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Utilising Polar Tour Vessels as Platforms for Science

Lauren Farmer and Alex Cowan

Abstract

Every austral and boreal summer, the expedition cruise fleet journeys south and north toward the poles. Carrying passengers already invested in education and conservation and with trained biologists, meteorologists, geologists and ice experts as expedition guides, these ships make ideal platforms for citizen science. The Polar Citizen Science Collective, created and led by expedition guides with a passion for meaningful travel, is a non-profit aimed at empowering the polar tourism industry to make valuable contributions to science through data collection and monitoring. Its goal is to maximise the potential of the industry and to create efficiency around the development, implementation and data delivery of these programs.

Key words

citizen science, data collection, tourism, sustainability, expedition cruising

The Opportunity

The polar tourism fleet consists of dozens of ice-strengthened expedition vessels, often spending up to 5 months at a time in the Southern Ocean (common itineraries include south Atlantic islands and the Antarctic Peninsula) from October to March, and a slightly shorter season length (June to September) in the north, ranging across the Norwegian, Canadian and Russian Arctic, all the way to the pole.

Together, the polar tourism fleet represents a major underutilised data collection platform. The polar expedition cruise industry is unique in that competing companies work collaboratively in the field, making for a fleet that would be the envy of any national polar research program.

In collaboration with the International Association of Antarctica Tour Operators (IAATO)1, the Polar Citizen Science Collective works together with scientists to develop projects that can be a valuable addition to a ship's educational program. These projects range across disciplines and are carried out by a trained and experienced Citizen Science Coordinator, along with the participation of guests. Key projects include Happywhale's2 marine mammal identification network, phytoplankton sampling for FjordPhyto3, cloud observations through NASA's GLOBE Observer4 app and seabird surveys for the Antarctic Site Inventory5. The Collective is actively seeking new scientific partners and initiatives which will continue to utilise the far-reaching and unique capability of the polar tourism fleet.

What It Looks Like Now

The Collective works together with scientists to thoughtfully develop a wide variety of projects, which can require minimal, moderate or significant effort. The scientist or scientific organization drives the research question and protocols, while the Collective works to integrate the project into the tour operator's existing program. The Collective can be as involved as the operator desires, but the standard is to deliver all the necessary information and training required and then be an ongoing support throughout the season. During the data collection phase, the scientist receives regular updates from the team in the field and can provide appreciated feedback to the participants. At the end of the season or in regular intervals, the data collected is delivered to the scientist for analysis.

Figure 1. *An expedition guide leads guests through a cloud observation using NASA's GLOBE Observer app. These ground-based observations, together with corresponding satellite imagery, help to paint a more complete picture of cloud cover, and can help us understand how much solar energy is being absorbed by the earth.*

Figure 2. *A "Citizen Science Zodiac Cruise" led by a trained Citizen Science Coordinator tows a mesh met to collect phytoplankton samples at a site on the Antarctic Peninsula. These samples are then sent to the Scripps Oceanographic Institute for analysis. FjordPhyto is studying how glacial meltwater affects the productivity of phytoplankton.*

Figure 3. *A group of passengers, led by a trained sea ice observer/expedition guide, measure depth and salinity of melt ponds at the Geographic North Pole, with icebreaker 50 let Pobedy in the background. These on-station measurements, combined with ship-based visual observations of ice coverage, thickness, floe size and topography during icebreaking contribute to the ASSIST6 (Arctic Shipborne Sea Ice Standardization Tool) Ice Watch data network and are also delivered to the Norwegian Ice Service to assist in ice charting.*

The Results

Beyond the intrinsic value of the data collected, the participation of guests in these programs contributes to their greater understanding of the region in which they are traveling. Passengers are not only educated, but inspired to care. In the words of a recent guest, "Participating in citizen science allowed me to be more than just a tourist." Through this heightened level of commitment, they become true ambassadors, returning home to champion for the protection of our planet's most fragile ecosystems.

Additionally, the data collected by these citizen scientists is contributing to expanding datasets, such as Happywhale's marine mammal database, with aims to individually identify marine mammals, with a focus on Humpback whales, in order to better understand their behavior and distribution.

Figure 4. *In the 2015-16 austral season, 263 individual whales were identified, 6% having been "known to science" from previous sightings. In 2017-18 season, 487 individuals were identified, with 12% having been previously sighted7. Thanks to citizen scientists contributing their whale photos to the Happywhale database, more and more whales are being logged in the system and further resights allow us to track their returns to the Southern Ocean.*

Figure 5. *Cloud observations contributed by the polar tourism industry to NASA's GLOBE Observer program. The triangle shape represents the oft-transited itinerary of the Scotia Sea, including South Georgia and the Antarctic Peninsula, and one can observe the lack of data from other parts of Antarctica.*

Figure 6. *The citizen science efforts of the polar tourism industry are already being included in a number of academic and mainstream scientific publications, including this project update for EOS, a publication of the American Geophysical Union.*

The Challenges

Over the years, various efforts have been made to create more participatory data collection programs, but these often failed to gain much momentum due to a number of unique challenges the industry faces. Some of these challenges are a constant rotation of expedition staff coming and going from the vessel, leading to a lack of consistency in how the program is run, or whether it is run at all. Additionally, pre-existing cruise itineraries can be limited in time available for additional activities such as citizen science, as well as a difficulty in being relied upon for projects that require location-specific data collection, as ships' whereabouts are often dictated entirely by weather and ice.

These challenges serve to validate the work of the Polar Collective as a coordinator of the industry's efforts to participate in research and data collection, and the necessity for established protocols, training and resources made available to the dedicated Citizen Science Coordinator.

As enthusiasm and participation in citizen science grows, with more operators implementing these projects into their educational program, the challenge of scaling presents itself. How can it be ensured that all operators and expedition teams are following set protocols so that data is reliable and accurate? How is the collation and delivery of such large data sets to the scientists to be managed? What feedback loops can be created between the scientists and those on board expedition vessels, and how to best can that information be disseminated? How can it be ensured that citizen science remains a "no-brainer" for polar tourism operators to include it in their programs?

To answer the last question, the Polar Citizen Science Collective is developing an app which will serve to streamline data collection for those participating on board. It is being made possible by a generous grant of €170,000 from Booking Cares8. Ted Cheeseman, co-founder of the Polar Collective and founder of Happywhale said, "This award is going to help take citizen science to the next level. We know from established projects that travelers love participating in science, and that researchers need data from the regions we travel to. The app will bridge the gap between the two; it will make citizen science more accessible, fun and rewarding while generating quality scientific data to guide environmental protection." This will be achieved through well applied technology and by delivering feedback to participants that keeps them engaged long after the experience.

The Future

It is hoped that within the next few years, every operator in the industry will adopt a citizen science program. The Polar Collective works year-round to maintain collaborative relationships with the scientists driving the data collection projects, to gather feedback on data collected which can then be shared with citizen scientists on board, and to work with scientists or scientific organizations to develop new projects or extend the reach of existing projects, for both the Arctic and Antarctic.

On expedition vessels, there is an obvious opportunity for the implementation of monitoring programs which would require installation of equipment on board, and the Polar Collective is very open to receiving proposals for these kinds of automated data collection projects. However, a key focus of the Collective is to also develop programs which will allow for guest participation in the

data collection.

We believe citizen science in the polar regions holds a major key in assisting scientists in finding answers to cutting edge inquiries into how the poles are being impacted during this critical time in human history. The Polar Citizen Science Collective hopes to do our part by utilising polar expedition vessels as platforms for science, and passionate travelers as valued data collectors.

To learn more about the Polar Collective, visit http://www.polarcollective.org or email us at info.polarcollective@gmail.com.

References

1-The International Association of Antarctica Tour Operators (IAATO) is a member organization founded in 1991 to advocate and promote the practice of safe and environmentally responsible private-sector travel to the Antarctic. https://iaato.org

2-Happywhale tracks individual whales using an advanced ID algorithm, built in collaboration with scientists at Cascadia Research Collective and Allied Whale. https://happywhale.com/

3-FjordPhyto is led by research graduate student Allison Cusick and studies the effects of glacial meltwater on the biodiversity and productivity of phytoplankton in Antarctic fjord systems. https://scripps.ucsd.edu/programs/fjordphyto/

4-GLOBE Observer is NASA's citizen science program. Through the app, citizen scientists can observe clouds, mosquitos and land cover. The polar tourism industry utilized GLOBE Observer to observe cloud cover, cloud type, temperature and humidity across the Antarctic Peninsula. https://observer.globe.gov/

5-At-sea and on-shore surveys led by trained ornithologists facilitate continued, long-term monitoring and censusing by the Antarctic Site Inventory of penguin and seabird populations throughout the Antarctic Peninsula using opportunistic ship-based data collection. These data are intended to assist the implementation of the 1991 Protocol on Environmental Protection to the Antarctic Treaty. The Inventory is the only project monitoring penguin and seabird populations throughout the Peninsula, and the only project regularly censusing the species.
https://oceanites.org/research-portal/antarctic-site-inventory/history-research-plan/

6-Ice Watch is coordinating the collection and archival of visual sea ice observations recorded on ships in the Northern Hemisphere. We provide open source software (ASSIST) for recording and sharing shipborne Arctic sea ice observation data. Data can also be collected in the Southern Hemisphere, and if submitted here will be passed to the Australian Antarctic Division database for ASPeCt observations. Ice Watch is coordinated by the University of Alaska Fairbanks, the International Arctic Research Center, and the Geographic Information Network of Alaska. The Climate of the Cryosphere (CliC) office provides support for our international collaboration and networking. http://icewatch.gina.alaska.edu/

7-Data from Ted Cheeseman, founder of Happywhale https://happywhale.com

8-The Booking Cares Fund, a charitable initiative of Booking.com, "champions non-profit sustainable travel projects which present new and unexpected solutions to reimagine the industry." In addition to the grant awarded to the Polar Collective, Booking Cares is supporting 6 other projects that "strengthen local communities, preserve and promote local culture, help disperse tourism and protect natural resources".

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