

Improving and expanding the environmental monitoring efforts of expedition cruise ships in the Arctic

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The environment in the Arctic region is changing fast. Better environmental monitoring and management are urgently needed. Expedition cruise operators, guides and passengers regularly visit remote areas and may find it meaningful to contribute to these efforts. Here we report on efforts to improve and expand the environmental monitoring of expedition cruise ships in the Arctic.

In March 2019, the INTAROS project and the Association of Arctic Expedition Cruise Operators (AECO) facilitated a workshop where representatives of cruise operators, citizen science programs, local government and scientists in the Arctic came together in Svalbard to exchange experiences and perspectives on environmental monitoring from expedition cruise ships - and to discuss a pilot program for monitoring by cruise expeditions. Further discussions on the involvement of cruise expeditions in research as a basis for developing optimal tourism balance were held at a workshop in Svalbard organized by AECO, the Norwegian Institute of Nature Research (NINA) and Visit Svalbard in September 2019.

Sea ice is decreasing, human activities are increasing, and wildlife and other components of the environment are affected. The changes have global and regional implications. Moreover, the changes have a severe impact on people's living conditions within the Arctic. To inform sustainable development, a better understanding of the climate and environment in the region is needed.

Large remote expanses of the Arctic are rarely visited by anyone, including scientists. The changing climate is opening more areas in the Arctic to the itineraries of expedition cruise ships. Tour guides and passengers can contribute meaningfully to monitor the environment (Wagner et al. submitted).

Many expedition cruise operators are already participating in environmental monitoring in various ways. Cruise expeditions have the potential to support environmental protection efforts by obtaining information that can help scientists conduct research and provide a better basis for management decisions. The inputs from cruise expedition monitoring may become more useful if methods and communication are standardized and structured to a larger degree. It may be possible to learn from existing efforts, build on these and extend the citizen science monitoring to even more cruises. If well managed, these initiatives have the potential to make a meaningful contribution to Arctic observing systems, such as Svalbard Integrated Arctic Earth Observing System (SIOS).

It is particularly valuable to establish simple citizen science methods that can be used alongside the normal cruise activities at sea and on land, and which can be reported using standardized reporting formats that easily can be ingested into research and inform management decision-making. Such

approaches can be meaningful to all involved and may make the cruises an even richer experience for both guides and guests. Ship-of-opportunity installations (FerryBoxes), currently being tested onboard some cruise ships, may also be combined with citizen science approaches.

The environmental observing efforts of expedition cruise ships may improve the long-term monitoring and management of climate change challenges, wildlife and cultural sites. Such activities could have multiple benefits. The guests and guides will see the importance of their observations and know that they are making a contribution to the environment. The cruise operators will be able to oversee management interventions that will not interfere with but complement their operations. A seamless data exchange between cruise operators and researchers will allow the development of a reliable conduit of information to decision-makers, who then benefit from stronger observational data as evidence for management decisions.

The monitoring may include observations from guides and guests, photographs, or the collection of water, ice, soil or debris samples for later analysis by scientists, etc. The pilot agreed to evaluate the use of seven very different citizen science programs:

1. Secchi Disk Study (secchidisk.org)
2. Cloud Observations (www.globe.gov/web/s-cool)
3. Cultural and Historical Site Photography (to be developed)
4. Happywhale (happywhale.com)
5. eBird (ebird.org)
6. Tidal Glaciers as Hot Spots for Top Predators Feeding (Institute of Oceanology of the Polish Academy of Sciences; IOPAN)
7. Plastic Debris on Arctic Shores (IOPAN)

The citizen science programs and cruise operators will own the monitoring program and the resulting data but the information is envisaged to be shared widely as long as ownership is recognized. The receivers of the data, samples and reports may include cruise guests, cruise guides, relevant databases, civil society organizations, research institutions, and government agencies responsible for recommending or deciding on management actions. The piloting is in progress and further evaluation, discussions and consultations will follow.

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References

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Wagner, Penelope *et al.* Submitted. Evolving Polar Tourism Vessel Requirements for Environmental Data and the Role of Citizen Science.