SCIENTRIFFIC

CSIRO

TEACHER'S GUIDE | ISSUE 49 MAY 2007

Winter warmers

Welcome to this issue of your *Scientriffic* Teacher's Guide.

To welcome winter we invite you to an Antarctic adventure to celebrate International Polar Year. You might rest a little easier during the journey through the Southern Ocean knowing that your ship has the right amount of ballast to keep it stable when the storms kick in. Have a go at the first Hands-on Minds-on activity to test the buoyancy of your model ship in different ocean conditions.

Another thing you'll need to know before your journey to the pole is how to rescue someone in a whiteout, when you can't see or hear a thing. Recreate the conditions of a blizzard using blindfolds and develop a plan to find your lost team mate.

In Synapse, while building a model igloo, students will begin to understand how a picture or sketch can make a written instruction easier to understand. Explore the nature of a myth as your class creates their own Antarctic stories, play a board game to learn more about the icy continent and find out what a 'growler' and 'bergy bit' is!

Enjoy the inspiration - and inspire us with your suggestions by emailing scientriffic@csiro.au or writing to *Scientriffic*, PO Box 225, Dickson ACT 2602.

Gabrielle Tramby and Jean Watson
Scientriffic Teacher's Guide Authors

In this issue

you will find loads of invaluable information, resources and ideas that will help you bring science into your classroom.

> HANDS-ON MINDS-ON: two hands-on activities and two black line masters linked to the theme of this issue - polar science.

> SYNAPSE: five lesson plans to help you connect ***Scientriffic*** to literacy in your classroom.

> CLOSE UP: keep one step ahead of students by extending your knowledge of the topics in this issue.


Tanya Patrick/CSIRO/AAD

International Polar Year

International Polar Year (IPY) 2007-2008 has begun and there are great ways to get your class involved.

Polar science

During the course of International Polar Year, thousands of scientists from over 60 countries will carry out 220 science projects. It will be the largest internationally coordinated scientific research effort in 50 years. It's also your chance to get involved with cutting edge science in real-time. Visit www.ipy.org

Polar problems

Climate changes are affecting large ice sheets that will impact global sea level, affecting coastal cities and low-lying areas. Variation in snowfall and shrinkage of glaciers will influence millions of people whose daily use of water for personal consumption or agriculture depends on snow pack and glacial sources. For your chance to tell us what impact climate change is having on your area or to find out what's going on around the world visit www.aspacnet.org/iglo/climatexchange.

Science in a click

Scientriffic's editor Tanya Patrick visited Antarctica this summer. You can learn all about her journey on the Polar Eyes website. Visit www.csiro.au/csiro/channel/pchgc.html and brush up on your polar science, find some great weblinks or view photos from the icy continent.

Why do ships float?

CURRICULUM FOCUS

Energy and force

AIM

Students will conduct an experiment to demonstrate the effects of varying rates of salinity on how high a simple 'ship' will float. This will introduce students to the concepts of buoyancy and density.

BACKGROUND

Salt content differs from sea to sea and ships often sail from one body of water to another. This affects how a ship floats as they are only stable with the right combination of cargo or ballast and ocean conditions, including salinity.

Ships or boats can become unstable in stormy waters if their centre of gravity is too high in relation to their centre of buoyancy. Ships can swamp and sink if they ride too low in the water.

There are examples of heavily laden trawlers being lost at sea when they sailed from salty waters, where their cargo weight was safe, into waters diluted by fresh water melting from glaciers, which caused them to sit too low in the water!

TEACHER PREPARATION

Prepare three liquids with different densities before the lesson.

Solution 1 (fresh water): Use fresh water from the tap

Solution 2 (salt water): Dissolve table salt in a container of room temperature fresh water. Keep stirring the salt in until no more will dissolve. You will notice when this happens as the salt will fall to the bottom of the container without dissolving.

Solution 3 (really salty water): Heat water on the stove until it is simmering. Stir salt in with a wooden spoon. Keep adding salt until no more will dissolve. This solution will be much saltier than solution two. Allow the water to cool to room temperature.

YOU WILL NEED:

- Three liquids of different densities (solutions 1, 2 and 3)
- Three glass jars
- Light weight test tube
- Sand
- Wooden stick (ice cream stick or dowel works well) marked in one centimetre intervals
- Labels for each jar.

WHAT TO DO:

1. Fill each jar three-quarters full with one of the three solutions and label each jar with 'solution 1', 'solution 2' or 'solution 3'. Each jar needs to be the same size and contain the same amount of solution.
2. Place the marked wooden stick inside the test tube.
3. Add a little sand to the test tube.
4. Set the test tube in the first container and adjust the sand until the test tube floats upright.
5. Look through the jar and the test tube to read the height of the water level on the wooden stick inside the test tube. Record the water level.
6. Repeat this procedure in the other two glass jars.
7. Read the following story to your students and then ask them to answer question 2 on their worksheet.

THE STORY OF THE ANDREA DORIA

A well-designed, stable ship will stay upright in rough seas. In a stable ship, the part of the ship that is below the waterline is like a weighted pendulum; it keeps the bottom of the ship in the water and the deck above the water.

But if this balancing act is compromised, ships can be lost. One dramatic example of this is the spectacular capsizing and sinking of the Italian passenger liner Andrea Doria.

The Andrea Doria used up nearly all its fuel while crossing the Atlantic from Italy to the United States. The fuel added extra weight (called ballast) that kept the ship stable in the water. To keep the ship balanced the crew pumped seawater into the empty fuel tanks. This made the ship heavier and kept it low and stable. But seawater in fuel tanks is considered 'dirty ballast' and when they arrived in the United States they would have to pay a lot of money to have the 'dirty ballast' removed. So the crew pumped out the seawater into the open ocean just before they reached port.

This proved to be a fatal decision. The Andrea Doria collided with a smaller cruise ship and began to take on water. This made the ship unstable, rocking back and forth in the water. Normally the amount the ship rocked back and forth would have been fine, but without the ballast the tilt turned deadly. The ship capsized and sank. Luckily, all but 54 of her more than 1,600 passengers and crew were rescued.

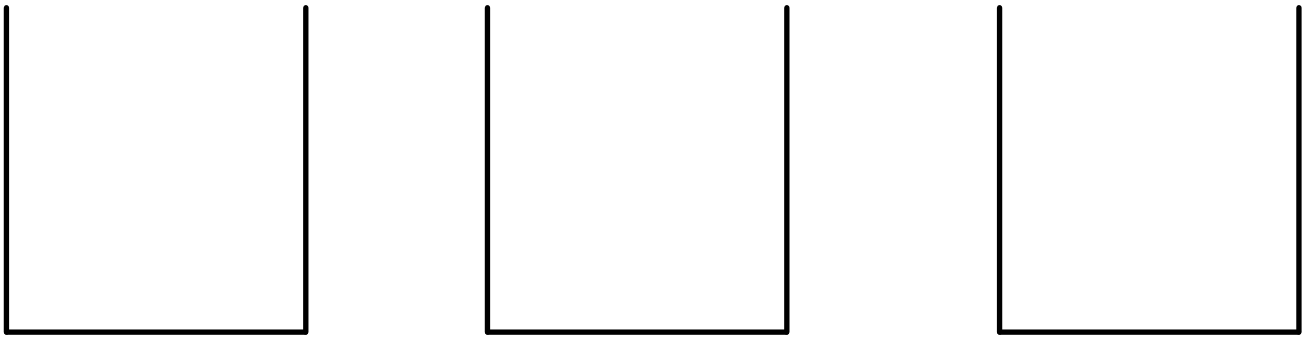
FOLLOW-UP QUESTION

Each jar contains the same amount of water but different amounts of salt. Therefore, the salinity is different. What other variables could you change that might affect the water level on the test tube?

NAME _____

Why do ships float?

Draw each jar with the test tube floating inside and mark the water level on the test tube.



Fresh water | Salty water | Really salty water

Questions

1. Did your ship sit higher above the water level when it was in salty or fresh water?

2. What might happen to a ship sitting very high in the water (a very light ship) that was caught in a storm? The story of the Andrea Doria might help you to answer this question.

3. What would happen if a ship travelled from really salty water, for example near the equator, to a place of not-so-salty water, like Antarctica? Would it sit high or low in the water?

DID YOU KNOW?

BALLAST IS HEAVY MATERIAL IN A SHIP THAT MAKES THE SHIP MORE STABLE.

Survival in Antarctica!

CURRICULUM FOCUS

Science in daily life

AIM

How do you find a lost crew mate in a whiteout, when you can't see or hear a thing! For this activity you need to create a plan to rescue a person lost in a whiteout storm.

BACKGROUND

You have landed in Antarctica. But be warned, this continent is a dangerous place. Every researcher who works in Antarctica undergoes survival training upon arrival. Among the many dangers is the risk of getting caught in a whiteout storm, which can strike quickly and often without warning. Fierce wind blows so much snow into the air that it creates a thick wall of white. Victims can't see beyond their arms or legs. Some get lost just metres from home. Roaring winds silence shouts before they can reach a rescuer's ears.

All science field workers must learn to locate a person lost in such conditions – without getting lost themselves.

YOU WILL NEED:

> A group of people (four to eight people)

> A length of rope

> One 'victim' from your group

> Snow screens for the rescuers (blind folds)

> The South Pole – this can be anything that marks a point, like a chair or a pole

> A watch to time each rescue attempt

> A person to watch the rescue to make sure no one lets go of the rope.

WHAT TO DO:

1. You need to develop a plan of action for rescuing someone in a whiteout.
2. Make sure everyone understands the rescue plan and knows what job they must do. It will help to write down your plan and check that everyone has written down the same thing.
3. Points to remember are:
   - Your only tool is the rope.
   - This isn't a 'lone hero' rescue. Individuals who stray from the group will become lost themselves.
   - You must always be holding on to something that connects you to the rest of the group. As soon as you let go you will be considered 'lost' as well.
   - You must work together to find the victim.
   - Time is of the essence; blizzard-level wind chills can freeze a human in minutes.
   - Whiteouts create a radio black-out; there is no audio or visual communication. You must do this activity in silence.
4. Now test your plan. Have all but one member wear a snow screen (blind fold). The eighth member is the victim, who should sit as far away as possible from the South Pole (maximum 20 metres)
5. How long did it take you to 'find' the lost person?
6. Compare your plan with the real thing.

ANTARCTICA RESCUE TECHNIQUE

- Victims learn that they must stay in one place and wait to be rescued.
- Rescuers tie one end of the rope securely to a stake in the ground; the remaining coils stay with the lead rescuer (who will be the farthest from the stake).
- Each rescuer spreads his or her arms and grabs the rope with both hands so that each hand is on the other side of the hands of the neighbouring rescuers. The 'base rescuer' stands no farther than one metre from the stake for the initial sweep.
- Rescuers spread themselves out along the rope until this human 'chain' is taut, and then walk slowly in a sweeping circle around the stake.
- If the victim isn't found, rescuers need to 'sweep' in a circle farther out from the stake. The leader ties a knot and then edges farther out the rope, maintaining contact with the hand of the neighbouring rescuer. As the followers feel the knot pass through their hands, they yell, 'knot coming' to the next person.
- When the last person feels the knot, he or she squeezes the hand of the next person and so on to the leader, who then stops moving outward.
- The group makes a second, large circle around the stake, repeating the procedure until the person is found.

NAME _____

Survival in Antarctica!

Team name _____

Members of the rescue team:

Victim:

Rescue plan:

Time taken to rescue the victim:

How long did the other teams in your class take?

Team one	_____	Time	_____
Team two	_____	Time	_____
Team three	_____	Time	_____
Team four	_____	Time	_____
Team five	_____	Time	_____

CONNECTING *SCIENTRIFFIC* TO LITERACY IN YOUR CLASSROOM

Snow-shelters show and tell

Before you start this activity you may like to check out the field manual for the US Antarctic Program at www.usap.gov/travelAndDeployment/documents/FieldManual-Chapt11SnowShelters.pdf

It shows many good examples of how a photo or a sketch can make a written instruction easier to understand.

WHAT TO DO:

1. Copy the instructions for making a model igloo from the *Scientriffic* article on pages 24-25 onto the board or a large sheet of paper.
2. Read through the instructions with the students and ask them to consider whether adding sketches or photographs would improve the instructions.
3. As a class or in small groups go through the steps to make the model igloo.
4. Organise time for students to make quick sketches of each stage as well as writing their own instructions under each sketch.
5. At the same time take a number of digital photographs of each stage.
6. At the end of the activity, display the sketches and demonstrate how they can be organised as a flow chart to show the sequence of the activity.
7. Show the photographs as a slide show and discuss the advantages or otherwise of using photographs.
8. Organise students to look through copies of *Scientriffic* to find whether photographs or sketches have been used to illustrate different articles.
9. Give each student a copy of the photo and sketch of the snow igloo and ask them to reflect in writing on how they can use photographs or illustrations in their own work.


Tanya Patrick/CSIRO/AAD

PLAYING THE GAME

Scientriffic pp 34-35.

Playing the 'Antarctic wandering' game will allow students to learn about Antarctica in an imaginative and fun-filled way. It could be used initially to engage the students and find out what they know about Antarctica before they start the topic.

1. Write the title 'What I think I know about Antarctica' on the board or a chart and ask students for contributions.
2. Write all responses without making comments or corrections. Encourage all students to contribute.
3. Show the students the game and explain the rules. Tell the students that the game is based on information about Antarctica. Explain the importance of reading the clues carefully.
4. Allow time for students to read the clues and play the game in pairs or small groups.
5. At the end of the game give each student a Post-it note and ask them to write an interesting fact about Antarctica they remember from the game board.
6. Organise Post-it notes on the board so students with a similar interest form a research group.
7. At the end of the research ask students to contribute to a chart titled 'What I have learned about Antarctica'.

ICEBERGS

Scientriffic pp 24-25.

1. To start research on icebergs, ask students to read through the instructions and study the photos that accompany the edible model of Antarctica.
2. Ask them to note any information about icebergs from the article. For example, do icebergs have different colours; how do icebergs get their names?
3. Ask students to think about the saying 'the tip of the iceberg'. This phrase alludes to the fact that the greater part of a floating iceberg is concealed beneath the surface of the water leaving only the tip visible above the surface. Research the size and shape of icebergs. Find a definition of 'growler' and 'bergy bit'.
4. Find out how ice sheets give birth to icebergs and what the process is called.
5. Icebergs are found in both the Arctic and Antarctic regions. Research the differences in icebergs from the two areas.
6. Find interesting information and amazing photos at: www.uscg.mil/lantarea/iip/FAQ/Icebergs_5.shtml and http://oceanworld.tamu.edu/students/iceberg/iceberg1.htm

MYTHS OF ANTARCTICA

Scientriffic pp 6-9.

Myths are narrative texts that people create to help them explain their history or natural phenomena.

Myths are very common in most human societies, and often have links to religion. As there are no human cultures in Antarctica, there are no myths about Antarctica. However your students can invent some of their own.

1. Collect some examples of myths and read to the students. Myths from polar societies (such as Inuit or Scandinavian myths) would be particularly relevant.
2. Use one of the stories to explain the purpose and organisation of the text.
3. Tell students they are going to write a myth of Antarctica.
4. Guide the students through the text and pictures of 'The icy pole' article discussing phenomena that could be used in their story. For example, why emperor penguins huddle to keep warm or how Antarctica was created from Gondwana.
5. Organise students to work in pairs on an oral version of their myth. Give them time to memorise and rehearse their stories, then have students share their stories with the whole class.
6. Organise students to write and illustrate their story.

WHAT ABOUT THE WHALES

Scientriffic pp 3-5.

The scientific study of whales is an important factor in marine biology studies. The fact that many whales are being killed in the name of scientific research is hard for students to understand. Allow students to put forward their views on this situation by organising an informal debate.

1. Ask students to read information in *Scientriffic* about Australian research techniques that do not harm whales.
2. Organise students to explore the plight of whales around the world by researching the information at www.deh.gov.au/whales and www.aad.gov.au/camms
3. Organise students into groups of three to further explore the question of why whales are still being killed in the name of scientific research.
4. Allocate roles in the groups:
   - Manager – who keeps the group on task and makes sure everybody is having a turn.
   - Recorder – who writes down the group's ideas and asks questions to check on what people mean.
   - Reporter – who reports the group's ideas back to the class.
5. Invite discussion, questions and a whole class reflection on the topic.

KEEP A STEP AHEAD OF YOUR STUDENTS WITH THIS BACKGROUND INFORMATION

INTERNATIONAL POLAR YEAR

Scientriffic pp 14-19.

The International Polar Year (IPY) is a large scientific program focussed on the Arctic and Antarctic. To have full and equal coverage of both areas, IPY 2007-8 covers two full annual cycles from March 2007 to March 2009.

This will be the fourth occasion in the past 125 years for scientists to band together to organise scientific and exploring programs in the polar regions.

Twelve countries participated in the First International Polar Year (1882-1883) and 15 expeditions to the poles were completed (13 to the Arctic and two to the Antarctic).

IPY 2007-8 will involve over 200 projects with thousands of scientists from over 60 nations examining a wide range of research projects.

Australia will lead eight scientific projects, co-lead three, and participate in 46 other international projects.

http://www.ipy.org

http://ipy.antarctica.gov.au

SNOW SHELTERS

Scientriffic pp 24-26.

The Inuit (indigenous people of the Arctic), who once lived in igloos made of snow, constructed their snow dwellings in three different sizes for different purposes.

The smallest, called an iglooit, was constructed as a temporary overnight shelter. They were used by hunters while out on the land or sea ice.

Next in size was a single room dwelling that housed one or two families. Several of these built together in a small area formed an 'Inuit village'.

Large temporary buildings were constructed for community feasts or other special occasions. A large igloo could be constructed from several smaller igloos attached by tunnels with a common access to the outside.

Snow is an insulator. Outside the igloo, temperature may be as low as -45 °C but on the inside the temperature may range from -7 °C to 16 °C when warmed by body heat alone.

http://en.wikipedia.org/wiki/Igloo

ANTARCTIC FOOD WEB

***Scientriffic* pp 6-9**.

The Antarctic food web is relatively simple compared to ecosystems in other parts of the world. There are fewer different species but greater numbers of them.

Antarctic krill play a key part in the Antarctic food web. They are a small semi-transparent crustacean like a shrimp, about 5 cm in length when fully grown. Krill feed on microscopic phytoplankton that is extremely abundant in Antarctic waters.

The size and super-abundance of krill provides an important food source for many large animals such as seals, penguins, squid, whales, albatrosses and many other species of bird. These large animals are able to tap into the food chain close to the production of the phytoplankton before energy is lost.

A good example of the Antarctic food web with a small number of links is that of phytoplankton fed on by krill fed on by baleen whales.

www.coolantarctica.com

http://en.wikipedia.org/wiki/Antarctic_krill

SCOPE IT OUT - LINKS TO TV'S SCOPE

ANTARCTICA

Antarctica! It's huge, cold, isolated and practically unspoilt by human activity, which is why scientists love it so much. But how can people survive in such an extreme environment, let alone do research?

Watch a video clip about penguin adaptations, try an experiment about freezing water and discover lots more of the science behind the frozen continent with Dr Rob and the team from SCOPE.

www.csiro.au/scope/episodes/e101.htm

BUOYANCY

What do super tankers, submarines, airships and Archimedes all have in common? Science of course! The law of buoyancy to be precise.

Watch a video clip to find out what would happen if you dropped a shark and a whale into a swimming pool – which would sink and which would float? And learn how to make a lava lamp as Dr Rob SCOPEs out the science of buoyancy.

www.csiro.au/scope/episodes/e39.htm

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