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Marine Science Matters!

Primary unit Seaweed 11

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Introduction

Australia is a marine nation, surrounded by oceans and seas, but how much do we know about our aquatic neighbourhood? What we do know is due to collective efforts of marine scientists whose diverse research endeavours have revealed many secrets of the marine world. Much of their work is only known to people interested in their specific field of research. Marine Science is a dynamic and exciting area; our oceans are so vast and so deep that there is huge scope for future research with a multitude of questions still to be answered.

This unit is designed to:

- Highlight marine science endeavours in a range of different areas to inform and inspire your students about the significance and value of research on marine and coastal environments.
- Profile marine scientists and their work in helping students learn about our marine environment to understand it more and become better equipped to preserve it.
- Initiate interest and actions for supporting marine science that help us learn more about marine and coastal environments and how to effectively manage them.
- Provide you with a guide to educational resources available for your classroom based activities.
- Suggests ways your school can participate in local marine science endeavours.

Students will also:

- Use the outdoors and direct experiences using scientific techniques and ways of thinking to investigate marine organisms and their environments;
- Use websites to find out about the variety of research conducted by Australian Marine scientists;
- Use primary or secondary sources to engage in scientific activities (e.g. identifying shells, illustrating fish species, comparing sand samples);
- Use a range of technologies to organise and manage information collected about marine scientists and the importance of their work;
- Use critical and creative thinking techniques (e.g. De Bono's Six Hat Thinking) to clarify a range of perspectives about marine matters;
- Explore environmentally friendly actions they can initiate at home and school to reduce human impacts on our oceans and their inhabitants.

Background Information for Teachers

"The line where the land meets the sea is the margin between two worlds, a frontier that belongs to both. The ebbing tide abandons it to the land until the flowing sea reclaims it. In this fringe of sea and land a great community of strange and often beautiful animals live, reproduce, and die in the pools, on the rocks, or under the stones. So abundant are they, and so easily seen that they make the seashore an endless source of fascination". (Isobel Bennett, 1966)

Isobel dedicated her life to the study of the sea through her job as a marine biologist. She was a pioneer for women in science and made outstanding contributions to her field. Unlike Isobel many Australians take the ocean for granted. Will there always be fish and other seafood for us to catch and eat? Will we one day rid the ocean of sharks so that no one ever need fear swimming in the open ocean? Just how much pollution and human caused changes can the ocean take? How many new organisms are still to be discovered in our vast oceans? How can the work of scientists like Isobel help us understand more about our oceans and the issues

facing us as our population continues to grow? These are just a few questions that should get you thinking about the Seaweed 11 theme and the many ways it can be adapted to develop a fascinating unit of work for students.

Oceans as a resource

Australia has one of the largest ocean territories in the world, a resource that remains largely unexplored and unknown. Should we view our ocean as a resource or a responsibility? Many of us think of the marine environment as something to be used, taken from or added to, used for leisure & sporting activities, obtaining food or mining resources such as oil & gas, sand and even fresh water. Who thinks about the myriad of organisms that live in the diverse ocean environments? Do we even know what lives there and how modern human lifestyles are impacting on them? All habitats and organisms in the marine environment are inextricably linked by the one thing they have in common, the water they live in. This is a major resource that needs protecting because if the quality of the ocean water suffers so does everything that depends on it, including us! Marine science matters!

Ocean habitats

Our vast ocean area contains one of the greatest arrays of marine biodiversity on earth. Australia's marine environments contain more than 4,000 fish varieties and tens of thousands of species of invertebrates, plants and micro-organisms. From the spectacular coral reefs of Australia's tropical north to the majestic kelp forests of the temperate south, the number of newly discovered species tends to increase with each survey. Currently scientists estimate about 80% of our southern marine species occur nowhere else in the world. But these are threatened by: over fishing; marine pests and diseases; increased tourism and recreation; human driven climate change and increased pollution and sedimentation. We need to manage human activities more carefully and more consciously to ensure these habitats are protected. Without the work done by marine scientists, we wouldn't know these habitats were there or what impact, most of us unknowingly are having on their existence. Marine Science Matters!

Aquaculture

Aquaculture is the fastest growing primary industry in Australia and the fastest growing food production sector in the world. The stagnant or diminishing of the world wild caught fisheries together with growing world population have led to the reliance on aquaculture as the mean for fish production to meet the world demand for fish protein. There is a fabulous unit on Aquaculture in Australia on the MESA website (see web links). The development of aquaculture systems has been made possible through marine science research and development into controlling artificial breeding, farming food sources and preventing diseases. Marine Science Matters!

Research informs legislation

The results of research by eminent scientist Professor Malcolm McCulloch from the University of Western Australia are used by agencies such as the Productivity Commission to regulate farming practices to reduce the impacts of river run off on the Great Barrier Reef. At first these regulations were voluntary but recently more stringent regulations have been put in place to control farming practices. Current zoning of the Great Barrier Reef has been also been an outcome of the work, with the introduction of Green Zones and No-take zones which have reduced fishing. Over fishing is another factor that can impact on coral reefs. Marine Science Matters!

Contributions to technology and scientific knowledge

The oceans and the range of organisms they contain provide raw materials, new sources of food, textiles, medicines and energy. Each day new discoveries are being made by marine scientists about the ocean environment that contribute to the world's scientific and industrial knowledge. The potential of thousands of yet-to-be discovered marine products to provide lifesaving drugs is virtually untapped but expanding every year. Invention of new technologies and research techniques continues to increase our understanding of the balance of chemical, physical and biological components of the oceans. Marine Science Matters!

Marine parks and sanctuary zones

Australia has many marine protected areas - areas of land and/or sea especially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources, and managed through legal or other effective means. These cover a range of environment including: reefs; sea grass beds; tidal lagoons; mudflats; saltmarshes; mangroves; rock platforms; shipwrecks; archeological sites; underwater areas on the coast; and seabed's in deep water. Activities are allowed in a marine protected area depend on the reasons for protecting that area. Each marine protected area is different. Some are total exclusion zones which bar access, some are 'no-take' zones where you can look and not touch whilst others are 'multiple use' areas which include fishing, boating and other sporting activities.

As a developed nation with a maritime area larger than the continent itself, Australia has a special responsibility for the conservation and management of its marine and coastal environments and their resources. Society expects that natural areas will be protected. Results from Marine science research provides evidence to help make decisions about which areas should be protected and to evaluate the effectiveness of protection measures. Marine Science Matters!

Flora and fauna

Do you really know how many interesting, unique, boring or just plain weird organisms live in the variety of marine zones in our oceans? Australia has many ecologically rich sites, such as the Great Barrier Reef, Queensland wet Tropics, Kakadu wetlands, Australian Alpine areas, south-western Australia and Sub-Antarctic Islands. Some organisms are so tiny or so elusive that they have not yet been observed by humans. There is still so much to discover. Marine science matters!

Importance of marine science research

The vastness of our oceans doesn't mean we should take them for granted. It means that there is so much more out there to discovery, imagine one of your students in the future discovering and describing a new species previously unknown or figuring out that a common sponge holds the key to curing cancer, or that humans being able to spend time at the beach, or enjoying other marine environments contributes seriously to reducing work related stress and makes for a happier community? Current studies on ocean acidification cause by increased greenhouse gases and dissolving of carbon dioxide (which forms an acid) in sea water may be able to predict the limits the ocean waters can tolerate before coral reefs like the Great Barrier Reef will cease to exist. These are just some of the reasons why the work of marine scientists is important to our society. Marine science matters!

(Information sourced from Australian Government, Department of Sustainability, Environment, Water, Population and Communities).

Key Understandings

- *There are different types of marine environments and a huge diversity of marine organisms.*
- *Changes are occurring to our ocean as a result of global warming and ocean acidification.*
- *There are causes, effects and consequences of human impacts on the marine environment.*
- *Individuals, communities and Local Governments have a responsibility in making informed decisions for the sustainable management of marine environments, the results of the research conducted by marine scientists provides evidence to support decision making.*
- *Information about the findings from scientific research is communicated in numerous ways.*
- *There are differing views concerning some marine science issues and scientific knowledge changes as new evidence becomes available.*
- *Marine matters are local, national and global issues.*
- *What humans do on land affects marine organisms and environments a long way from the coast.*

Focus Questions

- *What is a marine scientist and what kind of work do they do?*
- *What would it be like to be a marine scientist? How could your work make a difference to the world?*
- *What more can we learn about marine organisms and environments? Are there really lots more things than we already know? What is needed for us to be able to solve unanswered questions about the oceans?*
- *How does the ocean affect you? How does the health of the ocean affect different groups of people?*
- *How can we reduce human impact on the ocean both directly and indirectly?*
- *What can we do and why is it important to get involved in protecting our marine zones?*
- *Why is it important to keep finding out more about the ocean, it's environments, the organisms that live there and the ways modern human lifestyles impact on it?*

Key Literacy Terms

acidification, algae, alternatives, anemone, animals, atmosphere, behaviour, birds, biodiversity, care, cetaceans, citizens, clean, climate, crabs, crustaceans, conserve, conservation, consumers, cultural values, ecosystem, echinoderms, endangered, environment, environmental values, equipment, ethics, facilities, features, fields, fishers, food, government, human-made, impacts, Indigenous peoples, intertidal, invertebrates, investigate, leisure, local, marine, nature, non-lethal, nudibranch, ocean, oceanographer, organisms, particles, permits, pollution, protect, rare, research, resource, rips, safety, sea, seagrass, scientist, signs, sources, species, sustainable, technology, threatened, tourism, tsunamis, volutes, water, weather, work.

Key Learning Areas

- *Science;*
- *Mathematics;*
- *English;*
- *History;*
- *The Arts; Society and Environment; Health and Physical Education*

Outcomes

The unit focuses on the content strand *Science as a Human Endeavour* from the National Syllabus, (ACARA). Outcomes for other Key Learning Areas can be added to meet local school program requirements:

Nature and development of science

- Science is about exploring and investigating our world using our senses
- Science helps people to explain how things work and why some things happen
- Science helps us to understand our world and solve problems, and can be used to make prediction
- Scientific knowledge changes as new evidence becomes available
- Advances in scientific knowledge and practice help us to explain events and phenomena

Applications and influence of science

- People use science in their daily lives
- Scientists' work has resulted in discoveries and inventions are used every day and people use science and technology to make decisions about the way they live
- Advancements in science and technology change the way people live, work and communicate

Science and society

- People in the community use science to help each other
- People in the community make use of scientific knowledge and skills in a variety of ways
- The needs of society influence the work of scientists, technologists and others and people make decisions about how science and technology are used
- Our understanding of the natural world has been influenced by people from many different cultures
- People work in many different fields of science and Australian scientists have made significant contributions to many areas of life

Key Competencies

- Collecting, analysing and organising information;
- Communicating ideas and information;
- Planning and organising activities;
- Working with others in teams;
- Using mathematical ideas and techniques;
- Using scientific thinking and techniques;
- Solving problems; and
- Using technology.

Planning Considerations

- What resources do you have available to assist in teaching this unit?
- Is your school in easy travelling distance to a coastal marine environment?
- Is there a Marine Discovery Centre, Aquarium or other marine education facility in your area?
- Do you have access to the Internet and digital technologies such as cameras, video cameras, interactive whiteboard, and video conferencing equipment?
- Is there a local university with a Marine science section who you may be able to contact?
- Do you have a personal interest in the marine environment or know others that do?

Some tips to help the unit run smoothly:

- *Read through the unit thoroughly and highlight activities you think are most relevant to your students;*
- *Consider which of the key learning outcomes from the National Curriculum are most likely to “come out” of the unit;*
- *Gather together key resources used in the unit, e.g. photographs, picture books, resource sheets etc. (see resources page);*
- *You may wish to write to parents informing them of the topic, sharing the understandings for the unit and inviting any assistance and resources; and*
- *Organise a learning log for each student.*

Sample Unit Sequence and Activity Ideas

TUNING IN: Sample activities

Class Discussion

Ask students what they know about the marine environment. Ask students how we know about: some of the organisms that live in the ocean; what causes Tsunamis and how we can predict them; effects of marine pollution such as oil spills on marine environments; what lives in the deepest parts of the oceans; what kills sharks apart from humans; how new islands form; and the consequences of human driven climate change on sea water.

Ask students what they know about marine scientists and what kind of work they think they do. List all ideas on a chart or whiteboard. Invite students to talk about their experiences with ocean environments. Has anyone ever seen a real sea horse in the ocean? Ask students how they feel about a reported increase in the numbers of sea horses in Sydney Harbour. Water quality in the harbour is improving as a result of new pollution control measures which are good for sea horses (they are sensitive to pollutants and cannot survive in poor quality water). Encourage students to think, reflect and share ideas with others.

It is important to focus on the positives and not over-dwell on the negatives of human impact on the oceans. This helps children view marine issues as problems we can do something about rather than give up in despair.

Questioning

Ask students to respond to ‘What if’ statements. e.g. What if...

- *We developed technologies to prevent storm water run-off dumping rubbish and sediments into the ocean?*
- *everybody caught as many fish as they wanted regardless of type or size?*
- *Fishing was banned in all Australian waters for a period of 3 years?*
- *You could see turtles, dolphins and seahorses when you went snorkelling because their populations had increased in numbers?*
- *Every harmless Grey Nurse shark was killed off because they look fierce?*

Narrative

View the internet link to the video of Sammy the Sea Turtle. Students are to write down keywords, thoughts or feelings about the pictures that have been viewed. Following the viewing, promote discussion about the pros

and cons of rescuing Sammy. Have students write and illustrate a narrative from Sammy's perspective. Encourage them to take one side of the story – was it good for Sammy to be rescued and made better? Or – was it bad for him to endure capture, transportation and handling by humans?

Mind Map

Ask the students to brainstorm all of the things they think marine scientists might do in their work. Encourage students to think about all aspects of their work including: planning, field work, laboratory work, applying for grants, reporting on their findings to the scientific community and the general public, travel to research sites, living conditions during fieldwork, communicating with other scientists, supervising students, etc.

A - Z

Use resource 1 A-Z of marine science for this activity. Ask the students to suggest definitions, write a sentence, list words or draw pictures that come to mind when they hear or see these words. Use these topics as a basis to begin a class glossary.

Create a KWFL chart based on climate change. Use student's ideas to inform class questions, ideas, statements and ways to find out chart.

Learning Log

Students begin a learning log by writing down questions and reflections about what they already know, what they would like to know and interesting facts or information.

PREPARING TO FIND OUT: Sample activities

Questions

- During the unit, the students will ask many questions. Talk with the students about the many ways to find the answers including looking, asking and experiencing.
- Discuss the people or places that might help them find out the answers to their questions. These may include teacher/librarian, expert, parents, Internet or books.
- Discuss some of the questions students have. Collate into a table form then give them time to find out the answers.
- During the course of your unit encourage students to add to the table.

Question Grid

What is?	Where/when is?	Which is?	Who is?	Why is?	How is?
What did?	Where/when did?	Which did?	Who did?	Why did?	How did?
What can?	Where/when can?	Which can?	Who Can?	Why can?	How can?
What would?	Where/when could?	Which could?	Who would?	Why would?	How would?
What will?	Where/when will?	Which will?	Who will?	Why will?	How will?
What might?	Where/when might?	Which might?	Who might?	Why might?	How might?

Use different ways of listing students' comments and questions. For example:

What we know	What we're not sure about	What we want to know

Research starters

Write incomplete statements on strips of paper and place them in a hat. In pairs students draw a topic out of the hat to research. Students should first record what they already know about the topic before using selected resources to or guided internet research to find out information on their topic. Students report back some of the information gained. For example:

- An ichthyologist is...
- Reducing marine pollutions, benefits
- Organisms that live in intertidal rock pools include.....
- Some problem marine pests in Australia are.....
- An oceanographer is a scientist who
- I wonder if sharks give birth to live young or lay eggs.
- Sea grass beds are important because

FINDING OUT: Sample Activities

Guest Speaker

Invite a marine scientist to speak to the students about their work, what area they study, why is it important, what interests them most about their work. If you are in a remote area try to organise an interview by webcam or video conference.

Fact cards

Read some of the profiles of scientists on the MESA webpage. Compose a mind map summarising the most important pieces of information. Make up a vocabulary of new words and look them up to create a glossary.

Think of another way to visually display this information. Present the information orally and show the visual displays to the rest of the class.

Web Search

Use the list of websites and others you have found to allow students to explore questions like:

1. What are seagrasses and why are they important? Where is research being conducted in Australia on sea grasses and what are they trying to find out?
2. What are ship worms?
3. How do scientists measure global surface temperatures?
4. How do scientists explore what lives deep in the oceans?
5. How much will sea levels rise as the world warms?
6. What is Australia doing to address the slaughter of whales in other countries?
7. How many fish species have scientists discovered on Lord Howe Island off NSW?
8. What differences exist between fresh water and marine crayfish?
9. What do you think will happen if a major environmental disaster wiped out the Great Barrier Reef?
10. What changes would you recommend to pollution laws to stop the use of plastics in Australia?
11. Predict what will happen if humans kill of all the sharks and whales in the ocean
12. Where are some areas of the ocean that have hardly been explored by scientists?
13. What's the difference between a marine biologist and a marine chemist?
14. What do Port Jackson Shark eggs look like?
15. What do sea spiders and sea slugs look like?
16. How can microbes help clean up oil spills?
17. Do scientists find out everything about the ocean all by themselves?
18. What sorts of technology do scientists use to study the oceans?
19. What is an echinoderm?
20. Are waves important to our marine ecosystems?

Find out about some of the localities research is being conducted by CSIRO

To find out more about the localities CSIRO is conducting marine research, search for localities in marine and coastal environments. Talk with the students about these examples, introducing new vocabulary as needed. Look for clues and ask questions. For example:

- What is this place like?
- Why is it of interest to marine scientists?
- What is happening in this place?
- What kind of scientific research is being conducted here?
- How are people travelling to this place?
- Where do scientists stay when conducting research in this place?
- What agencies are involved in conducting research at this place?
- What marine organisms live here?
- What technologies are used by marine scientists to conduct their research here?
- How is this research important?

Note: Coastal and marine environments can be of interest to scientists for a number of reasons; once a research facility is established it is common for a group of scientists to work on different but related projects. For example the Monkman research station on Green Island in Cairns is used by many different scientists: some

doing regular sampling on long term projects such as seagrass monitoring, impacts of tourism on the reef; and others making single visits to collect data on, e.g. rainfall patterns, sea water acidification and changing distribution of plants and animals.

Research project

Brainstorm how the increase in human population world- wide will impact the ocean in terms of seafood supply and demand. Consider the alternatives offered by aquaculture. What kinds of seafood can be farmed? Use a graphic organiser to compare and contrast the advantages and disadvantages of aquaculture. Allocate groups to investigate:

- Fish farming
- Oyster farming
- Sustainable seafood
- Growing crustaceans
- Traditional fishing techniques
- Aboriginal and Torres Straight fishing

Recreational and commercial fishing – survey

Design a set of questions students could use to interview their parents and grandparents about their past and present experiences of fishing. Questions should gather information about the types of fish caught, the numbers and size of fish and any changes in these over time. Questions should try to find out reasons for changes in how easy it is to catch a fish and opinions about commercial fishing and the new laws regulating recreational fishing, e.g. Marine parks and fishing licences.

Whales and dolphins

Have students read or listen to you read: *Australia’s Research Priorities for Cetaceans* produced by the Australian government (see website links). Discuss questions such as:

- What are the main areas of research interest conveyed in the publication?
- Do you think all countries would have similar research priorities as Australia?
- Who is responsible for ensuring these research priorities will be met?

View the fact sheets - *Non-lethal techniques for studying whales* and *The role of science in the international whaling commission* (see web links). Have students write reflective responses about the issues raised.

But there’s more! View and select suitable activities for your students from the website that includes 3 units of work for teachers and video of Minke Whales (see web links).

SORTING OUT: Sample activities

Representing data

Use resource 2 – Fish Survey data sheet as a secondary source for this activity. Ask students to look at this data which is a record of results from volunteer SCUBA divers collecting information for scientists to use about fish populations on a local reef. This data is organised in a systematic way that makes it easy for scientists to collect and compare data and for direct entry into a database. Ask students to discuss different ways the data could be presented to display the results for the general public. Have students share ideas with a partner and then a

group of four before decided on the most useful methods. Share methods with the class and select a few different ways to use to present the data. Organise groups to work on the chosen methods and present these to the class. Analyse the data: what fish types were most common? Why were no Grey Nurse Shark recorded?

Classifying organisms

Students place a picture/name card of a marine organism on their chest. They then move around the class to find one or more students with cards that might belong in a group similar to theirs. Students justify their groupings. Use this activity as an introduction to a lesson on marine organisms and their groups. A useful resource for this and the next activity is the units on Marine animals on the MESA website.

What am I?

Play "What am I?" Students state facts or something known about a marine organism or environment one at a time until someone can guess what it is. Record and illustrate responses. Make a class big book.

What shell is that?

Use resource 3 -Shell identification guide for this activity. From a small shell collection (your own or a class collection contributed to by students) help students try to identify what families they belong to. This could be a small project for a group of students or a class activity. You could even put together a book to help people identify shells found at your nearest beach.

Six Hat Thinking

Introduce Edward de Bono's Six Thinking Hats.

<p>Red Hat</p> <p>= feelings</p> <p>What are my feelings about marine organisms?</p>	<p>White Hat</p> <p>= Information</p> <p>What are some facts we have learned about marine organisms?</p>
<p>Blue Hat</p> <p>= what thinking is needed</p> <p>Can we think of ways to reduce use of plastics?</p>	<p>Green Hat</p> <p>= new ideas</p> <p>What is possible for us to do as users or consumers of things that cause marine pollution?</p>
<p>Black Hat</p> <p>= weaknesses</p> <p>What questions or issues does our learning about marine science research uncover?</p>	<p>Yellow Hat</p> <p>= strengths</p> <p>What are the good points we have learnt about discoveries made by marine scientists?</p>

Place cut out hats on the floor and group responses as a class. Use the Blue Hat to determine major areas and focus questions for future investigation.

Class Marine life data file

Prepare a digital or physical data file to record information collected by students about marine organisms. Think of the best way to organise the record file: by type of organism, by habitat, by size or abundance and how to display the information. For example: digital data can be displayed using PowerPoint, in a web page design with linked pages or using interactive whiteboard software. Physical data can be arranged in a folder with dividers or a creative book with fold out pages.

Scientist role play

Select students who will act as expert scientists to visit the class a give a short presentation about themselves and their work. Provide student scientists with a scientists profile from the web and give them time to read about the person they will pretend to be. As well as reading the information on the profile students should think of other information they may be able to use to help answer student questions. If time they locate or make up some props that might make their talk more interesting. In groups, other students can be asked to think and write down questions they would like to ask of the scientists. Some children can be given the job of greeting and introducing the student scientists to the class. If you have access to a video camera some children could act as TV reporters and record the presentations.

Using a futures perspective

View the *Wealth from Oceans Flagship* video to discover how the *Wealth from Oceans Flagship* is helping Australia secure its social, economic and environmental future through knowing our oceans. Ask students to talk about the issues raised in the video. How does the Flagship project aim to deal with these issues? Why is such a project of value for Australia's future?

Marine Parks – do we really need them?

Not everyone agrees with the need for marine parks, your students could debate the pros and cons of these restrictions for the sake of the environment. See web link *Marine protected areas*.

Swimming and surfing

Brainstorm reasons why people swim and surf in the ocean. For example, surfing is fun, swimming keeps you fit, it feels refreshing to be in the cold water, waves are unpredictable making surfing a game against the ocean, etc. Encourage students to add to this list and develop a mind map of the reasons people swim and surf.

Look up the website on ocean swimming – it has some fascinating facts about history of swimming in Australia, cultural links to swimming holes and can be used to discuss issues such as mixed bathing, swimming costume designs and post war ocean pollution.

Mapping

Use the internet link - *Tasmanian scientists expand their view of the ocean*. After viewing this resource ask students to: List some reasons why this project is important? Discuss what advances in technology have made this project possible?

Drawing and Modelling

Use Resource 4 – Fish species photographs and Resource 5 – Scientific drawing for this activity. Before underwater cameras were invented and became affordable the only way to identify marine organisms was to

do scientific illustrations. Often this required capturing the organism so that detailed observations could be made and recorded. Have students illustrate different fish species and use these to make a classroom display.

Investigating Sand, Rock Pool Audit and Beach diary

If you have a beach near enough to arrange a class visit try some of the activities suggested in Weekend Marine Science Series on the MESA website. Whilst these activities were written for community groups they can easily be modified for school students.

GOING FURTHER: Sample Activities

Do we really need it?

Use the plastic bags and plastics websites to prompt discussion on the issue of plastics as marine pollutants. Have students think about what other animals may be affected by eating plastics, e.g. Whale sharks and other plankton feeders as well smaller filter feeders.

Imagine a world without...

Ask students to think about those 'things' they could do without. Present pairs of students with a hypothetical situation in which a component of the marine environment no longer exists, how would that impact on our lives and those of future generations. For example:

- Imagine life without oxygen - The oxygen in every second breath we take comes from ocean algae, not trees. What if the oceans were so polluted all the algae died and we had to rely on artificial supplies of oxygen?
- Imagine the marine environment without corals, seagrass beds, marine mammals, species of fish, species of molluscs, and species of birds.
- Imagine a coastal environment without mangroves, seagrass beds, nudibranchs and echinoderms.
- Imagine if our coastal waters became so polluted we could not swim in the water and it was only safe to walk on the beaches with closed in shoes?

As a class, discuss what would happen in this situation and actions they make take to prevent these scenarios occurring. Compile the ideas into a class book. Note it is important to get students to think about preventative strategies have them consider themselves as solutionaries – what can they do to help change human lifestyles to reduce our effects on the marine environment that many people don't realise is vital to our existence.

MAKING CONNECTIONS: Sample Activities

Problems

Ask students to identify problems in the marine and coastal environments, they think could occur as a result of direct and indirect human impact. Group those together that relate to caring for ourselves and these environments, the ocean water and technology. Brainstorm possible solutions for these problems. How could the work of scientists help in generating solutions to these problems?

Prepare a chart to record student findings.

Problem	Example	Solution
<i>Caring for the ourselves and the coastal and marine environment</i>		
<i>The ocean water</i>		
<i>Technology</i>		

Mime or Role-Play

Ask students to mime or role-play scenarios that model ways we can reduce human impact on coastal and marine environments

Communicating

Students design signs to go around the classroom, school and home to remind others about ways to reduce direct human impact on coastal and marine environments or to promote the value of marine science research.

For example:

- design a sticker for boats to be distributed by the Maritime Services Bureau (or equivalent in your state or territory) to ensure fishers bring their plastic bait packets back to shore for proper disposal
- make a poster to promote alternatives to plastic bags
- make a short PowerPoint presentation or video promoting the work of a chosen marine scientist to show why marine science research should be supported
- design a pamphlet displaying what you have found about a particular marine issue from your research

Marine art and issues

Some ideas to help you integrate art into this unit include:

- Beach art (see Weekend Marine Science -Art and Science on the MESA webpage).
- Enter your students' artworks in the Marine Art, Poster & ICT challenge (see MESA webpage for details)
- [Resource 6 - Tropical fish wall paper](#) and [Resource 7 - Fish patterns](#).

Sand science

Sand can be more interesting than you think. If you have a beach nearby see the Weekend Marine Science – Sand Science resource on the MESA web page. Otherwise, have students do some research into different types of sand. Rob Holman, a coastal oceanographer from Oregon State University, has collected more than 860 samples of sand, from all continents; he has an interactive website that shows you where each sample was collected and has photos of each that you can compare (see web links). There is also a news story about his research and an audio slide show that includes findings from Palm Beach in NSW (see web links).

TAKING ACTION: Sample Activities

As a class, suggest how we can make sure people become more aware of the marine environment and ways marine scientists can help us better understand the saltwater part of our world. Better understanding leads to more informed ways to reduce our impact and develop more sustainable management practices.

Students could:

- *Contribute to a class article for the school newsletter on marine scientists and how they help us understand more about our oceans.*
- *Prepare a display of scientific drawings and models of different marine organisms and invite other classes or parents to view the display and ask questions.*
- *Speak to other classes about the care of our coastal and marine environments.*
- *Turn your classroom into an underwater observatory and invite other classes to visit the display and ask questions.*
- *Organise school events that can include actions such as coastal environment clean ups, environmental monitoring and raising awareness of the importance and fragility of marine organisms and their environments.*
- *Work with local or regional scientists by making observations and recording data to contribute to research projects.*
- *Encourage the broader community to take more notice about the seafood products we consume and how our everyday lifestyles can impact on the oceans of our planet.*
- *Identify and reflect on the factors that may influence the choice of sustainable seafood by shoppers.*
- *Prepare letters to family and friends encouraging them to stop using plastic shopping bags.*
- *Invite a marine scientist or other local expert on marine matters to speak in class.*
- *Make a pamphlet to advertise marine science research projects that could have an impact on your community.*
- *Create a calendar illustrated with photographs or drawings of some of the unique organisms that live in our oceans and or the variety of marine habitats they live in.*
- *Make a poster about things we can learn from the work of marine scientists to help us repair, protect and preserve the marine environment for the future.*

REFLECTION: Sample Activities

Ask students to complete a self-assessment and reflection activity using the following questions:

- *What is the most important thing I have learned?*
- *Share one fact you think is true about marine scientists.*
- *Share one question you have about marine organisms.*
- *How do you feel about marine pollution?*
- *What is a nudibranch?*
- *What are some of the areas marine scientists' research?*
- *List five effects of humans on the marine environment.*
- *Describe five actions I have taken this week to make a difference.*
- *Describe five actions I will take to make a difference in the future.*
- *Three things I know now that I didn't know before.*
- *What is the most important message about marine science?*

- *What have I learned about myself and how I might treat our marine and coastal environments?*
- *What would I still like to find out about our marine environments?*
- *What piece of work am I most satisfied with? Why?*

References

Australian Government, Department of Sustainability, Environment, Water, Population and Communities (various websites).

Ayling, T. & Parish, S. *Amazing facts about Australian Marine Fishes*. Steve Parish Publishing Pty Ltd., 2008.

Bennett, I. *The Fringe of the Sea*. Rigby Ltd., 1966.

DeBono, E. *Six Thinking Hats for Schools, Books 1 and 2*, Hawker Brownlow Educational, 1992.

MTAQ. *Coast and Marine Education Syllabus. Level 4 – beyond Level 6*. Marine Teacher's Association of Queensland Inc., 2005.

Roe, D., Hammond, N., Yyse, M. *HarbourKeepers & CoastKeepers Fish Survey Manual*. National Parks Association of NSW, 2006.

Websites

Australian aquaculture

<http://www.mesa.edu.au/aquaculture/default.asp>

Australian museum – fantastic links to Fish and Marine Invertebrates

<http://australianmuseum.net.au/animals>

Bureau of Meteorology

www.bom.gov.au

CSIRO Wealth from the oceans online Biodiversity poster

<http://www.cmar.csiro.au/biodiversity-poster/index.htm>

Fact sheet Marine voyages discover hundreds of new species in the Southern Ocean

<http://www.csiro.au/resources/SeamountBiodiversityFacts.html>

Fishers help scientists

<http://www.csiro.au/science/Commercial-fishers-and-ocean-observation.html>

High tech ocean equipment

<http://www.csiro.au/science/Ocean-Observing.html>

Impacts of Climate Change on Australia's Marine Life

<http://www.climatechange.gov.au/impacts/publications/marinelifelife.html>

Impact of Climate Change on Marine Environment

<http://www.defra.gov.uk/news/latest/2008/marine-1601.htm>

Marine Microbes – Australian Institute of Marine Science

<http://www.aims.gov.au/docs/research/marine-microbes/microbes/microbes.html>

Oceans Alive - ABC website for kids

<http://www.abc.net.au/oceans/alive.htm>

Marine protected areas

<http://www.environment.gov.au/coasts/mpa/about/index.html>

Ocean swimming

<http://www.cultureandrecreation.gov.au/articles/swimming/>

Plastic bags and plastic

<http://www.environment.gov.au/settlements/waste/plastic-bags/index.html>

<http://www.abc.net.au/science/features/bags/default.htm>

Note this is a you tube video and may be blocked from direct viewing in some schools

<http://www.youtube.com/watch?v=MJal-Ohqgd4&feature=related>

Note the following is an American based study and includes some images of dead sea-birds

<http://www.youtube.com/watch?v=XxNqzAHGXvs&feature=related>

Sammy the turtle

<http://australianmuseum.net.au/Sammy-the-Turtle>

Sand science – interactive website

<http://www.nytimes.com/interactive/2009/01/05/science/06sandmap.html?ref=science>

Sand science – news story and audio slide show that includes findings from Palm Beach in NSW.

http://www.nytimes.com/2009/01/06/science/06prof.html?_r=1

Scientists question fisheries health test

<http://www.csiro.au/news/Scientists-question-fisheries-health-test.html>

Seabirds

<http://www.environment.gov.au/coasts/species/seabirds/index.html>

Sea horse farming

<http://www.seahorse-australia.com.au/>

Sea shells of NSW

<http://seashellsofnsw.org.au/>

Sea spiders

<http://www.oceanwideimages.com/categories.asp?cid=195>

Seals and Sea lions

<http://www.environment.gov.au/coasts/species/seals/index.html>

Shark research – CSIRO

<http://www.cmar.csiro.au/whitesharks/index.html>

Teeming biodiversity discovered in extinct volcanoes off south-eastern Australia

<http://www.csiro.au/science/SeamountBiodiversity.html>

The blue highway ABC's interactive webpage showing the importance of all the different types of aquatic habitat for fish.

<http://www.abc.net.au/science/bluehighway/default.htm>

Tasmanian scientists expand their view of the ocean

<http://www.csiro.au/news/Tasmanian-scientists-expand-ocean-view.html>

Using microbes to improve oil recovery

<http://www.csiro.au/science/MEOR.html>

Waves, are they important to our ecosystems?

<http://www.csiro.au/science/waves-in-ocean-ecosystems.html>

Whales and dolphins

Australia's research priorities for Cetaceans

<http://www.environment.gov.au/coasts/species/cetaceans/publications/fs-research-priorities.html>

Fantastic site with 3 units of work for teachers and video of Minke Whales.

<http://www.environment.gov.au/coasts/species/cetaceans/education/index.html>

Non-lethal techniques for studying whales

<http://www.environment.gov.au/coasts/species/cetaceans/publications/fs-techniques.html>

The role of science in the international whaling commission

<http://www.environment.gov.au/coasts/species/cetaceans/publications/fs-science-iwc.html>

Wealth from Oceans Flagship video

<http://www.csiro.au/science/WfOvideo.html>

Resources

Note: Resources referred to in activities are available in the member's only section of the MESA website. Also see Weekend Marine Science series in members only section for more ideas.

Happy Seaweeek 11 from the MESA team.

