Monterey Bay Aquarium Research Institute

The Adopt-A-Float program benefits the scientific community and beyond

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Summer 2022

Keywords:

Adopt-A-Float

GO-BGC

EARTH workshop

Biogeochemical

Climate change

Education

ABSTRACT

The Adopt-A-Float program is an addition to the Global Ocean Biogeochemistry Array (GO-BGC) project that connects educators and students to scientists and real-time ocean profiling float data. Educators can participate in an annual Education Research: Testing and Hypotheses (EARTH) workshop where curriculum is developed. In addition, educators can

utilize data visualization tools to explore profiling float data throughout the school year. Students, educators, and scientists are enthusiastic about collaboration.

INTRODUCTION

The Global Ocean Biogeochemistry Array (GO-BGC) is a project funded by the National Science Foundation. This network of ocean robotic profiling floats collects biogeochemical data in the ocean. First, a float is deployed at a predetermined destination in the sea. Once deployed, it sinks to a depth of 1000m. The float then drifts along at the 1000m depth for ten days before descending to 2000m. From a 2000m, the float rises to the surface, where it can transmit all the profiling data collected over the past ten days via satellite. It takes approximately three and a half hours for a float to rise to the surface from a depth of 2000m. Once surfaced, the float repeats this cycle. A float operating on this ten-day cycle can have nearly five years of battery life (Bif, 2022). Once a float has died, it is not collected but rather sinks to the seafloor, where the environmental impact is minimal and much less detrimental than retrieving each float by ship (Riser, 2020).

The BGC-Argo plan was created in 2016, and the project began implementation in the year 2020. The goal of GO-BGC is to build and deploy 500 biogeochemical ocean profiling floats worldwide to monitor the condition of the ocean in real-time, with a larger goal of deploying another 500 with international partners in the future. Partnerships of GO-BGC include the Monterey Bay Aquarium Research Institute, University of Washington, Scripps Institute of Oceanography, Princeton University, and Woods Hole Oceanographic Institution. This global ocean observing system builds upon the existing Argo and Sothern Ocean Carbon and Climate Observations Modeling (SOCCOM) programs. The BGC array of floats are equipped with multiple biogeochemical sensors that measure oxygen, pressure, nitrates, pH, chlorophyll, particles, temperature and salinity (Matsumoto, 2022). For example, floats equipped with oxygen sensors allow scientists to look at timely issues pertaining to ocean health, such as oxygen flux in oxygen minimum zones in the ocean (Voosen, 2020). Argo is a worldwide float program that has been collecting data on salinity and temperature in the ocean for multiple decades. There are currently close to 4,000 Argo floats in operation worldwide today. These programs are establishing annual and seasonal changes in the sea that are making way for future climate changes and effects on sealife. (Wijffels, 2020).

SOCCOM has a separate group of partners: Princeton University, University of Washington, Scripps Institute of Oceanography, University of Arizona, Oregon State University, University of Maine, Rutgers University, Monterey Bay Aquarium Research Insitute, National Oceanic and Atmospheric Administration, and National Aeuronatics and Space Administration. SOCCOM floats are placed in the southern ocean. The Southern Ocean is an ocean area that previously has not been able to be studied in the winter months (SOCCOM, 2020).

Connecting all the information from these multiple projects has allowed scientists to observe ocean health on a significantly larger scale than ever previously observed. The floats have also enabled scientists to look at specific occurrences in the ocean at particular times, like the effects of ocean heat events like the blob (McKenzie, 2021).

The Adopt-A-Float program was created to link classrooms to real-time ocean profiling float data and scientists. Dr. George Matsumoto, a research and education specialist at Monterey Bay Aquarium Research Institute currently oversees the Adopt-A-Float program. Adopt-A-Float is an outreach effort to get ocean health data to students worldwide. The program is free of cost. Educators and students are able to name a float that is set for deployment. They can track their float's path and collect profiling data from their float in real-time. There are currently over 90 GO-BGC floats adopted. Floats have been adopted by groups from across the United States and worldwide (Matsumoto, 2020). Adopt-A-Float data allows students to engage with current ocean status information. One classroom followed the position of their float closely and were able to detect that the pH sensor on their float had stopped working. They were able to notify Dr. George Matsumoto of the failed sensor (Runwal, 2019).

Groups adopting a float have multiple resources available to work with the float data. A very valuable tool that has been developed is the AdoptAFloatViz website which allows users to manipulate variables and construct their own plots using a specific (or multiple) float's data. In addition to the AdoptAFloatViz webtool, a monthly newsletter is sent out to participants, which highlights a different adopted float each month. Included in the newsletter are multiple social media outlets to connect to GO-BGC and the community of adopted floats. Additionally, the Adopt-A-Float website provides lesson plans for educators to implement using float data in the classroom (GO-BGC, 2022).

Annually, the Monterey Bay Aquarium Research Institute hosts an Education and Research: Testing Hypotheses (EARTH) workshop. Educators from across the country attend. Attendees of the workshop are encouraged to Adopt-A-Float and develop lesson plans centered around utilizing float data. The EARTH workshop aims to get accurate scientific data into the classrooms.

METHOD

While at the EARTH 2022 workshop in Seattle, Washington, I interviewed all the attending educators about their participation in the Adopt-A-Float program. Moreover, I investigated and explored the GO-BGC and Adopt-A-Float programs publications, news, team presentations, and video content.

RESULTS

42.9% of educators at the EARTH workshop were participants in the Adopt-A-Float program before coming to the workshop. 100% of educators in attendance plan to participate in the Adopt-A-Float program post-EARTH 2022 workshop. It is not uncommon for educators involved in the adoption process to adopt more than one float. 67% of the already Adopt-A-Float participants attending the workshop had adopted more than one float. When asked, "What would you like to do with the float data in your classroom?", educators gave a range of answers from water quality testing, comparing float data set to local data set, look at plankton blooms, explore ocean acidification with changes in temperature and salinity, use the data to combat misinformation, look at seasonal changes, look at chlorophyll data, graphing, climate change modeling, and plot depth against other variables to examine water column.

Over a week-long workshop, educators could hear from scientists about how ocean profiling float data is being used. In addition, workshop attendees did see the float lab at the University of Washington in person and heard from the team assembling the floats. Educators from the EARTH 2022 workshop produced eleven new lesson plans for the Adopt-A-Float program.

DISCUSSION

The Adopt-A-Float program has room for growth and improvement. In response to a request from teachers at the EARTH workshop, the AdoptAFloatViz page was reorganized to list floats by name and number instead of name and school name. This simple adjustment has already made navigating the AdoptAFloatviz page easier to navigate. Demonstrating a walk-through of the website was helpful to educators. The data seems overwhelming when looked at as a whole. Once it is broken down into smaller sections, it is much more manageable and less intimidating.

Development of lesson plans for the Adopt-A-Float program is ongoing. Research shows that students can develop a better understanding of scientific concepts through narrative thinking. Therefore, adding story-telling to the Adopt-A-Float lesson plans may benefit a larger demographic of students (Hadzigeorgiou, 2019).

A favored step in the Adopt-A-Float process is the naming of the float. Educators agreed that their students enjoyed the naming process. Naming a float gave their students pride and ownership over their float. Educators who have adopted floats also shared they were not currently working with the float data before the workshop but now felt more comfortable navigating the float data website. The educators who visited the float lab in Seattle were excited to share their experiences with their students.

Incorporating the Adopt-A-Float curriculum into the classroom is a great way to engage students in science. Students who may not have been previously interested in the scientific method can become interested in inquiries relating to profiling float data. Asking questions about the floats may lead to more questions, which fosters more learning (Shafer, 2015).

Covid restrictions put a halt on in-person classroom demonstrations of the floats. Reimplementing classroom visits would be well received by students and teachers alike. Experiencing an actual float and making it tangible ignites the students' interest in float data.

I would have liked to further this research by engaging with current and past students who have participated in the Adopt-A-Float program to get their input. I would like to know how adopting a float has influenced them and find out what is most memorable about that experience. In addition, I am curious if adopting a float sparked any other research interests. I would also like to have expanded my questionnaire to all Adopt-A-Float participants and scientists.

Furthermore, creating another social media campaign would be a helpful way to connect to a new audience and deepen the connection with the existing group of followers. In 2021, there were eleven new adoptions of floats within the first twenty hours of the Adopt-A-Float social media campaign kickoff (Monson, 2021). Continued development of social media content and new curriculum would enhance the program.

CONCLUSION

The Adopt-A-Float program is building a network of young scientists and creating engagement in a new way. This program has enabled students to use actual data in real time to answer their own inquiries about ocean health. It allows students to explore countless avenues of ocean science interest. The ocean is an integral part of our planet and climate. Working with scientists and current data to solve pressing climate issues gives students a sense of fulfillment and gratification to be a part of a large-scale observation project. The data available to students is exceptionally current. The Adopt-A-Float program is valuable and meaningful to students and the world population. Engaging students with fundamental ocean data is cultivating young scientists who will be at the forefront of solving the climate crisis. Overall, the Adopt-A-Float program is a big success.

ACKNOWLEDGEMENTS

I genuinely appreciate the mentorship, guidance, and expertise of my mentor Dr. George Matsumoto. I am sincerely grateful for the summer internship experience.

Thank you to the E.A.R.T.H. 2022 Workshop participants who participated in my survey.

Adopt-a-Float is sponsored by US National Science Foundation's Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM) Project under the NSF Award PLR-1425989 (with extension NSF OPP-1936222) and the US National Science Foundation's Global Ocean Biogeochemistry Array (GO-BGC) Project under the NSF Award OCE 1946578. Logistical

support for SOCCOM in Antarctica was provided by the U.S. National Science Foundation through the U.S. Antarctic Program.

The MBARI Summer Internship Program is generously supported through a gift from the Dean and Helen Witter Family Fund and the Rentschler Family Fund in memory of former MBARI board member Frank Roberts (1920-2019) and by the David and Lucile Packard Foundation. Additional funding is provided by the Maxwell/Hanrahan Foundation.

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