

Float on with Argo

Activity - Worksheet

Dive into ocean monitoring with the international Argo project! Discover how scientists observe water properties like temperature and salinity to understand and monitor climate change. Explore scientific data collected by this program to become familiar with important oceanic measurements.

Learning Outcomes

- Explain the importance of ocean monitoring
- Identify one way that the international community monitors the ocean
- Interpret ocean data gathered by Argo floats
- *Optional Challenge:* Investigate scientific studies to learn more about the information Argo floats provide, and share your findings

New Terms

As you work through Step 1 and 2 of this activity, write down any words that are new to you! Take a minute to look up what each word means, and write the definition in your own words.

Example:

Oceanography - study of oceans. Includes physical (how they move, energy), chemical (what they're made of), and biological (living parts).

Step 1: Guided Notes for the [Ocean Monitoring Video](#)

This video was created by Fisheries and Oceans Canada. It explains how Canadian scientists monitor the ocean. Scientific observations about the ocean can help people make informed decisions, from developing ocean policy to making daily choices that impact our ocean. Use the following questions to help you keep track of new information.

 [Ocean monitoring of Canada's West Coast](https://www.youtube.com/watch?v=9E-men0VJ68)
<https://www.youtube.com/watch?v=9E-men0VJ68>

Why monitor oceans? What could changes in the ocean indicate?

What kind of information can be collected by a ship? In your own words, how does a rosette collect samples at different depths?

What is the Argo system, based on this video?

What are some benefits to Argo floats? What is the difference between sampling the ocean from a ship, and sampling from Argo floats? What is the same?

Are you a fan of Greek mythology?

The name "Argo" came from the myth of Jason and the golden fleece! The array of floats are nicknamed after Jason's ship, the Argo. And the satellites the floats send info to? They're called the Jason earth observing satellites! To learn more about the Jason satellites, visit NASA's page:

 <https://sealevel.jpl.nasa.gov/missions/jason-1/summary/>

Step 2: Guided Notes for Argo: A window into the ocean:

This story map was made by the Argo International Program. It provides information about what the Argo system is, how it works, and why it is important. Use the following questions to help you keep track of new information as you read through the story map.



Argo: A window into the ocean

<https://oceanops.maps.arcgis.com/apps/Cascade/index.html?appid=a170a0d522bb42f1a019e4e473cf1bdd>

How much of our planet is covered in ocean? What are some of the things it does for us?

Why is it hard to collect data about the ocean?

The Argo Program is made possible by an impressive level of collaboration on an international level. In your opinion, what do you think the benefits of this collaboration could be?

Draw the cycle or write a schedule to explain what an Argo float does during a 10 day cycle. Include depths, and how long the float stays at that depth. *Curious about how the floats move up and down? Check out the videos on the “What is an Argo float?” page.*

Who is allowed to use the data collected by Argo floats? What does it cost?

What information has Argo told us about our changing climate?

How many scientific papers have been published using Argo data (since 1998)?

What is next for Argo? Give a quick explanation of what each of these projects are working on, and why they are needed:

Deep Argo:

Biogeochemical (BCG) Argo:

Argo in Ice Zones:

Argo is an important part of the Global Ocean Observing System. Why is this system needed?

You've made it through the story map! In 3-5 sentences, explain what the Argo system is, and why it is important.

Step 3: Practice Data Gathering:

Scientists around the world have free access to the Argo data. Like a scientist, you have the opportunity to gather and interpret data! Use the first few questions to practice with a data selection site.

 **Euro Argo Data Selection:** <https://dataselection.euro-argo.eu>
Ocean Ops: <https://www.ocean-ops.org/board?t=argo>

Practice 1: Using the map, click on a float (dot) that is currently in the Pacific Ocean, near the coast of British Columbia. A window will pop up, with some details. For the float you clicked on, write down the information needed in the table below. *Note: You may need to click on “details page”, or “show profile data” for more information. Then, try this again with a different float on another data site.*

	Example	Practice - find information about a float on the Euro Argo Data Selection website.	Practice - find information about a different float on the Ocean Ops website.
Float Number (Reference)	Float 4902536		
Cycle #	93		
Date (Latest Observation)	12.03.2023 13:57:00		
Latitude	45.115		
Longitude	-125.82		

Practice 2: Using one of the data websites, select a float in the Mediterranean Sea. Can you find out what the temperature of the water is at sea level on the most recent observation? *Note: after selecting a float, you may need to select “details page” and then “data”, or “show profile data”.*

	Example	Practice
Float Number (Reference)	Float 6903822	
Date (Latest Observation)	05.03.2023 13:59:30	
Temp at sea-level (°C)	16.1	

Practice 3: One way to measure the salinity (salt concentration) of the ocean is using Practical Salinity Units (PSU). The higher the PSU is, the higher the concentration of salt. For example, seawater at 35.4 PSU has higher salinity than seawater at 34.2 PSU.

Using a data site, and information from at least 3 different floats, answer the question below. You can use the “select area” or “sea region” to select a predefined area to look at.

At what pressure measured by Argo floats is the practical salinity of the Labrador Sea at the lowest?

In point form, explain the steps you took to reach this answer.

Step 4: Data Gathering and Interpretation

When you're feeling confident with using the data sites, choose a research question or design your own. Looking for some help to design your question? Check out Ocean School's resource "Put the "Quest" in Questions" (linked here: <https://oceanschool.nfb.ca/media/put-the-quest-in-questions>).

Research Question Examples:

- *Has the temperature of the water around in the Baltic Sea changed over the last 5 years?*
- *How does the average salinity of the Black Sea today compare to 3 years ago?*
- *Has the pH of the Great Barrier Reef changed between now, 5 years ago, and 10 years ago?*

My Research Question:

Watch out for bias!

"Bias" means a "systematic error introduced into sampling or testing by selecting or encouraging one outcome or answer over others" (Merriam-Webster, n.d.). In a scientific study, bias is important to think about and avoid.

For example, let's pretend you conducted a study about students' favourite movies at your school. You might personally think that Shrek is a great movie, and your hypothesis is that Shrek will be the favourite movie choice according to other students too. If you only ask the people you think also like Shrek for their answer, you are conducting a biased study - you're not gathering data randomly and fairly, you're choosing people you think will give you the answer you want. Even if Shrek actually IS the favourite movie at your school, you won't know if your study is accurate, and people may not trust your findings if they know you only asked Shrek fans for their thoughts.

To help avoid bias, try to collect information without thinking about whether or not it proves your hypothesis, or if it matches what you think is the right or acceptable answer. In your Argo research, don't change your mind if the data from the float you select isn't what you're expecting. Instead, record the information, and consider gathering data from many floats, or dates. More data points can give us a more detailed understanding of trends. Sometimes things don't go as expected!

What kind of information do I need to collect to answer my research question?

Ex. What area of the map will I be recording from? Will I need to use data collected by the same float, at different dates? Am I collecting information that was observed during a specific time frame?

Using a spreadsheet or notebook, create a table that will best help you collect the information you need to answer your question. Collect data related to your research question (we recommend using at least 20 data points in your research exercise). Then, interpret your data by graphing your findings and responding to a few questions, listed below. Your teacher may ask you to include your answers to these questions with your table and graph.

Interpretation Questions:

What did my data collection indicate?

What assumptions am I making about the data?

Do I think I chose the right data to answer my research question? How could I increase the reliability of my data (ex. More data points? Longer time frame?)?

How could my findings be helpful to the scientific community, and society?

Statistical Analysis

Data collection and interpretation is an important part of research. Over time, the scientific community has developed different tests and tools to make sure that data is interpreted correctly.

*These statistical analysis tools help scientists understand whether or not something is “statistically significant” or not. If something is statistically significant, it means that it is highly unlikely that there is no relationship or pattern in your data. In other words, if your findings **are** statistically significant, you’re on to something!*

These tests and tools are typically taught in university classes about statistics. If you’re interested in learning more, check out Khan academy or Crash Course to learn about these tests.

For now, we’ll leave you with a friendly reminder that as a scientist using Argo data, you would need to perform some statistical analysis to check your findings before sharing them with the rest of the world.