on scientific excellence. And if there are no good proposals coming from groups in a given country in a given year, that country's funding is not used.; All operators should publish multiyear cruise plans, even if they are not complete for every coming year. |
| Other | in the EU; with an icebreaking research vessel; non-Arctic nation | yes | yes | non-Arctic | Yes, as funder; Yes, as scientist | Personal contact. Berth was not paid. Travel and shipping expenses paid with national project funds. | Lack of a sustained mechanism that allows Transnational access and the planing of international cruises; Funding for (international) ship time | | | |
| Research | in the EU; with an icebreaking research vessel; non-Arctic nation | yes | yes | non-Arctic | Yes, as funder | My transnational access was via EUROFLEETS in a similar mode as ARICE uses: I accessed also Russian vessels via bilateral agreements | too many proposals too little infrastructures | | | At the end, additional national funding has to be mobilised, which works only via excellent and high-priority science; An agreement on accepting each others proposal evaluation system on an international level could make the possibility of international third party funding much more easy to implement |

| Who do you represent? | Do you represent or reside in an EU country - can select multiple | Icebreaker | EU | Arctic | Do you have experience in participating in or facilitating transnational access to polar research vessels - can select multiple | If you have accessed PRVs trans- nationally, how was the access arranged, how was it funded? Bilateral or multilateral agreements? Personal contacts? Other? (free text comments). | Here are some examples of possible obstacles for trans- national access to research icebreakers, in your opinion what is the most significant obstacle? | To follow-up on the previous question, in your own words, what are the specific obstacles you have phased? (free text). | On what level of society or research community are these obstacles? I.e. where do we need to look for solutions (free text) | What are possible steps or solutions for improved transnational access to research icebreakers in the Arctic? (free text) |
|-----------------------|--|------------|-----|--------|---|--|---|---|---|---|
| Research | outside the EU; with an icebreaking research vessel; Arctic nation | yes | | Arctic | Yes, as scientist | As part of the Distributed Biological Observatory we have a collaborative agreement between Canadian DFO and my home institution (UMCES). Funding by NSF.; During Pacific Arctic Group meetings we discuss potential ship opportunities (berths, science collaboration) that has facilitated joint science efforts | National support is needed to participate in an internally -developed research cruise.; Successful transnational scientific cruises would be facilitated by joint funding calls for research by national funders. | | | An international funder agreement to support national science toward common, high priority international science questions is one solution. |
| Other | in the EU; with an icebreaking research vessel; Arctic nation | yes | yes | Arctic | Yes, as operator | | Funding; Timing of calls | | | |
| Other | outside the EU; with an icebreaking research vessel; Arctic nation | yes | | Arctic | Not in any capacity | | Availability of funding for ship time and other costs (travel to and from port etc.) - who pays? | | | 2 types of transnational calls could be considered - long-term, detailed scientific collaboration and more opportunistic offers of spare berths on already planned cruises available at short(er) notice; There is probably great potential for more widespread use of remote access to vessels, which would increase the scientific value of cruises at low additional cost. |
| Research | Arctic nation | | | Arctic | Yes, as scientist | | 1 - funding 2 - permissions 3 - language (certainly for Russian cruises) | | | Science diplomacy - utilizing platforms like ASM to bring forward scientific agenda |
| Ship operator | in the EU; without an icebreaking research vessel | no | yes | | Yes, as operator | | | | | |
| Funding agency | in the EU; without an icebreaking research vessel; Arctic nation | no | yes | Arctic | Yes, as scientist | Informal collaboration. Berth made available for guest scientists.; I suppose it also depends on the type of access. Joining a preplanned cruise or leading or at least influencing the cruise track. The first is easy. The second more difficult. | | | | Sustained Arctic funding. If you want high quality research then an area needs long term funding so that a competitive community can develop and the best science be done. Sporadic funding does not allow the best science to necessarily come through. |
| Research | in the EU; with an icebreaking research vessel | yes | yes | | Yes, as operator | | | | | |

