Lesson 5
EXPLORE

AUSTRALIAN
MARINE DEBRIS INITIATIVE

Plastic island

Our oceans are dynamic systems, made up of complex networks of currents that circulate water around the world. Large systems of these currents, coupled with wind and the earth's rotation, create 'gyres', massive, slow rotating whirlpools in which plastic trash can accumulate.

Orientation:

Show the first slide from the Lesson 5 Plastic Island PowerPoint presentation – see what Ss come up with when you ask them why we might find marine debris from Asia on Australian beaches. You may want to cover the fact that sometimes rubbish gets illegally dumped from ships in Australian waters. Continue to ask Ss what they think happens to all the rubbish once it is in the ocean. Where does it go? Help remind Ss that most marine debris is plastic and that plastic is mostly buoyant. See if any of your Ss mention that currents in the ocean make it move around. If they don't, suggest this information to them and see what they think.

Ocean currents:

Introduce the concept of ocean currents to Ss. Use the Lesson 5 Plastic Island PowerPoint presentation for a visual display. Spend some time with your Ss helping them to understand that it is wind, Coriolis effect, cabbeling, changes in temperature and salinity that transfer energy and make the water move around. If your Ss have access to the internet, it would be good to let them research this for 10 minutes and then in pairs contribute two different things each that they found out about currents in the ocean. Make a list on the whiteboard. The following Wikipedia website is a good starting point for more information on ocean currents:

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

5 gyres:

From the diagram in the Lesson 5 Plastic Island PowerPoint presentation or from their research, Ss will be introduced to the term 'gyre'. These are the places in the ocean where the current circulates and collects the marine debris. They are also known as plastic islands, the Great Pacific Garbage Patch and plastic soup. Let Ss watch the following YouTube clip about the marine debris in the gyres:

http://www.youtube.com/watch?v=h6i16CrI8ss. Elicit the main points to show understanding.

YEAR LEVEL

Years 7 - 10

MATERIALS

PowerPoint presentation
7-10 Lesson 5.ppt

Equipment for Ss to view PowerPoint presentation

Experiment Instruction Cards

Experiment Worksheets

KEY WORDS

- Gyres
- Great Pacific Garbage Patch
- Coriolis effect
- Cabbeling
- Temperature
- Salinity
- Tide
- Depth
- Contours
- Shoreline configuration
- Dead zones

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Extension activities

Ocean current experiments:

For a hands-on way of helping Ss understand some of the concepts of energy transfer and ocean currents, conduct two simple experiments: Ocean Currents - Temperature; and Ocean Currents - Wind. (See the Experiment Instruction Cards and experiment worksheet at the end of this lesson).

Carbon cycle:

Ss can research the roles that the ocean plays in the carbon cycle; it is importance, what 'dead zones' are and how marine debris may contribute to this problem. A starting place for information can be found at:

http://science.nasa.gov/earth-science/oceanography/ocean-earth-system/ocean-carbon-cycle/.

There is also a good NASA video clip about dead zones: http://www.youtube.com/watch?v=XEZpo9uLIc0.

Class debate:

Help the Ss come up with a topic to do with marine debris that they could have a debate about. This may be an issue you as a teacher come up with or one the Ss develop depending on their level. Below are some suggestions for how Ss could prepare for their debate.

The issue: What is the current environmental issue being researched?

What aspect of the marine debris problem have Ss shown most interest in so far?

Location: Where does the issue take place? What places does it affect?

Have Ss describe the current issue in a few sentences. What impact could the issue have on the environment?

Roles: put the Ss into small groups and work out whether you are going to get the small groups to run the debate each or do it as a whole class. Below is an example of how to set the debate up if each group are running their own debate.

Stakeholders: identify 2 to 4 stakeholders who have an interest in your issue. These will be the Ss debating. For each stakeholder, write down:

- Who are the stakeholders?
- Why are they interested in the issue?
- What are their concerns about the issue?
- What is the outcome they would like to see when the issue is resolved?
- How do you personally feel about your issue? How would you choose to resolve this issue?
- Who will be the facilitator?

Prepare some questions to ask the stakeholders (it may be T asking questions or another person in the group may be the facilitator).

Debate

Planning the debate:

In their small groups, students should:

1. Choose one student who will act as a neutral facilitator. This facilitator will ask questions, take questions and comments from the student audience and give each stakeholder a chance to speak.
2. Choose one or more students to represent each stakeholder involved in the current issue.
3. Brainstorm a list of questions related to the issue and each stakeholder's answer to those questions.

Prepare the debate:

Ask stakeholders to prepare three things for the debate:

1. An introductory statement about who they are.
2. Answers to the brainstormed questions on the pertinent issue.
3. A summary statement of what they would like to see happen.

Have all students prepare their debate ready for presentation.

Running the debate:

Have students present their debate to the class. Each group will need at least 10 minutes for their presentation.

The debate format might look like this:

1. The facilitator will briefly describe the issue and ask stakeholders to introduce themselves.
2. The facilitator will ask up to 4 questions, giving each stakeholder a chance to answer in turn without being interrupted.
3. The facilitator will take questions from the student audience.
4. The facilitator will invite each stakeholder to sum up how they would like the issue to be resolved from their point of view.
5. The T will then ask students their opinion of the debate by indicating whether they strongly agree, agree, disagree or strongly disagree with each point of view.

Students may be observed during research and planning periods to assess participation and focus. During the debate, older students or teachers can form a panel to mark each group.

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Experiment Instruction Card

Ocean Currents - Wind:

Materials:

Equipment: one baking dish filled halfway with water, straws, food colouring, two sieves and paper chads (paper holes from your class hole punch).

Your baking dish with the water inside represents the ocean. Ask one student to carefully hold one of the straws just above the water level on one edge of the baking dish. Ask them to blow gently into the straw and watch how the water reacts. The air coming out of the straw represents a wind-driven current in your ocean. What does this mean?

While the first student stops for a moment, assign a second student in your group to face the opposite direction and to generate a gentle wind-driven current on the opposite side of the baking dish by blowing gently on the water surface.

Now, using your best group cooperation, have students blow into both straws at the same time to create a clockwise current of water. What do you think happens to a single drop of water in your ocean when the wind blows like this from above? Record your hypothesis.

Let's see what happens if we introduce litter to our ocean model. The pile of paper chads at your station will represent shoreline litter that has blown into the ocean. What do you think will happen to the chads when the ocean current carries water clockwise around your ocean? Record your hypothesis.

Sprinkle the chads gently (a few at a time) into the water as the two students continue to generate a clockwise current. See what happens to the chads. Did they travel the way you expected? Record your findings.

Use the sieves and the materials at the station and find the fastest way to separate the chads from the water. Leave the station as you find it.

Discuss:

- What did the wind-driven current do to the litter in your ocean?
- Is there anywhere in your ocean for the litter to go?
- How do you think this litter would affect animals if your ocean had marine life in it?
- What do you think this means for shoreline litter that we see in our community?

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Experiment Instruction Card

Ocean Currents - Temperature:

Materials:

Equipment: one baking dish filled halfway with water, one ziplock bag of hot water and a rock to weigh it down, two colours of food colouring, an ice cube, two sieves and paper chads (paper holes from your class hole punch).

What do you think will happen to the water in your ocean when it has different temperatures on either side? Record your hypothesis.

Place the ziplock bag of hot water in one corner of your baking dish. Place the ice cube at the opposite corner of your baking dish.

Place two drops of one colour of food colouring beside the hot water in your ocean. Place two drops of another colour of food colouring beside the cold water in your ocean. Watch what happens. Record your findings. Was your hypothesis correct?

The paper chads will represent shoreline litter that has blown into the ocean. When litter reaches your ocean, what do you think will happen to it based on how the water currents are moving in your ocean? Record your hypothesis.

Gently sprinkle the chads in the water a few at a time and wait to see whether the water moves them. Record your findings.

Use the sieves and the materials at the station and find the fastest way to separate the chads from the water. Leave the station as you find it.

Discuss:

The movement of the water caused by temperature in your ocean is called a current.

- What did the temperature-driven current do to the litter in your ocean?
- Is there anywhere in your ocean for the litter to go?
- How do you think this litter would affect animals if your ocean had marine life in it?
- What do you think this means for shoreline litter that we see in our community?

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Experiment Worksheet

Name _____ **Date** _____

Research Question _____

Hypothesis _____

Materials Procedure _____

Procedure _____

Observations _____

Conclusion and Analysis _____

Notes on Group Discussion _____