BLUBBER POWER

For use with the **PLAN** section of *Southern Exposure*

Overview: Students will learn about how scientists conduct a health assessment in the field and students will practice interpreting scientific data.

Learning Objectives:

The student will:

- *Interpret a thermal image, explaining what various colors in the image represent.*

- *Plot study data and describe the relationship between the depth of a seal's blubber and its mass.*

Standards Addressed:

Alaska Science GLE's:
5th: SA1.1, SE3.1
6th: SA1.1, SE3.1
7th: SA1.1, SE3.1
8th: SA1.1, SE3.1

National Science Education Standards:
Content Standard A: Science and Inquiry
- Abilities necessary to do scientific inquiry (5-8)

Content Standard G: History and Nature of Science
- Science as a human endeavor (5-8)

Materials Needed:

Day one:
- *Printed **color** copy of BLUBBER POWER worksheet for each student (included below)*
- *Pens and Pencils*

Day two:
- *Graph paper*
- *Pencils, pens*
- *Science Journals/Notebooks*
- *Printed copy of Blubber vs. Mass data set for each student (included below)*

Teaching Time: 1.5 hours

Preparation Time: 30 minutes
- Practice analyzing thermal images
- Prepare poster paper (You'll need one large poster-sized piece for each group of 4 students)

Background:

Dr. Mellish and her colleagues used health assessments to select Weddell seals for their study. In order to participate in this project, animals had to be healthy. The scientists were interested in blubber depth as an indicator of overall body condition. To measure blubber thickness, Dr. Mellish used a hand-held ultrasound machine. Just as an ultrasound can be used to monitor the prenatal development of a baby, the vibrations from this machine's high frequency sound waves can be used to survey the internal structures of a seal. Blubber depth data can be used in a number of ways. For this project the scientists were interested in examining how blubber thickness correlated with the animal's mass and whether blubber depth affected how seals lost heat to their environment.

On **day one** of this lesson, students will navigate through the PLAN section of *Southern Exposure* and interpret ultrasound and thermal images collected by Dr. Jo-Ann Mellish and her team. In the thermal images students will use a key to determine patterns of heat loss on dry seals – information that scientists used as a baseline in the project. (They then looked at how different environmental conditions changed patterns of heat loss.) In the ultrasound images, students will compare the blubber depths of seals with different body conditions. Students will respond to questions in their science journals and will participate in class discussion to strengthen their understanding.

On **day two**, students will plot blubber depth data against seal mass data and analyze the relationship between the two variables. Students will observe that there is a direct correlation between the depth of a seal's blubber and its total mass. Furthermore, students will note variations in body condition between the four population subsets studied in this project: pup, juvenile, adult female (no pup) and adult female (weaned pup).

Directions:

Day One:

1. After completing the health assessment portion of the PLAN section of *Southern Exposure*, ask your class if they have ever heard of a camera that can take thermal images.
2. Explain that a thermal imaging camera allows us to view variations in temperature between objects and their environment by looking at the temperature of the area surrounding the object (for this reason, thermal images are most useful for looking at temperature variation rather than exact temperatures of objects). Since warm-blooded animals maintain a constant body temperature they can be easily viewed against their environment using this technology.
3. Ask students to brainstorm other real-world applications for thermal imaging. This list might include: by doctors to assess patient health (including cancer screening), by builders or inspectors to find bad wiring or areas of energy loss in a building, or by firefighters to see through smoke and find the source of fires.
4. Explain that animal physiologists can use this technology to study animal health and to examine how warm-blooded animals exchange heat with their environment.

5. Pass out student worksheets. As students complete the worksheet remind them that the goal of this activity is to challenge them to think like a scientist.
6. Review worksheet responses as a class.

Day Two:

1. Introduce part two of the project. Let students know that they'll be building on their understanding of the variables that impact animal health by plotting data the research team collected about the study population.
2. Pass out a copy of the *blubber depth vs. mass* data set to each student. Discuss as a class which variables should go on the x- and y-axes.
3. Ask students to write a few sentences in their science journals describing their predictions about relationships they might find between the two variables.
4. Allow students time to plot all data points, using different symbols or colors to represent each population subgroup: pups, juveniles, females (no pup), females (just weaned a pup).
5. Encourage students to draw best-fit lines for each of their population subgroups.
6. In their science notebooks have students reflect on their findings. Prompt them with questions:
   - *Briefly describe the relationship between a Weddell seal's mass and the thickness of its blubber.*
   - *Were your initial predictions supported by the data?*
   - *Which group of animals had the thickest blubber? Which had the thinnest?*
   - *Hypothesize why juvenile seals have thinner blubber at a given mass than weaned pups.*

Extensions:

Have students test out the insulating power of blubber by making their own blubber gloves. You'll need four quart-size freezer zipper baggies, duct tape, and 2 cups shortening to make each glove.

To prepare:

1.) Roll down the tops of two baggies and fill each with shortening (need about 1 c. in each bag). Be careful not to get the shortening anywhere near the zipper!
2.) Carefully seal baggie shut and put duct tape over the seal; make sure to remove all air before closing baggie, and leave a little gap between the shortening and the top of the baggie.
3.) Tape the bottoms of the 2 baggies together using a single strip of tape. Use two small strips of duct tape to connect the top edges of the baggies. Don't use too much tape - you want the kids to be able to see the "blubber," and it doesn't need to be sealed all the way around because it will be inside another baggie. This will be the basis for the glove.
4.) Place the 2 bound baggies inside a 3rd baggie.
5.) Use the 4th baggie to finish the project. Turn the 4th inside-out and stuff it into the glove (between the two bound shortening-filled baggies), then bring the seals of the inside-out baggie

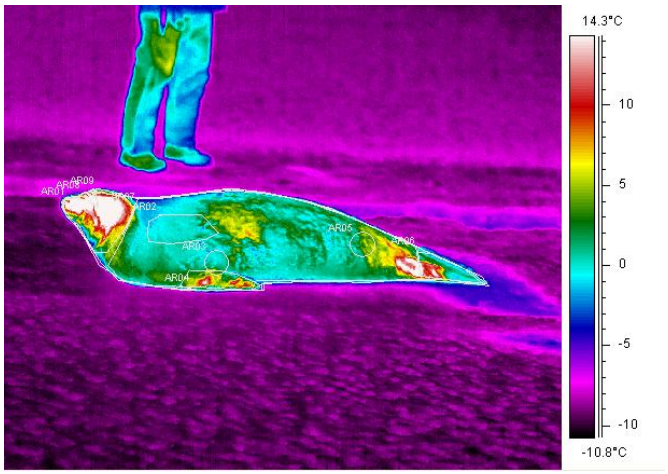
to meet the outer baggie (baggie #3). Seal them together as best you can (it won't be perfect). Tape this common seal to ensure it stays closed and secure.

6.) Fold the top edge down (this is why you leave a gap between the blubber and the seal), and finish the glove with a strip of tape all the way around the outside of the glove to hold the folded edge in place.
7.) Prepare a bin with ice water.
8.) Being careful not to get water inside their blubber glove, have students put one bare and one gloved hand into the ice water.
9.) Discuss student observations.

Name: _____

BLUBBER POWER Student worksheet

Use the information you've learned about thermal images to analyze the image below and answer the following questions.



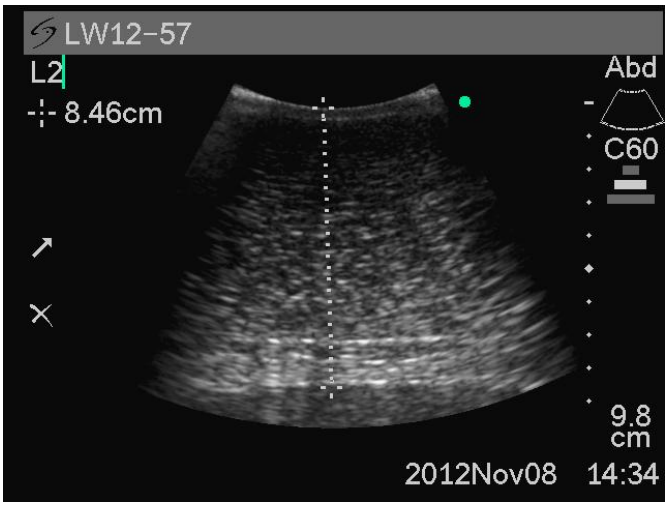
1.) Describe which areas of this seal's body are losing the most heat to the surrounding environment (these areas appear the hottest temperature in the image).

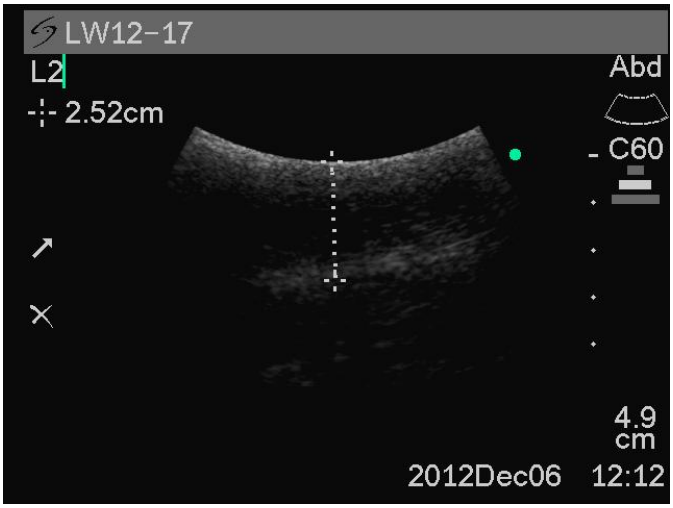
2.) What is the approximate temperature (in ° Celsius) of the ice surface this seal is lying on?

3.) What **environmental conditions** might affect how much heat a Weddell seal loses to its environment? Describe one scenario where a seal would lose less heat, and one scenario where a seal would be likely to lose more heat. (Hint: heat loss can be thought of in terms of the difference between the temperature of the environment and temperature of the hottest part of the seal's body surface).

4.) How might the amount of blubber a Weddell seal has affect the amount of heat it loses to its environment?

The images below were taken with an ultrasound machine. Both images show measures of blubber depth in adult female Weddell seals. The seal on the left has blubber measuring 8.46 cm thick, while the blubber layer of the seal on the right is only 2.52 cm thick. Use the information from these images, and your existing knowledge about Weddell seals, to answer the questions below.





1.) On the day they were sampled, one of these seals weighed 1058 lbs (480 kg), while the other weighed 547 lbs (248 kg). Explain which weight you think matches which photo. Justify your reasoning.

2.) The Weddell seal on the left did not have a pup in 2012. The seal on the right weaned (<u>finished</u> nursing and caring for) her pup just before this image was taken. List at least two reasons why a female seal might have less blubber as a result of caring for a pup.

3.) Describe three consequences that a seal might face as a result of not having enough blubber.

Class	Mass (kg)	Blubber depth (cm)
JUV	136	3.1
JUV	193	4.0
JUV	181	4.9
JUV	155	3.6
JUV	164	4.3
JUV	125	2.7
JUV	95	2.3
JUV	169	5.0
JUV	148	3.3
JUV	120	3.8
JUV	129	3.1
JUV	170	3.9
FNP	336	6.0
FNP	285	4.6
FNP	350	5.8
FNP	312	5.1
FNP	326	5.8
FNP	337	5.9
FNP	357	5.1
FNP	480	7.0
FNP	392	5.8
FNP	520	5.4
FNP	394	5.3
FWP	205	3.9
FWP	358	4.6
FWP	347	5.4
FWP	250	3.0
FWP	238	3.9
FWP	248	2.7
FWP	305	3.9
FWP	257	2.7
FWP	230	2.7
PUP	124	5.7
PUP	110	4.3
PUP	125	4.7
PUP	114	4.7
PUP	110	4.8
PUP	93	4.3
PUP	90	4.3
PUP	135	5.2
PUP	138	5.6
PUP	106	4.6
PUP	98	4.3

Classes:

PUP:	pup
JUV:	juvenile
FNP:	adult female, no pup
FWP:	adult female, just weaned a pup

Directions:

- Decide which variable belongs on the x- and y-axis of your graph.

- Draw your graph and label your axes. Remember to include the units of measure!

- Look at the dataset and brainstorm a hypothesis about the relationship between a seal's mass and its blubber depth.

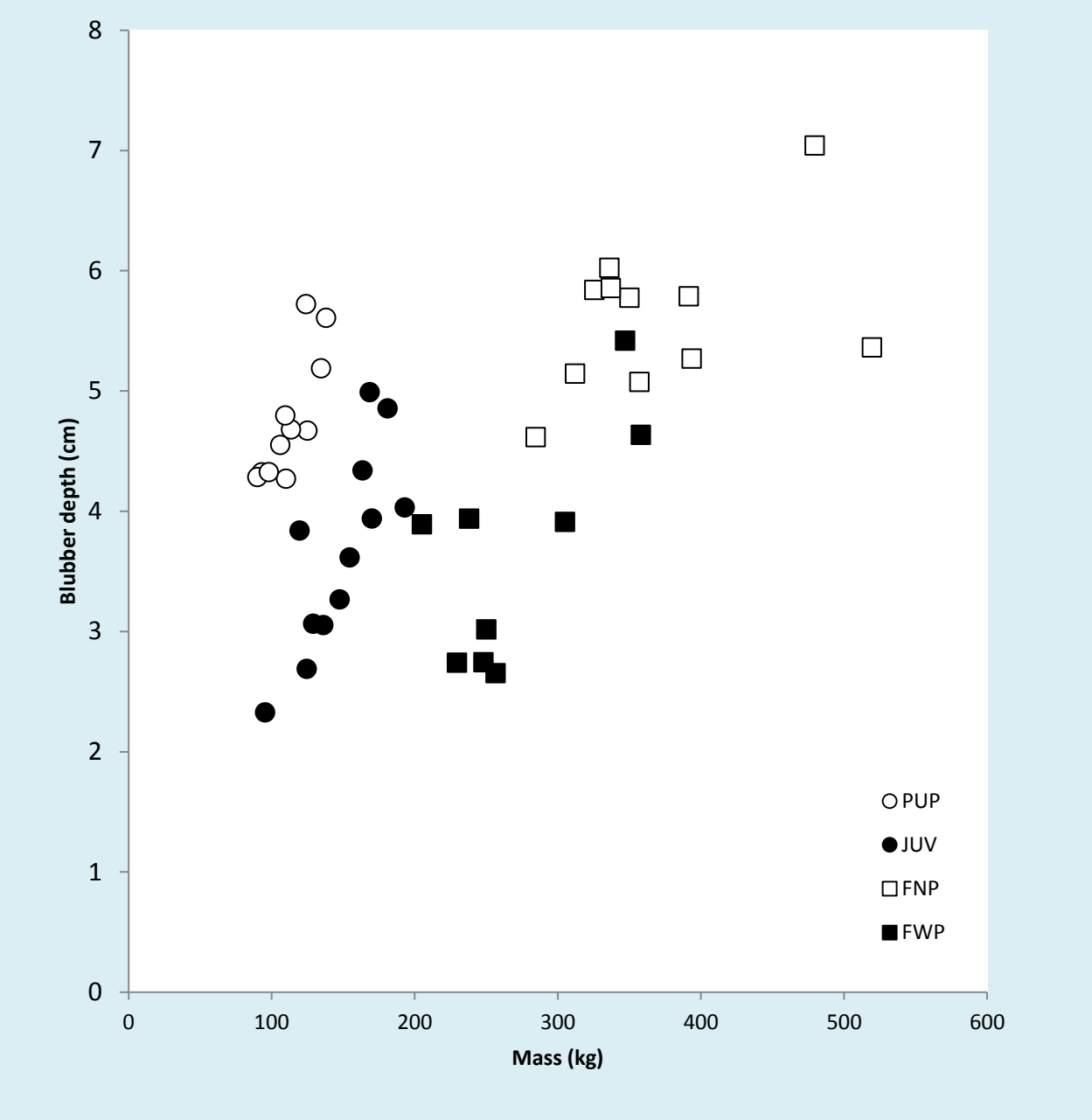
- Pick a color or symbol for each of the four classes of seal, and make a key for your graph.

- Plot each data point on your graph using the correct color or symbol for each different class.

All research conducted under National Marine Fisheries Service Marine Mammal Protection Act authorization 15748 and Antarctic Conservation Act permit 2012-003.

Teacher's Answer Key

Blubber vs. Mass Plotting Activity



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