



Education and Research: Testing Hypotheses

## Southern Life Digital Breakout

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### Summary

Students will explore the history, climate, and ecosystem of Antarctica as they access various documents and real scientific data collected by researchers during field experiences along the West Antarctic Peninsula. Significant events in Antarctic Exploration, Research, Technology, and Policy will be discussed and relevant concepts and principles relevant to climate and polar literacy standards will be assessed via a completed worksheet. In addition to historical and policy information, students will also explore data from Palmer Station's LTER (Long Term Ecological Research) Program. Information obtained during their exploration will assist students in completing a student worksheet while also "opening locks" using a Digital Breakout format. Students may work in pairs to complete the Digital Breakout and the Worksheet.

*[TAGS: LTER, Digital Breakout, Antarctica.]*

### Key Concepts

- Antarctic Exploration and Policy
- Antarctic Food Web and Ecology
- Impacts of Climate Change on Population Dynamics

### Objectives

Students will:

- Develop and use multi-tiered learning levels to solve and "open locks" for the ***Southern Life*** Digital Breakout.
- Apply knowledge gained during the ***Southern Life*** Digital Breakout to identify the advantages and disadvantages of conducting research in Antarctica.
- Use graphing skills to analyze and interpret data collected using gliders and marine mammal tags.
- Collaborate with a partner to examine biotic and abiotic variables and parameters (including climate change) that impact the ecology in the West Antarctic Peninsula.

### Materials

- The following materials are provided to assist the successful completion of the Digital Breakout and Activity Worksheet:
  - Website link to ***Southern Life Digital Breakout Activity***
  - ***Southern Life Digital Breakout*** KEY
  - Resource links for background and additional information
  - Student ***Southern Life*** Activity Sheet
  - Teacher ***Southern Life*** Activity Sheet KEY

## Procedure

### Recommendations:

Use this activity as a review session for concepts relevant to Energy Transfer through an Ecosystem or Environmental Impacts to Ecosystems. It is also recommended that the teacher work through the *Southern Life* Digital Breakout to become familiar with the content presented in the activity.

1. Provide students with an overview of the expectations for the *Southern Life Digital Breakout* Activity. Demonstrate the use of each website included in the breakout and in the *Southern Life* Activity Worksheet. **CAUTION:** Do Not visit links directly from the Digital Breakout website. Students should explore and locate each website that is appropriate for each lock without teacher guidance. Open each website in a separate window or tab to demonstrate and assist students in navigating the various websites but refrain from creating connections to the digital breakout. Be sure to include the following in your review:

Website	Information to Review
<a href="https://photolibary.usap.gov/#1-1">https://photolibary.usap.gov/#1-1</a>	<b>United States Antarctic Program:</b> Use the USAP photo gallery to encourage interest and understanding of the challenges in Polar research.
<a href="https://unctv.pbslearningmedia.org/resource/lsp07.sci.life.eco.oceanfoodweb/antarctic-food-web-game/en/#.Wi7T70trzkJ">https://unctv.pbslearningmedia.org/resource/lsp07.sci.life.eco.oceanfoodweb/antarctic-food-web-game/en/#.Wi7T70trzkJ</a>	<b>Antarctic Food Web Game:</b> Demonstrate how to locate and launch the Antarctic Food Web game. Comparisons can also be demonstrated between the Arctic's Terrestrial/Aquatic Food Web and Antarctica's Aquatic Food Web.
<a href="https://www.mbari.org/wp-content/uploads/2016/10/EARTH_Workshop_Kohut_FINAL.pdf">https://www.mbari.org/wp-content/uploads/2016/10/EARTH_Workshop_Kohut_FINAL.pdf</a>	<b>Observing Our Ocean Planet:</b> Review the use of AUVs (autonomous underwater vehicles) known as Gliders for collecting continuous data. Use J. Kohut's slide #30 to illustrate the use of gliders in Antarctica and demonstrate the correct methodology for interpreting the graphs of data collected on January 27, 2015. Remind students to record their data based on the colors distributed between the blue lines, which match the specific time stamp on the map.
<a href="https://polar-ice.org/focus-areas/polar-data-stories/finding-food/">https://polar-ice.org/focus-areas/polar-data-stories/finding-food/</a>	<b>Finding Food:</b> Demonstrate how to navigate through the Data Story.

2. Provide students with a link to the *Southern Life Digital Breakout* Activity: (<https://sites.google.com/view/southern-life/>)
3. Allow students to work in pairs as they complete the *Southern Life Digital Breakout* and the *Southern Life* Activity Worksheet.
4. Assess student performance based on their accurate completion of the *Southern Life* Activity Worksheet and *Southern Life* Digital Breakout.

## Assessment

- **Formative assessments**—Digital Breakout activities encourage students to use different cognitive patterns than normally used in academia.
- **Summative assessments**—Student knowledge will be assessed using the *Southern Life* Activity Worksheet. The worksheet addresses Climate and Polar Literacy Standards and Science Standards for the transfer of energy through an ecosystem; aquatic food webs; exploration; and sea ice morphology.

## Additional Resources (Resources for Southern Life Digital Breakout Activity)

- <http://snotes.com/snotes/ss.php?snoteId=5970d369043775.13370439> (Snotes link)
- <http://puzzlemaker.discoveryeducation.com/code/BuildWordSearch.asp> (Word Search link)
- <http://www.coolantarctica.com/Antarctica%20fact%20file/History/exploration-history.php> (History of Antarctic Exploration)
- <http://lrs.ed.uiuc.edu/students/downey/project/penguins.html> (Info of number and types of Antarctic penguins)
- <https://www.nsf.gov/geo/opp/support/palmerst.jsp> (Data for Palmer Station)
- <https://www.usap.gov/videoclipsandmaps/palwebcam.cfm> (Palmer Station Info)
- [http://www.ats.aq/documents/ATCM32/op/atcm32\\_op022\\_e.pdf](http://www.ats.aq/documents/ATCM32/op/atcm32_op022_e.pdf) (Antarctic Treaty info)
- <http://coseenow.net/converge/how-gliders-work-a-look-inside-the-blue-hen/> (Converge Page, including “How Gliders Work” info)
- <http://news.nationalgeographic.com/news/2013/08/130817-antarctica-krill-whales-ecology-climate-science/> (NatGeo article on vital role of krill to Antarctic Food Web)

## Extensions:

1. Use this website (<https://photolibrary.usap.gov/#1-1>) to view images from Antarctica, including the various research vessels/stations and wildlife. Record your insights and thoughts in a journal entry.
2. Graph the data recorded from Josh Kohut’s Glider Data that was recorded on the worksheet. (This extension allows students to practice graphing skills.)



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 Student *Southern Life* Activity Worksheet

**Exploring the Southern Continent – The Antarctic Treaty**

1. What date was the Antarctic Treaty signed?	
2. What is a cornerstone of the Antarctic Treaty?	
3. Which treaty Article safeguards Antarctica from mining of resources, such as oil or iron?	
4. How many countries signed (HINT: signatories) the original treaty?	
5. How many countries currently abide by the treaty?	
6. When was the most recent International Polar Year?	

**Exploring the Southern Continent – US Research Stations**

Use this link (<https://www.usap.gov/>) to locate and list the 3 Antarctic Research Stations operated by the United States. Browse through the USAP Webcams to view images from these three stations to complete the table below:

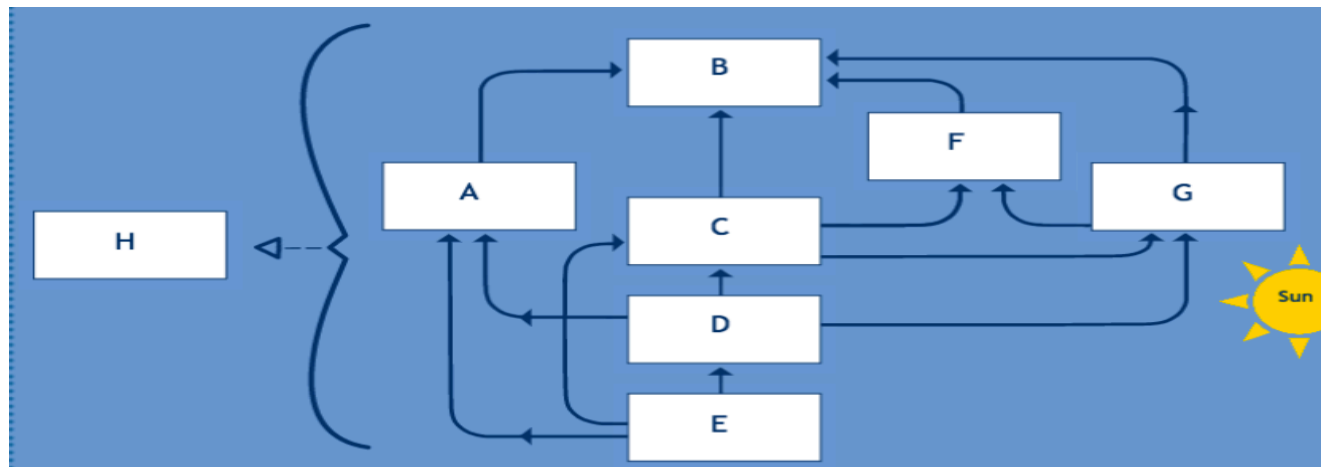
US Research Station	Current weather data			How's the view? (Describe the camera view)
	Date	High-Low Temp (°C)	Wind Chill	
7.				
8.				
9.				

10. When (year) did the United States establish a research station in Antarctica?	
11. Why is most of the research in Antarctica conducted between September and March?	

**Exploring the Southern Continent – Antarctica's Food Web**

Use this link to locate the Antarctic Food Web Game. Play this game to learn about Antarctica's uniquely aquatic food web: <https://unctv.pbslearningmedia.org/resource/lsp07.sci.life.eco.oceanfoodweb/antarctic-food-web-game/#.WYs82oqQwxE>

12. Write the correct arrangement in the chart below:



### Exploring the Southern Continent – Using Technology to Explore Below the Surface

Use Dr. Josh Kohut’s presentation, “**Observing Our Ocean Planet**” to learn how Gliders collect data beneath the surface. Complete the table and questions below using the Glider Data collected on January 27, 2015.

TIME (GMT)	Temperature at Depth				Chlorophyll Concentration at Depth			
	Warmest (°C)	Depth (m)	Coolest (°C)	Depth (m)	Highest (ul/g)	Depth (m)	Lowest (ul/g)	Depth (m)
00:00								
04:00								
09:00								
20:00								
23:00								

13. Circle the coolest temperature recorded in this data set.
14. Where is the highest concentration of chlorophyll found? (in relation to the depth)
15. Why is the highest concentration of chlorophyll found here?
16. What island is located north of the data collection area?
17. Identify the latitude/longitude coordinates where the Adelie and Gentoo penguins foraging tracks overlap.
18. What type of relationship is supported between Adelie and Gentoo penguins based on this data set?
19. Identify the lowest temperature and highest chlorophyll concentration when the Adelie and Gentoo penguin foraging tracks overlapped.
- |           |  |                    |  |
|-----------|--|--------------------|--|
| Temp (°C) |  | Chlorophyll (ul/g) |  |
|           |  |                    |  |
20. Tides and Weather events can generate variations in surface currents in this research area. How might variations in surface current affect foraging behavior in the penguins found in this region?

### Exploring the Southern Continent – Using Technology to Explore Below the Surface: Whale Ecology

Locate the “humpback whale backs” video link at this website: <https://polar-ice.org/focus-areas/polar-data-stories/finding-food/> and observe the technique used to tag whales in Antarctica. After viewing the video, locate the numerical links ( ← Prev 1 2 3 4 5 6 End Next → ) to read the through the Polar Data Story for questions 21 - 25:

21. Why do scientists tag and track whales?
22. Analyze the **Whale Track Data** to determine the time the whale was at the maximum depth during its diving behavior.
- |            |  |           |  |
|------------|--|-----------|--|
| TIME (GMT) |  | DEPTH (m) |  |
|            |  |           |  |
23. Observe the krill data in section 4. Where would you expect to see the whales? Use your mouse to click inside the graph where you think a whale would be. Record that time and depth here:
- |            |  |           |  |
|------------|--|-----------|--|
| TIME (GMT) |  | DEPTH (m) |  |
|            |  |           |  |
24. What does LTER stand for?
25. Describe an advantage of using drones to observe whale behavior.

