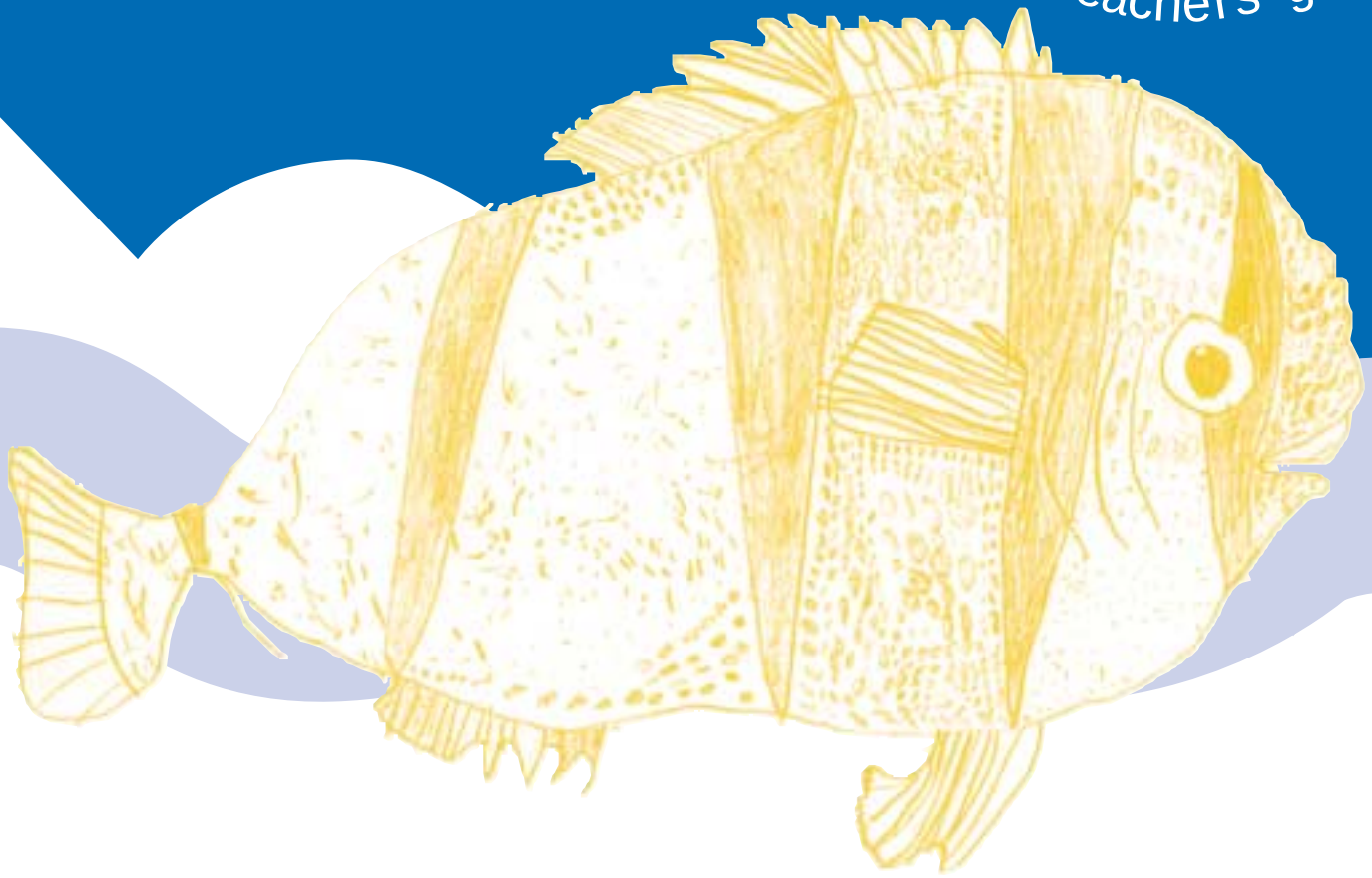
Putting a toe in the water

A teachers' guide



Getting started with coastal and marine studies in Tasmania

COASTCARE

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MESA was formed to develop understanding, wise use, protection and appreciation of the marine environment. It runs Seaweek every year to raise community awareness, provide teaching ideas and encourage an appreciation of the sea and marine habitats.

Note: The information presented in this booklet was provided by the people acknowledged below. Every effort was made to check the accuracy of this information but the editors and publisher are not responsible for any factual errors.

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COASTCARE

Natural Heritage Trust
Helping Communities Helping Australia
A Commonwealth Government Initiative

MESA Marine Education Society of Australasia

UNIVERSITY OF TASMANIA

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Contents | Page

A Coastcarer's perspective

The coasts and oceans are full of amazing and undiscovered wonders. The resources, ideas and activities are countless. A shell, dried seaweed, sand, sponges all provide the basis for so many activities and imaginings. Close your eyes, put a shell to your ear and there you are swimming with the sea dragons, diving through the dark forests of kelp, singing with the whales. In a split second, with minimal props, a sea story will take children into another place, filled with mermaids, giant sea serpents, storms and sailing ships. A picture will provide a thousand words, all opening up new meanings and understandings, ways of expression and sharing.

This is how I feel about my world. It is fabulous, magnificent and full of wonder. I wish every child could learn to see it that way for themselves. If we all saw it for the paradise it is, perhaps we wouldn't want to wreck it and would do everything in our power to protect our beautiful blue planet.

The key to our future is through our children. Their hearts and minds are open to ideas, wonder and learning. The Australia that they inherit will be one we have created…and they will need a great many skills to put it right. It is our responsibility to see they get the best information available.

Julia Butler-Ross, Rubicon Coast and Land Care Inc.

Taking the plunge – introduction

Coastcare is a program aimed at protecting and conserving Australia's coastline. It encourages direct community participation in managing coastal and marine areas, focusing on practical actions. In 2000–2001, Coastcare provided funding to enable Tasmanian teachers to attend workshops, supported by MESA, on coastal and marine topics with the aim of inspiring them to include a Coastcare perspective in their teaching. The activities in this book are the outcome of these workshops.

The aim of this teaching resource is to encourage you to include coastal and marine studies in the K–10 curriculum in your school. Many schools in Tasmania are only a few minutes walk from a beach, a rocky seashore, a salt marsh or an estuary.

This booklet provides a springboard for teachers who would like to venture into a learning environment with enormous appeal to students, where they can learn to appreciate and actively care for Tasmania's unique coastline.

The booklet contains units used by Tasmanian teachers who have found practical ways of integrating coastal and marine activities into the curriculum. We hope these units will be useful for new and experienced teachers looking for activities proven to be successful in the classroom and outdoors. Although each of the activities was written for a specific age group, most can be adapted for other levels. Similarly, many activities developed for a particular environment such as an estuary can be used in other coastal places.

This is a cross-curricular resource, with the emphasis on Science, SOSE, and Art. Activities are linked to the national curriculum and the new Tasmanian Essential Learnings (ELs). Some activities are suitable for citizenship projects, perhaps working with local community groups such as Coastcare or Waterwatch. These groups are often a good source of knowledgeable people willing to assist with excursions.

Flinders Island District High School is in the process of developing a whole-school curriculum framework based on coastal and marine studies. It is very much a work in progress as new material continues to be added. The framework is included here as an example of one school's approach and as a possible template for other schools to use.

Safety first

The coastal and marine environment is beautiful but can be dangerous. Take care on all excursions to remind students to watch out for waves and slippery rocks. Make sure they can recognise venomous creatures (e.g. bluebottles and blue-ringed octopus) and avoid syringes and broken glass. Warn students not to touch these and to notify teachers immediately. See the Department of Education's Outdoor Education Guidelines, Field Activities for Coastal and Marine Environments and field guides such as *Common Venomous Animals in Tasmania* (listed on page 39).

Caring for the coast

Encourage students to care for the environment and its living creatures. The foreshore is an extremely valuable resource for teachers as long as its use is sustainable. It is important to model appropriate behaviour not only during the excursion but beforehand (e.g. not collecting large amounts of beach life) and afterwards (e.g. disposing of material carefully).

Discussing and agreeing on a coastal conservation code beforehand is a valuable learning activity. Here are some things to consider:

- follow existing tracks to avoid trampling plants (which provide habitat and reduce erosion)
- watch out for nests and eggs of shorebirds, and burrows of shearwaters and penguins
- encourage students to watch animals rather than touch them – handling can damage them and they might hurt you
- avoid collecting live animals and leave plenty of empty shells to provide homes for other creatures
- always put rocks back as you found them – they shelter creatures sensitive to sunlight
- report any dead mammal or large numbers of dead seabirds to the Parks and Wildlife Service
- collect any rubbish to leave the beach cleaner than you find it.

See also the Coastcare brochure *50 Ways to Care for Our Coast*. The MESA publication *Field Activities for Coastal and Marine Environments* has an excellent section on safety and field work issues. It is available free by phoning Environment Australia on 1800 803 772.

Protocols for handling marine organisms have been developed by Ingrid Albion (Interpretation and Education Officer, Parks and Wildlife Service) in the unit *Discovering Marine Pests – a classroom resource.* This is available on the Marine Links website at www.forum.discover.tased.edu.au.

Diving in – list of activities

Activity	Key Learning Areas	Grades	Strand/outcome	Page
Beach creatures*	Science	Prep–2	Life and Living	6
Life cycles of beach creatures*	Science	Prep–2	Life and Living	6
Making an underwater diorama	Science/Art	3–4	Life and Living	9
Mapping and monitoring your local estuary	Science/SOSE	3–6	Life and Living/Natural and Social Systems	10
Research a marine pest	Science/SOSE	3–6	Life and Living/Natural and Social Systems	12
Modelling the water cycle	Science/SOSE	3–6	Life and Living/Natural and Social Systems	13
Journey of a river	Science/SOSE	3–6	Life and Living/Natural and Social Systems	13
Sorting shells and beach life	Science	K–6	Life and Living	15
Integrated activities with molluscs	All key learning areas	K–6	Numerous outcomes	16
The life of Mother Earth	SOSE/Art	3–10+	Life and Living/People and Space	17
SOS – save our shores	SOSE	7–8	Natural and Social Systems	22
Beach excursion – life in a rock pool	Science	5–6	Life and Living	23
– measuring a rock pool	Maths	5–6	Measurement	23
– beach scavenger hunt	Science	5–6	Life and Living	24
– beach bingo	Science	5–6	Life and Living	25
– sand activities & beach art	SOSE/Art	5–6	Natural and Social Systems	25
Molluscs and cephalopods*	Science	7–8	Life and Living	7
Colours in the coastal/ marine environment	SOSE/Art	7–8	Natural and Social Systems	26
Seastar survey	Science	7–8	Life and Living/Natural and Social Systems	27
Design a sea creature	Science	2–10	Life and Living	27
Design a marine reserve for an endangered species	Science/SOSE	2–10	Life and Living/Natural and Social Systems	28
Transect and quadrat studies of a rock platform – intertidal life	Science	9–10	Life and Living	29
Succession on sand	Science	9–10	Life and Living	31
How do living things cope with changes in salinity?	Science	9–10	Life and Living	32
Visit by a commercial fisher*	SOSE	9–10	Use of Resources	8
Talk by marine police*	SOSE	9–10	Use of Resources	8

* These activities are part of the Flinders Island DHS curriculum framework (pages 6–8).

Scanning the horizon – planning ahead

Flinders Island DHS Curriculum Planning Guide for Coastal and Marine Studies K–10

Teachers at the Flinders Island District High School have prepared some sample curriculum units based on nine key issues. Each curriculum unit starts with a particular key question, which students investigate through discovery questions and activities. The discovery questions are the most important part of the framework – they form the starting point for the hands-on teaching and planning of curriculum units. The framework has been modified slightly for this booklet.

In this framework, the key issues and questions are concerned with how the unique coastal and marine environment can be protected while still developing the economy of the island. This question is also of fundamental importance to the whole island of Tasmania.

Key Issues and Key Questions

Understanding the physical environment

What do we need to know to understand our coastal and marine environment?

Biodiversity

What makes our own coastal and marine environment special?
What are the current and/or potential threats to this biodiversity?
How can we protect and conserve what we have?

Aquaculture/commercial fishing industry

How can we develop and sustain a viable aquaculture and commercial fishing industry?

Ownership/control

How does the past affect the present and the future?
How do we decide who uses our coastal and marine environment and how it is used?

Employment

What sort of training and ideas do we need to create jobs?

Tourism

What type of tourism can and should be developed?

Isolation/global community

What can we do to improve communication with the outside world and promotion of what we have?
How can we celebrate and express our feelings about living here?
To what extent are we custodians of this place for the whole world?

Cultural issues

What are the stories of the people and our islands?
How do we enjoy our coastal and marine environment?

Safety and health

How can we live, work and play safely in our coastal and marine environment?

Samples from the Flinders Island DHS curriculum framework for coastal and marine Studies K–10

Key issue: Biodiversity

Samples from Level I–II: Prep–Grade 2

Key questions	Discovery questions	Activities	Resources
What makes our own coastal and marine environment so special? Strands: Life and Living Living Together/ Structure and Function	**Beach creatures** What shapes and colours can we find? What plants and animals can we find on our beach? Why do you think it is a plant or an animal? Are the animals like me? Do they have the same body parts? What do I need to stay alive? Do the animals that live in the sea and on the beach, need the things I need to stay alive? What body parts help us to walk/swim? How do the animals we've found move? What does our skin do? What does it look like under a magnifying glass? What is the covering like on the animals we've found? How do empty shells get changed into shell grit?	1. Use paint colour cards – find colours on the beach that match. 2. Have word lists e.g. smooth, rough, spiky. Find things to match these words. 3. Put a jar of water near the window – what can you see when you first leave the jar there? 4. I spy – or a treasure hunt, clues children have to find. 5. Close eyes – what can I hear? 6. Smell experiences. 7. Keeping an aquarium – observations. 8. Sketching with quill and ink – what makes up a feather? 9. Camouflage – draw the animals they find, fill in the whole page with patterns – give to a partner to try and find the animals.	*Between Tasmanian Tide Lines*
Biodiversity, Change and Continuity	**Life cycles of beach creatures** How do people change, as they grow older? Are the things that you have found young or old? How do you know? What body parts do we use to discover the sight and sounds of the sea? Can you find any eggs on the beach? What lays eggs? Did you know snails lay eggs? What might they look like? How do chicks change as they grow older? How do birds look after their babies?	1. Make an egg (e.g. with plasticine or playdough) that can be laid on a rocky ledge without rolling off. 2. Observe which birds live on our beach.	*Australian Marine Life* *Field Guide to Tasmanian Birds*

Key questions	Discovery questions	Activities	Resources
What makes our own coastal and marine environment so special? What are the current and/or potential threats to this bio-diversity? How can we protect and conserve what we have? Strands: Life and Living Living Together/ Biodiversity, Change and Continuity	**Molluscs/cephalopods – a special study** What are molluscs? What are the main types of molluscs? What is the difference between a gastropod and a bivalve? How is each main group of mollusc different from each other group? How are shells useful to humans? What are cephalopods? Where do they live? What remains of them may be washed up on beaches? In what ways do humans use some cephalopods? Why are some associated with horror stories? How long have they existed? What is the closest living relative of the early cephalopods? What are the three main groups of cephalopods? How do nautiloids use their chambers to help keep them afloat? Why did cephalopods evolve smaller and lighter shells? What is the mantle? In many modern cephalopods how is the relationship between mantle and shell (or 'bone') different from other types of molluscs? What other methods do more recent cephalopods use to keep afloat? What is the relationship between many of them and a jet airliner? How many tentacles does a chambered nautilus have? How many arms do all the other cephalopods have? Which two groups have an extra pair of feeding tentacles?	**Molluscs** 1. Check dictionary definitions of molluscs. 2. Colour in and label diagrams of gastropods and bivalves. 3. Fill in a diagram of a mollusc family tree. 4. Visit different types of beaches and collect shells – identify them and plot on a map where they were found. 5. Use the patterns from a shell to design fabric or wrapping paper or use shells to produce a craft item or an item of jewellery. 6. Research two of the gastropods and two of the bivalves that you found. 7. Find out about any of these other types of molluscs – chitons, nudibranchs or garden snails. **Cephalopods** 1. Draw a creature following instructions such as 'I have a beak', 'I have arms coming out of my head' etc. (a fun starter exercise). 2. From the Gould League Beachcombing poster, draw and identify cephalopod remains (follow up later with specimens collected from the beach). 3. Start a glossary of cephalopod words. 4. Sketch a typical cephalopod showing the funnel and other visible body parts. 5. Draw a diagram or make a model to illustrate one type of cephalopod movement. 6. Cephalopod defence systems – produce a poster to illustrate the six methods used. 7. Choose a cephalopod found in the Tasmanian region for special study:	*A Guide To Squid, Cuttlefish and Octopuses of Australia* *Tasmanian Sea Shells* *Beachcombing* poster

Key issue: Biodiversity

Samples from Level V: Grades 7–8 (Continued)

Key questions	Discovery questions	Activities	Resources
	How do cephalopods breathe? How can they move and change direction so rapidly? Which group of cephalopods uses 'medusoid' swimming? What other creatures also move like this? Which cephalopods move by undulating their body fins? What are chromatophores, where are they found and what are they used for? What produces the iridescent sheen visible on some cephalopods? How do creatures like cuttlefish make their skin look like seaweed? Are they intelligent? What evidence is there to support your answer? How good are their eyes? What do they eat? What are some methods they use to catch their prey? What is their beak used for and how is it like some snake fangs? What is special about their tongues? What are some of the unusual features of their reproductive biology and behaviour?	- draw/paint it - show its distribution on a map - list five features common to the group of cephalopods it belongs to - write four or five sentences about your chosen animal - present all this information on a poster or in a Powerpoint presentation. 8. Using recycled plastic bags and other materials make a model of a cephalopod. Think of ways you can make them glow.	

Key issue: Ownership/Control

Samples from Level VI: Grades 9–10

Key questions	Discovery questions	Activities	Resources
How do we decide who uses our coastal and marine environment and how it is used? Strand: Resources Use of Resources	What are the issues and impacts of commercial versus recreational fishing? What rules should we have to conserve the fish resource?	1. Visit by a commercial fisher. 2. Talk by marine police – their tasks, skills and knowledge of the fishing laws and regulations.	DPIWE Sea Fisheries brochures, local fishers, aquaculture industries, marine scientists, marine police.

Making a class underwater diorama and individual underwater scenes

Gina Rowbottom, Wesley Vale Primary School

Learning Areas: Science/Art	Level: Grades 3–4
ELs: World futures, thinking and communicating	Time: 3 hours +

Making a three-dimensional underwater scene with drawings or models is a great art activity to follow up research into sea creatures and their habitats. The diorama can be as simple or as elaborate as the students' imaginations and the time available allow.

What you need

Books, CDs, calendars and posters about marine life (see Resources on page 39).

3 m length of corrugated cardboard (from a continuous roll found in school art supplies) and clear cellophane strips about 1 cm wide to form the backdrop for the diorama.

A4 cartridge paper, oil crayons (each child needs five crayons – white, yellow, blue, light green and dark green in a plastic container), glue, coloured pencils and scissors for making the creatures.

String, fishing line and paper clips to hang them up.

What to do

Discuss with children how to research the creatures inhabiting Tasmanian marine areas.

Paint the strip of corrugated cardboard to resemble an underwater scene, with waves along the top and changes in colour to show the depth of the water (darker blue at the bottom, paler blue at the top).

Stand the cardboard backdrop in place by rolling each end around a support e.g. a cardboard box or large cylinder.

Tie string across the top of the cardboard. Hang strips of clear cellophane from the string to give a shimmering effect. Hang different lengths of fishing line from the string and tie a paper clip to the end, ready to hold the sea life.

Before children make their individual A4 underwater scenes and models, display pictures of the sea that show its many colours. Demonstrate how crayon drawings can be rubbed with a thumb or tissue to smudge and blend the colours to achieve a deep-sea effect. Children then practise blending the colours on small pieces of cartridge paper (8 cm by 6 cm).

Once children can blend colours successfully, they draw an underwater scene to cover an A4 sheet of cartridge paper. Include scenes of the sea floor with rocks, plants and crabs made from coloured paper.

Children draw, colour and cut out a few sea creatures to glue onto their scene. These scenes are suitable for framing. Put the scenes on display stands just in front of the cardboard backdrop, placing sea floor scenes at the base.

Children draw and cut out fish, rocks, seaweeds and other sea life to attach to the paper clips. Colour the creatures on both sides before cutting them out. Alternatively, supply fish shapes for the children to colour in.

Resources

Between Tasmanian Tide Lines
Gould League books and posters (see list of resources page 39)

Mapping and monitoring your local estuary

Fran Read, Orford Primary School

Learning Areas: Science/SOSE
ELs: World futures, thinking and communicating
Level: Grades 3-6
Time: Up to 2 hours

These activities are part of an integrated unit suitable for any school situated within a few minutes walk of an estuary or other coastal environment. The outdoor components of the unit could be completed within a half-day excursion, but it is fascinating to see the changes occurring over time. The Orford Primary Grade 3–4 class visits the Prosser Estuary at least once a month.

What you need

A simple black and white map of the site (or students can draw their own).

Waterwatch test kit (available from your local Waterwatch coordinator).

Investigation sheet (overleaf), pencils and clipboards.

Field guides.

What to do

Students mark in the main geographical features (paths, bridges, ponds) and vegetation (trees, bushes, salt marshes, beaches, seagrass meadows). They devise a key to their map.

Students test the water quality (pH, temperature, turbidity and salinity) and fill out the investigation sheet.

Students observe any crabs, molluscs, fish or birdlife and write a short illustrated description. (They could take notes on-site and write them up later in the classroom).

Discovery questions

What are the physical and biological features of our estuary?

What structures in or near the estuary did humans make?

How do human activities affect the water quality?

What plants and animals live in the estuary? What can you observe about them?

Waterwatch Estuary Investigation

Site: _____ Date: _____ Time: _____

Name of Investigators _____

Temperature

Air _____ Water _____

Physical Features

☐ sand ☐ rock platform ☐ dunes ☐ mud ☐ boulders

Water

☐ calm ☐ choppy ☐ rough

☐ clear ☐ muddy ☐ foamy or frothy ☐ scummy ☐ smelly

☐ oily ☐ stained brown or green

Tide: ☐ high ☐ coming in ☐ going out ☐ low

Wind

☐ none ☐ slight breeze ☐ strong

Human Presence

☐ drains ☐ planted trees ☐ jetties ☐ walls ☐ litter

☐ vandalism ☐ people-made structures

Plants

☐ grasses ☐ reeds ☐ underwater plants ☐ small woody plants

☐ larger woody plants ☐ tall trees

Animals

List any animals you can see in the area, including insects and birds.

Research a marine pest

Fran Read, Orford Primary School

Learning Areas: Science/SOSE	Level: Grades 3-6
ELs: World futures, thinking and communicating	Time: Up to 2 hours

Students monitoring their estuary are likely to find at least one marine pest. Some pests, such as the New Zealand screw shell, are spreading widely and displacing native species.

What you need

Books and brochures about marine pests.

Access to the Internet.

What to do

Find out about a marine pest and produce a poster. Include the following:

- common name of the pest and its scientific name
- a paragraph in your own words describing what your pest looks like
- which country did your pest originally come from?
- how did your pest travel to Australia?
- write a paragraph about what habitat your pest likes.

Resources

Centre for Research into Marine Pests (CRIMP) website at www.csiro.gov.au (research divisions/marine research/information sheets)

The Department of Primary Industries, Water and Environment website www.dpiwe.tas.gov.au (the marine environment)

Further activities

Find out which species in your area are native and which are introduced. Use field guides such as *Between Tasmanian Tidelines* and *Australian Marine Life*, which include introduced species such as:

- Northern Pacific seastar (*Asterias amurensis*)
- regular seastar from New Zealand (*Patiriella regularis*) arrived in shipments of oysters in the early 20th century
- Pacific oyster (*Crassostrea gigas*) was introduced from Japan for aquaculture
- Japanese seaweed (*Undaria pinnatifida*) arrived in ships' ballast water
- Piecrust crab from New Zealand (*Cancer novaezelandia*) arrived in shipments of oysters.

Discuss how various introduced species got here.

Discuss how they affect the native species (the Northern Pacific seastar has eaten most soft-shelled molluscs in the Derwent Estuary) and how they affect us (toxic dinoflagellates can poison shellfish; a problem for aquaculture).

Design a method of stopping more species from entering our coastal waters.

Find out what the foreshore was like 200 years ago by reading the journals of explorers such as Nicolas Baudin or visiting the Maritime Museum.

NB If you wish to collect and dispose of marine pests you need a permit from the Wild Fisheries Branch at DPIWE. This is available on the website www.dpiwe.tas.gov.au (permit fisheries) or by phoning Rob Green on 6233 6208.

Protocols for handling marine organisms are in the unit *Discovering Marine Pests – a classroom resource* by Ingrid Albion (Interpretation and Education Officer, Parks and Wildlife Service) available on the Marine Links website at www.forum.discover.tased.edu.au.

Modelling the water cycle

Fran Read, Orford Primary School

Learning Areas: Science/SOSE	Level: Grades 3-6
ELs: World futures, thinking and communicating	Time required: 1-2 hours

Building a model is fun and develops children's understanding of the water cycle.

What you need

Recycled icecream buckets, margarine containers, coloured papers, straws, string, balls etc.

What to do

Students build a model of the water cycle from the materials provided. For instance, a ball covered in gold paper may represent the sun, an icecream bucket the ocean, straws the river.

Discovery question

How does water move through the different parts of the environment?

Journey of a river

Fran Read, Orford Primary School

Learning Areas: Science/SOSE	Level: Grades 3-6
ELs: World futures, thinking and communicating	Time required: 1-2 hours

Children enjoy describing and illustrating the changes in their local river as it flows from source to sea. These activities are a good follow-up to Nel Smit's River Life interactive story on the Department of Education website (see Resources below).

What you need

Worksheet, drawing paper and coloured pencils.

What to do

Students complete the worksheet and draw the journey of the local river through its catchment from headwaters to estuary, showing geographical features and human activities.

Discovery questions

How is the estuary connected with its catchment?

In what ways is the estuary an important part of the catchment?

(Estuaries are rich in nutrients – run-off from the whole catchment brings sediments such as soil particles, which are deposited along with the remains of dead seagrass and other organisms. These nutrients support extensive seagrass meadows that provide excellent nurseries for fish and shellfish.)

Resources

River Life interactive stories (www.discover.tased.edu.au/landcare/teachingideas.htm)

The Journey of a River

Water drops fall down from the - - - - - -. The water runs down from the high - - - - - - - - - and hills. It cuts out a - - - - - - - in the rock as it moves. This flowing water forms a river.

The start of a river is called the - - - - - -. A river can be fed by a melting - - - - - - -, an overflowing - - - - or a mountain spring.

Little streams often join together to make a fast flowing river. These streams are called - - - - - - - - - - -. The river carries loose stones along its bed and the water and stones cut a channel through the rocks to make a V-shaped - - - - - -. Sometimes the river tumbles over a cliff, making a - - - - - - - - -. Fast swirling currents cause rough patches called - - - - - -.

As the river reaches the end of its journey, the land becomes flat and the river becomes - - - - -. This is often called a - - - - - plain because the land is often flooded. It slows down before it reaches the sea and forms an - - - - - - -. Some rivers fan out to make a - - - - -.

clouds	rapids	delta	estuary	source
tributaries	wider	channel	lake	waterfall
flood	mountains	glacier	valley	

Sorting shells and beach life

Dilys Fyle, Bicheno Primary School

Learning Area: Science	Level: Grades K–6
ELs: World futures, thinking and communicating	Time: 30 minutes each

These are interesting activities for teaching classification and life cycles of molluscs (shells). Before these activities, put up posters and pictures of various molluscs and other beach life, and display books on the topic. There are many excellent books (listed under Resources on page 39).

Do some beachcombing beforehand to collect a variety of shells, seastars, seaweeds and other drift line finds. Include univalve shells (with a single shell, e.g. snails) and bivalves (with a double shell, e.g. mussels). Include the upper and lower shell of a scallop.

These activities are suitable for children working in groups around tables.

What you need (per group)

Tray of various Tasmanian shells and a tray of objects found washed up on beaches (seaweeds, sea urchins, cuttlefish, feathers, seastars, crab skeletons, shells, drift wood).

Paper and pencils.

What to do

Sorting shells

1. **How might we group the shells on a tray?**

   Give the children limited time to discuss and write down their ideas before they present their findings.

   List the criteria on the board – colour, size, shape and so on.

   Are any shells in two groups? Why might this happen?

   Encourage the children to name the shells they know.

2. **Univalves and bivalves**

   How do univalves and bivalves differ?

   After discussion set up the trays again and ask groups to classify the shells with the new information. Then discuss and answer any queries.

   Were any of the bivalves similar?

   Could the univalves be put into different groups?

3. **Life styles of molluscs**

   How do the habits of bivalves and univalves differ?

   Where do they live?

   How do they feed?

   How do they move?

   How do they reproduce?

   Look closely at the inside of a bivalve. What are the marks inside the shells?

   Are both shells of a bivalve identical? Look carefully at the scallop shells.

   Which part of a scallop shell is the top? Why is the lower half concave?

Sorting beach life

Discuss with the class the various origins of the plants and animals washed up on beaches.

Group the seaweeds by colour. Which seaweeds are usually found growing in the shallows and which in deeper water?

Discuss how sea urchins live. What are their relatives? What are cuttlefish?

Talking about feathers will lead into the study of seabirds.

Crab shells (carapaces) are often found. At times, following heavy swells, many small spider or surf crab shells wash up. Collect these to discuss exoskeletons.

Related activities

The activities could be done on the foreshore at low tide by looking at beach life rather than collecting it. Have the children sit in groups of four or five around a hoop placed on the ground. They can count crabs, shells, seaweeds, describe colours, sounds and textures and discuss the questions already listed. If the hoops are placed at different distances from low tide up the foreshore, comparisons can be made as a whole class about the effects of varying exposure to water, sun and wind, and how animals and plants are adapted to these conditions.

Children could choose an animal in their hoop, give it a name and write about a day in its life.

There are lots of teaching ideas and drawings of sea life in the old but very useful books by Janet Somerville (*Beach Life and Tasmanian Shells*), which may still be in your library.

Resources

Many field guides and reference books are listed at the end of this booklet.

Integrated activities with molluscs and other beach life

Language	**Art and craft**
Writing descriptions of beach life	Sketching
Word lists: whorl, spiral etc.	Photography using a digital camera
ABC lists of marine creatures – this can be limited to molluscs, rock pool inhabitants, shoreline dwellers etc.	Create a plaque using a glue gun with shells and beach finds
Autobiography of a mollusc or a crab	Explore patterns and reproduce them
	Make a collage using drift line finds
Maths	**SOSE**
Sorting	Commercial harvesting of shellfish
Sequencing	Marine harvesting
Patterns	Impact of introduced species
Number sequences	Uses of shells – coins, etc.
	Distribution
Health	**Technology**
Algal blooms – toxic dinoflagellates	Design an implement for measuring the volume of a shell
Hepatitis – oysters	Design a way to rid our shores of the Northern Pacific seastar
IT	**LOTE**
Research common molluscs from other regions e.g. giant clams, triton, crokoe shells	Discuss the naming of marine creatures using Latin and the discoverer's name

The life of Mother Earth: The story of threatened species in Tasmania from an Aboriginal perspective

Judy Jackman, Aboriginal Studies Unit, Department of Education, Tasmania

Learning Areas: Art/SOSE/Science	Level: Grades 3-10+
ELs: World futures, thinking and communicating	Time: Up to 2 hours

This activity involves all the students in making sand sculptures or drawings and reading out the story.

What you need

Sand, buckets and spades or large sheets of paper and equipment for drawing or painting.

What to do

1. Divide the class into groups representing Mother Earth (Tasmania) and a number of threatened and uncommon species. Stories for the white-breasted sea eagle, Australian fur seal and whales are provided here. Other species could include the spotted handfish or a rare seastar.

2. Read the narrative to all. Either proceed to a beach setting or provide each group with paper and pencils or paints.

3. Give each group a script about their species and ask them to sculpt in sand or draw and colour a representation of their animal or Mother Earth.

4. When all groups have finished, the Mother Earth group reads their script aloud, followed by the other groups in turn.

5. Students take turns to read each paragraph of the story.

Narrative

Many thousands of years ago, before the coming of humans, there existed many animals on the land and in the water.

The only impact upon a species' survival was disease or climatic change. The food chain was balanced, with each animal able to fulfill its needs without competition from introduced species or human interference. Slowly, Aboriginal people took their place in the food chain. Taking only what was needed and wasting nothing.

The Aboriginal Australians were a creative, innovative people who designed and manufactured the tools needed for their own survival. There was no waste, no abuse of the environment. Mother Earth was respected and cared for. Animals were hunted for food, skins and implements. Hunting was undertaken with such tools as spears, waddies and fish nets or fish traps.

The Aboriginal Tasmanians were the first people of this land. There was no hunting for the fun of it. There were no shops or factories, as we know them today, to supply their needs. Feeding the family was the most important aspect of any group's daily life.

According to what group you belonged to, respect was shown for different animals. Some families may not have hunted a particular animal because it was their family totem. Many stories were told around campfires about the ways in which plants and animals had come to this land. What animals had contributed to the people's lives and the need to look after Mother Earth was recognised and taught to children over thousands of years.

The people were aware of the importance of the land, plants and animals. They had knowledge of the seasonal movements of animals, the wide range of plants that could be eaten, the healing powers they contained and when and where such plants were in abundance. Mother Earth and what she provided played an important part in people's lives.

Life was in balance for Mother Earth, people, animals and plants.

As we move thousands of years through time, there came an invasion of Tasmania that had dire consequences for the Aboriginal Tasmanians and the flora and fauna of this land.

What or who were these invaders, what brought them here?

The invaders were people not used to respecting Mother Earth and what she provided. They did not have the skills or knowledge to survive as the first people had for thousands of years.

Convicts were regarded as low life, how were Aboriginal people regarded?

The invaders needed more and more land for the new plants and animals they brought with them for food.

What plants and animals would they have brought with them? What sort of feet did these animals have? What did the feet of the new animals do to the soft earth? Name a plant that was brought out here and became a nuisance all over Australia.

Aboriginal lands and native animal feeding grounds were cleared and fenced, foreign animals and plants were grown, and houses were built as well. Aboriginal people tried to defend their lands and their food sources. Many, many Aboriginal people were killed and some animals were hunted to the point of extinction.

Foreign animals such as dogs, cats, rats and rabbits were introduced to Tasmania. Small marsupials and birds had no experience or defences to cope with these pests. Rabbits bred quickly and took over grasslands, destroying the natural vegetation and creating soil erosion problems. Thousands of hectares were taken over for grazing sheep and cattle. The natural habitats of native animals were being destroyed and various species were being shot for food and sport by the invaders.

The land of the Aboriginal Tasmanians had survived for thousands of years. Within a short two hundred years, the air, water and land had been polluted and destroyed with chemicals, petroleum products, over-clearing of land, foreign animals, foreign plants, plastics and gases.

What can we do to protect our land, plants and animals? We can minimise our rubbish, recycle, plant trees, eradicate feral animals and plants, look after our cats and many other things.

Our abuse of this land has resulted in the loss, or near loss, of many native animals. Our task today is to tell the story of some of our endangered or threatened species. We are going to create a sand sculpture of the last 200 years of the life of Mother Earth (Tasmania) and what has happened to some of her creatures here.

Mother Earth group

It is your task to create in the sand or on paper a large map of Tasmania complete with three major rivers. Draw or find bits and pieces from the beach to represent the natural vegetation of Tasmania before invasion. Place these pieces right across the map of Tasmania to represent large areas of bush, rainforest, wetlands and open grassland. You can use seaweed, feathers, shells, sticks, rocks and grasses (do not break or pull up living plants).

When your script talks about destruction of forests and natural vegetation, remove a significant amount of vegetation from your map. When the script talks about reafforestation, place some vegetation back on the map.

Mother Earth script

Let us move back in time to 200 years ago.

My name is Mother Earth. I have survived for millions of years.

Look at my beautiful Tasmanian shape. I am happy and well looked after. My animals and plants are healthy and bountiful. My waters are clean and flow well. The spirits of the Aboriginal people are strong. The people respect and care for me. I am necessary for their survival and sacred in their beliefs.

10 years later

What has happened to me now? New people have come to my Tasmanian shape. My trees are being cut down, my animals and birds are fleeing their old homes. There are strange barriers around my grasslands. There are strange animals, eating my grasses, their hard feet are compacting my land. The native plants are finding it hard to grow and renew.

My animals in many areas are finding it difficult to find enough food. Hundreds of them have been killed for food for these new people.

100 years later

Many strange animals and plants now live on my earth. One species is digging tunnels and eating the food meant for my native animals. When we have rain, these tunnels collapse and huge areas of my land are being destroyed and washed away.

180 years later

So many of my forests have been cut down and cleared away. My air is no longer clean and pure. My land is sour and being washed and blown away.

There are so many foreign plants growing in my soil, they are not allowing my native plants to grow and thrive.

My marsh areas have been drained; the water is being sucked from my rivers. My waters are choking with the chemicals and rubbish the new people put in there.

Many of my land and sea animals are having difficulty maintaining their numbers. This is due to hunting, vandalism, destruction of their homelands and food, pollution and ignorance.

These new people do not understand what they have been doing to me. I need help.

From now onwards

The new people have realised what they have been doing to me. Lots of trees are being planted, rubbish is being cleaned up, people are recycling everything they can and noxious weeds are being removed. Feral animals are being destroyed; some are being used for food, which is good.

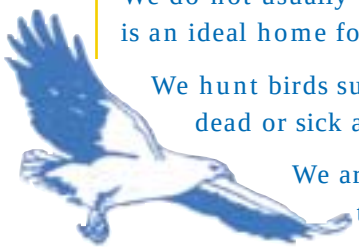
These people are learning quickly but they still have a long way to go. They must learn to fully protect my lands, waters, air and animals.

Let us move along to discuss some of my creatures that are under threat today.

White-breasted sea eagle script

My family of white-breasted sea eagles has about 200 breeding pairs in Tasmania. We are fully protected by law.

We do not usually migrate and will defend our territory of about three square kilometres. Tasmania is an ideal home for us with its many large rivers, lakes and coastal areas



We hunt birds such as gulls and shearwaters as well as fish, eels or penguins. We will scavenge dead or sick animals such as lambs.

We are wrongly blamed for killing healthy lambs. Surveys have shown that this is not true.

We like to build our nets in large, sheltered eucalypts although, on small isolated islands, rocky outcrops are OK. Our nests can be up to 4.5 m deep and 2.5 m wide!

We are not an endangered species, but there are human threats to our survival. Shooting by vandals, poisoning by landowners, tree felling and excessive disturbance of breeding from development and recreational activities are the main ones.

Please be careful when clearing land. Do not clear within 250 metres of our large nests.

By preserving our habitat and being aware of the dangers to us you can prevent our decline.

Information derived from Parks and Wildlife Service Tasmania Pamphlet *The White-breasted sea eagle in Tasmania* (September 1996). Image courtesy of the Tasmanian Parks and Wildlife Service.

Australian fur seal script

I am the Australian Fur Seal. I am a mammal, giving birth on land and suckling my young. I usually have only one pup at a time.

My diet consists mainly of jack mackerel, leather jacket, red bait, squid, octopus and cuttlefish.

Aboriginal people could see many thousands of my kind around Tasmania before the invasion of this land.

We were hunted intensively for 40 years before people realised that there were not enough of us left to sustain a viable sealing industry.

These days, we breed in Tasmania on only five isolated islands in the Furneaux Group of islands. Our numbers have been slow to recover.

My natural enemies, the killer whale and the great white shark are not the biggest threat to my survival. Humans and human activities are the greatest threat.

We are shot, caught in nets and suffer from marine pollution. The most horrific impact of humans is our entanglements in your marine debris. We are inquisitive creatures and often end up with rope, fishing net or packaging straps wrapped around our necks. As we grow, this material gradually strangles us. Death is slow and painful.

Humans! Look after Mother Earth and her waters. Do not use the sea as your personal rubbish tip. Our survival depends on your actions.

Information derived from Parks and Wildlife Service Tasmania Pamphlet Seals of Tasmania (September 1996). Image courtesy of the Tasmanian Parks and Wildlife Service

Whale script

I am a whale, a warm blooded mammal, living in the sea. I breathe air and suckle my young on milk. Large members of my family can eat up to two tons of krill a day.

When there were only Aboriginal people living in Tasmania, my family and cousins could be seen swimming in the seas and the River Derwent in large numbers.

As soon as the new people arrived 200 years ago, they began to kill us for our oil, bones, ambergris and teeth.

After only 37 years the southern right whale was hunted almost to extinction. These new people were greedy and ignorant. They did not foresee the harm they were doing to my species.

It is estimated that 26 000 of my species were taken during the years of whaling operations. We survived in huge numbers for millions of years; it only took a few years to endanger our numbers in the waters of Tasmania.

Today, only 500–700 whales are to be seen in southern waters.

Nearly all countries of the world have now banned whaling. Our numbers are thought to be increasing.

Many of my family strand themselves on beaches every year. There are many theories as to why this happens.

The people of Tasmania are now aware of the need to protect us. They must be careful with their chemicals, such as oil spills and take all their rubbish home with them, not throw it on the shore and in the sea.

Information derived from Parks and Wildlife Service Tasmania Pamphlet *Whales and whale strandings* (February 1997). Image courtesy of the Tasmanian Parks and Wildlife Service.

The original version of this story, which includes more stories about terrestrial animals, is available on the Education Department Tasmania website. Suggestions for other coastal/marine creatures include Tasmania's threatened seastars and the spotted handfish. Information about other animals is available from the Tasmanian Parks and Wildlife Service pamphlets and the websites listed below.

Resources

Parks and Wildlife Service Wildlife of Tasmania fact sheets and website www.dpiwe.tas.gov.au (especially Threatened Species – An Educational Resource)
CSIRO website www.csiro.gov.au (research divisions/marine research/information sheets)
Education Department Tasmania website www.education.tas.gov.au
State of the Environment Tasmania (page 4.15)

SOS – Save our Shores

Steve Archer, Devonport High School (adapted from the Coastcare workshops)

Learning Areas: SOSE/Science	Level: Grades 7–8
ELs: World futures, thinking and communicating	Time required: 1 hour

This indoor activity would be a great introduction to Coastcare issues or a follow up to a beach or estuary excursion (e.g. mapping and monitoring your local estuary, page 10). It is particularly good because you can use the resources and the issues relevant to your area (e.g. penguins, weeds).

What you need

For the first part of the activity: blue plastic or paper, sand, beach plant cuttings, collection of beach items (shells, cuttlefish, seaweeds, shorebird eggs), models of fish, birds and other native animals.

For the second part: small toy humans, dogs, cats, bikes, cars, bulldozers, beach rubbish and weeds and marine pests (e.g. Northern Pacific seastar, New Zealand screw shell).

Give each child a labelled paper bag with one of these items.

What you do

1. Students create a natural beach scene, beginning with an idyllic, untouched environment.

2. Once the peaceful scene is created, add humans and their pets, vehicles and rubbish.

Discovery questions

What effects can pollution have on the coastal and marine environment? Discuss the long-term effects on the water quality.

What are the consequences for the native plants (seagrass, seaweeds) and animals (including frogs in freshwater lagoons behind the beach)?

What are the impacts of domestic or feral dogs and cats on the native birds and other shore life?

Why is sand mining necessary? What effects does it have on the coastal environment?

What are the effects of introduced weeds?

What are the effects of marine pests?

What can be done to protect the coastal and marine environment?

Should people be denied access to some beaches (for all or part of the year) to protect habitats or species (e.g. nesting shorebirds)?

Resources

All the props are easily available. A blue tarpaulin from Chickenfeed makes a good base. Sand can be kept in a bucket and reused. The natural objects can be found on a local beach, while sweet shops provide shorebird eggs (speckled sugar eggs) and dog faeces (chocolate liquorice bullets).

Beach excursion – a great day on the beach

Anne Johannsohn and Steven Jones, Penguin Primary School

Learning Areas: SOSE/Science/Maths/English/Art | Level: Grades 5–6

ELs: World futures, thinking and communicating | Time required: A whole day

The activities in this excursion range from studying life in a rock pool and measuring its dimensions to the fun of beach bingo and beach art. Take as many parent helpers as possible. These activities could be repeated over several visits so that patterns, similarities and differences could be noted. Look for changes over time.

These activities are easily adapted for a wide range of ages.

Life in a rock pool

What you need

Rock Pools worksheet (overleaf) or field guides.

Paper, clipboard, pencil.

What you do

Always establish environmental and safety rules before proceeding:

- do not disturb creatures if possible
- leave any handling of creatures to an adult
- blue-ringed octopus live in rock pools, so do not put hands in places where you cannot see
- watch out for slippery rocks and big waves.

Students, working in groups of four, choose a rock pool. Look for identifying features so that the same pool can be returned to at a later date.

Use the Rock Pool worksheet overleaf to identify as many creatures as possible.

Measuring a rock pool

What you need

Paper, clipboard, pencil.

Rulers and string with markers tied at 10 cm intervals.

What you do

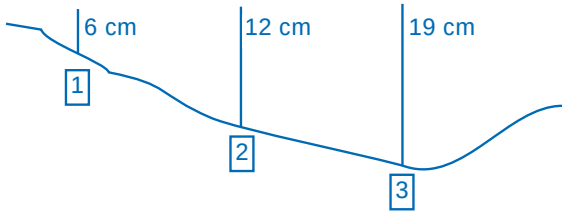
Draw a map of the pool, showing its shape and mark the positions of the creatures.

Using rulers and string, calculate the area, perimeter and depth of the pool.

Work out a depth profile for the pool. Stretch the string (with markers at 10 cm intervals) across the middle of the pool. Count the number of intervals. Use a ruler to measure the depth at each interval. Record the measurements as in the following example.

On return to school show students how to draw a profile as follows:

Interval	Depth
1	6 cm
2	12 cm
3	19 cm…



Rock Pools

Look closely in the rock pool. See if you can see any of these things. Record next to them how many you can see. Record any different things you find.

Beach Scavenger Hunt

Search the beach to find these things

- some litter
- a piece of rope
- something precious
- something red
- something very old
- a large shell
- a mermaid's scale
- something geometrical
- something living
- something dead
- some treasure
- a skeleton
- a colourful rock
- something shiny
- something spiky
- something that tells a story

Sand activities and beach art (beach excursion)

Anne Johannsohn and Steven Jones, Penguin Primary School

Learning Areas: Art/Technology — Level: Grades 5–6

ELs: Thinking and communicating — Time required: 2 hours +

These creative and enjoyable activities are part of the whole day beach excursion and will increase students' observation and modelling skills.

What you need

Magnifying glasses or hand lenses.

Pencils, paper, clipboards.

Buckets and spades.

Plaster of Paris (from hardware stores), yogurt container and stick for mixing with seawater.

What you do

Feel wet and dry sand.

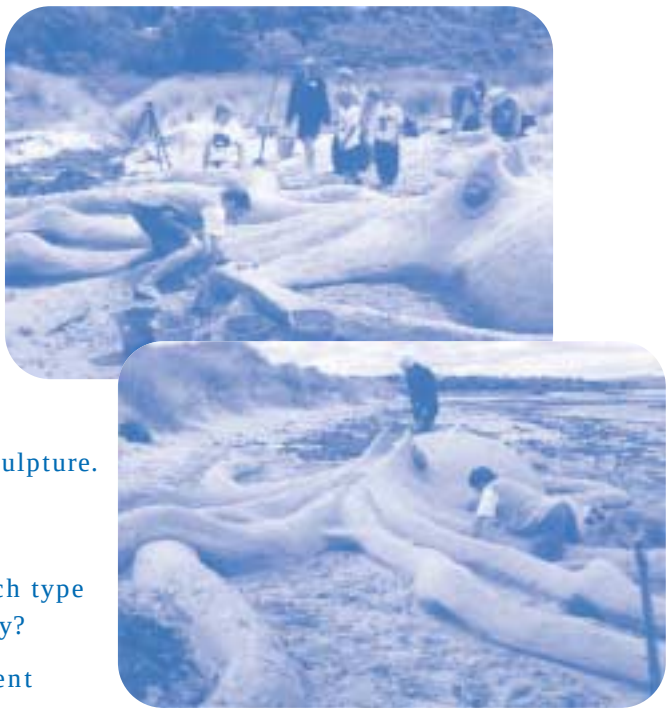
Look at the sand using a magnifying glass. Draw the shapes of the different grains.

Write a message in the sand that an aeroplane pilot could see.

Make a model in the sand – a whale, octopus, shark, ship, monster, castle or bridge.

Make plaster casts of bird prints and other shapes in the sand.

Collect items to make beach art such as a collage or sculpture.



Octopus sculpture made at the Coastcare Festival December 2001

Discovery questions

How does dry sand feel different from wet sand? Which type of sand is better for writing and modelling – wet or dry?

What shapes are the grains of sand? How many different coloured grains can you see?

Related beach activities

Descriptive writing and poems about the coast.

Rubbish survey – collect rubbish on two different occasions (or at two sites), sort and classify. Investigate where the rubbish might have come from. How does rubbish change over time?

Resources

Between Tasmanian Tide Lines
Coasting: Activities for coastal excursions and beach holidays
Marine Debris Education Kit

Colours in the coastal/marine environment

Steve Archer, Devonport High School

Learning Areas: SOSE/Art — Level: Grades 7–8
ELs: World futures, thinking — Time required: 30 minutes

This activity is fun to do anywhere outdoors and suitable for students of any age, including adults. It takes less time if students are asked to find only one or two colours.

What you need

Paint colour swatches (individual samples or cut from paint colour sheets).

What you do

Hand out colour swatches to each student, to find objects with matching colours.

Resources

Environmental Starters

Seastar survey

Jim Senior, Burnie High School

Learning Area: Science/Maths	Level: Grades 7–8
ELs: World futures, thinking and communicating	Time: 1–2 hours

Students learn to identify and survey seastars in a rock pool, and to graph their results. Choose a sheltered beach – and watch out for waves. This activity can also be done on beaches where numerous seastars are washed up.

What you need

Pictures of common seastars or field guides.

Pencils, paper and clipboards.

What to do

Students identify and draw each type of seastar in a rock pool.

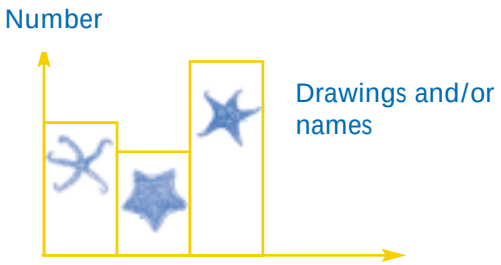
They count the number of each species and graph the results to produce an illustrated histogram.

Discovery questions

What types of seastar live on our coast?

Which are the most common ones?

What are the impacts of introduced seastars?



Resources

Between Tasmanian Tide Lines

Beach Life

Centre for Research into Marine Pests (CRIMP) website at www.csiro.gov.au (research divisions/marine research/information sheets)

Design a sea creature

Steve Archer, Devonport High School (based on an activity developed by Jenni Burdon)

Learning Area: Science	Level: Grades 2–10
ELs: World futures, thinking and communicating	Time: 1–3 hours

Students learn about adaptations of marine creatures and develop design skills.

Discuss how all animals are adapted to their environment, with special features that enable them to live there. Sea creatures are highly adapted. For instance, intertidal plants and animals have to cope with hot sun, wave action, severe changes in temperature and predators. Soft body parts are generally well protected.

What you need

Marine reference books (see list of resources on page 39).

What to do

Find out about the adaptations of sea creatures.

Invent a sea creature that lives in the shallows or some other environment. Draw this creature and label its adaptations.

Design a marine reserve for an endangered species

Steve Archer, Devonport High School (based on an activity developed by Jenni Burdon)

Learning Area: Science	Level: Grades 2–10
ELs: World futures, thinking and communicating	Time: 1–3 hours

This is a useful activity to increase students' knowledge about marine life and understandings about the purpose of marine reserves. It develops skills in designing and drawing maps.

What you need

Marine reference books.

Internet access (see Resources below) or brochures about marine reserves.

What to do

1. Brainstorm understandings and ideas about what is a marine reserve.
2. What is an endangered species? Choose an endangered marine animal.
3. Find out its habitat, sources of food, means of reproduction and adaptations. How did it become endangered? What are the current threats and how can we protect this species?
4. Draw a food web or list all the other animals in the marine reserve and 'who eats what'.
5. Design a suitable marine reserve for your species so it does not become extinct. The design should eliminate threats, protect its food supply, and consider its adaptations and reproductive cycle. Consider how big the reserve should be and whether it should be accessible to humans or not.
6. Draw a map of the reserve and develop a legend with symbols to represent features of the environment.
7. Compare results with the class – discuss and share ideas.

Resources

Parks and Wildlife fact sheets from offices or website www.dpiwe.tas.gov.au (Parks and Wildlife Service/Visitors' Guides).

Related activity

Design a poster to tell people about your endangered species and display it at school or in the local library.

Transect and quadrat studies of a rock platform – intertidal life

Denise Marable and Mark Franks, Smithton High School

Learning Area: Science	Level: Grades 9–10
ELs: World futures, thinking and communicating	Time: A half day

Choose one or more of these activities for an ecology excursion to study the distribution of intertidal life. Check ahead to make sure the tide will be low. Some low tides are more extreme than others and allow students to see a greater variety of animals and plants.

What you need

Paper, pencils (including red, green and brown) and clipboard.

Tape measure or metre ruler or string marked at 10 cm intervals.

Field guides.

Quadrat string or square or hoop.

What to do

Students complete the worksheets following.

Resources

Between Tasmanian Tide Lines

Where the Land Meets the Sea (see diagrams of zonation in chapters 7 and 8)

Transect study of a rock platform – life in the intertidal region worksheet

At low tide when the rock platform is exposed, you can find different plants and animals growing at definite zones or levels above water.

Draw a profile of the rock platform from low tide level to the point where grasses start to appear on land. Measure the distances between zones by stretching a measuring tape in a straight line. At each change in height, record the drop and distance from low tide. Record the distances in the table below. Also record the different living things.

Do a rough sketch of your profile and sketch in the animals and plants. Look in particular for animals and plants that are adapted (designed) to live in the special conditions of moisture, heat, light and wind at each zone.

Distance (cm)	Drop (cm)	Physical features	Living things

The abiotic environment is the non-living environment. Make as many observations as possible (at least five) of the temperature, light intensity, wind, waves and other physical features in the intertidal zone.

Describe how these factors would change as the tide goes in and out.

Seashore life worksheet

Make a list of fifteen living things you found in the intertidal zone. Three are given to start your list.

Classify these organisms as producers, herbivores, carnivores or decomposers.

Explain how each plant and animal is adapted to withstand the changes in this challenging environment:

- ways to avoid being knocked off
- ways to avoid drying out
- ways to avoid big temperature changes.

Combine the food chains to make a food web.

Living thing	Classification	Adaptation
Mussel	Carnivore	Hard shell, tightly hinged to prevent drying out
Limpet	Herbivore	
Periwinkles		

Quadrats on a rock platform worksheet

Choose a suitable rocky area with rock pools scattered along it.

Choose the pool nearest the low tide line with water in it. Lay out your quadrat. Identify the animals and the different coloured seaweeds within it

Draw your quadrat, marking the position of all the seaweeds inside it. Colour code the seaweeds red, brown or green. Complete the table below.

Repeat with a pool in the mid tide level and one near the high tide level.

Position	% red seaweed	% brown seaweed	% green seaweed	Types of animals
Near low tide				
Mid tide				
Near high tide				

Was there any change in the percentages of different seaweeds?

Was there any change in the total area of seaweed? Describe it.

How did the kind of animals change?

Succession on sand

Denise Marable and Mark Franks, Smithton High School

Learning Area: Science	Level: Grades 9–10
ELs: World futures, thinking and communicating	Time: 3-4 hours

This activity introduces the concept of succession and encourages students to observe how plants are adapted to different environments on a sand dune.

What you need

Paper, pencil and clipboard.

Succession on sand worksheet.

What to do

Ask the students what changes they notice in the plants as they move from the beach towards the land. Show them some plants and discuss their adaptations. Students complete the worksheet below.

Succession on sand worksheet

In some areas it appears that one type of plant has been gradually replaced (or succeeded) by other types of plants. This changing parade of plants is called succession. In looking at the foreshore community you will be looking particularly for evidence of plant succession.

As you move inland from the shore you should observe that the plants succeed or follow each other in a definite order.

Select ten different plants, starting with the one closest to the high tide mark, and gradually progress inland. For each plant (an example is provided in the table below):

- name it if possible (ask a teacher for help)
- classify it as a tree, shrub, grass or groundcover
- draw a few leaves of the plant
- describe features that allow the plant to cope with its environment (adaptations).

Plant name	Classification	Drawing	Features
Correa	shrub		Leaves are furry (lots of little hairs) to reduce drying out
Pigface	groundcover		

Describe any evidence of succession that you found.

The plants near the high tide level have to grow in sand. Describe their roots. Were the plants able to act as sand-binders?

What forms of plants were found to change going inland?

Can you determine the direction of the prevailing winds by looking at the plants? How?

Resources

Australia's Southern Shores
Coastal Wildlife

How do living things cope with changes in salinity?

Frances Karl, Triabunna District High School

Learning Area: Science — Level: Grades 9–10

ELs: World futures, thinking and communicating — Time: 1 hour

This is a good experiment to stimulate discussion about the effects of different salinities on living things and to introduce the concept of osmosis.

Students use equipment, make observations and collect data. They also make predictions, evaluate findings and draw conclusions.

Most marine animals and plants only have to deal with small changes in the salinity of the waters where they live. Some marine fish, however such as salmon, are born in freshwater streams, migrate to the sea when they mature, and eventually return to the stream where they were born to reproduce. How do these changes in salinity affect them? We can learn something about the process (osmosis) by observing the effects of different salinities on living tissue.

Use an apple corer to produce cores of potato just before the class.

What you need

3 test tubes in a test tube rack and 3 labels.

25 ml graduated cylinder.

Distilled water, 1% solution salt water, 20% solution salt water.

Ruler and balance.

3 potato cores.

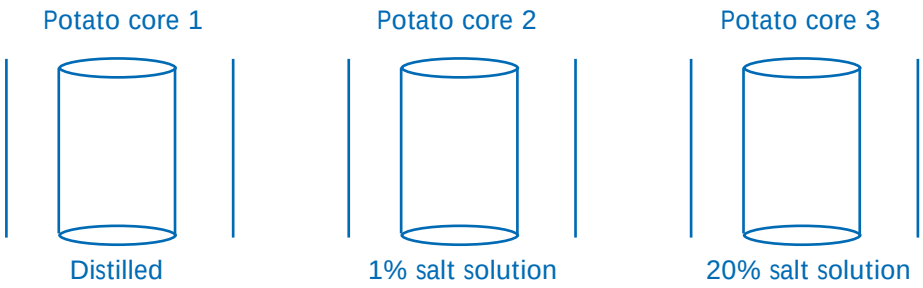
What to do

1. Label one test tube ‘1% salt solution’, one ‘20% salt solution’ and the other ‘distilled water’.
2. Fill each tube about half full with the correct solution and place in a test tube rack.
3. Measure, weigh and determine the volume of the 3 potato cores and record in the table below.
4. Place one potato core in each of the test tubes and let them stand for at least half an hour.
5. Remove the potato cores, measure, weigh and complete the table.

	Potato core in distilled water	Potato core in 1% salt water	Potato core in 20% salt water
Weight before treatment (grams)			
Weight after treatment (grams)			
Volume of water displaced before treatment (ml)			
Volume of water displaced after treatment (ml)			
Length before treatment (mm)			
Length after treatment (mm)			
Width before treatment (mm)			
Width after treatment (mm)			

Questions

1. What changes have occurred?
2. What is the likely cause of any changes?
3. Add arrows to the diagrams below to indicate whether water has moved into or out of the potato.



4. What is the problem fish have to deal with in water less salty than their tissue fluids?
5. What is the problem fish have to deal with in water saltier than their tissue fluids?
6. Devious Danny wants to change the surroundings of his pet cucumber. Danny has put his pet into a tank of fresh water. What will happen to the living tissue of the cucumber?
7. Danny notices something awry. 'Aha! I forgot the salt'. Quickly he adds a kilo of table salt. The resulting salt concentration is about twice the concentration of seawater. Assume that Danny's pet is still living, what will happen to its living tissue?
8. Are the results of your experiment relevant to the use of saline drips for humans? Discuss.

Related activities

How much salt is in seawater? Find out by evaporation (see any general science text).

Design a sea creature and discuss its adaptations to life in the sea (page 27).

Resources

Between the Tides

Australian Marine Life

Riding the waves – more good ideas

Explore other opportunities to help students discover and learn more about our special coastal and marine environments.

1. Learning about aquaculture (Grades 9–10)

Frances Karl, Triabunna District High School

Visit a local aquaculture industry such as a scallop or oyster hatchery. Arrange beforehand to see or collect samples of the plankton and various stages in the life cycle of the shellfish. Investigate the importance of the aquaculture industry to the local and State economy and find out what steps are taken to protect the water quality on which the industry depends.

2. Investigating marine debris (all ages)

Use the Marine Debris Education Kit available from the Tasmanian Environment Centre in Hobart, phone 6234 5566.

3. Stencilling stormwater drains – your street is part of a catchment (all ages)

Break O'Day & Glamorgan/Spring Bay Councils

Some Councils have stencil kits – contact your local Waterwatch coordinator to find out about borrowing these. Bob Moffatt's *Marine Environment Student's Manual* (pages 322–323) has illustrated instructions. You will need to obtain permission from the school and local Council before you start.

Supply each team with stencils, safety vests, dustpan and brooms, rubbish bags, paint, tape, a map of the area and leaflets explaining what you are doing. Witches-hats are a good safety precaution.

Safety

- You are responsible for yourself, but watch out for each other.
- Wear safety vests and use witches-hats (if available) on the road or path.
- Watch for hazards: dogs, traffic, paint, dust, wire brush, broken glass and sunburn.

Aims

- To do a top quality and durable sign painting job for the community to see.
- Get the message out that what washes down the street and into stormwater drains goes into our rivers and the sea.

Paint the messages – Drains to the river/sea/bay and Please keep it clean

Paint your messages at stormwater inlets on road gutters, preferably:

- stormwater inlet covers (manholes)
- adjacent vertical sides of gutters
- horizontal upper surfaces of kerbs
- horizontal lower surfaces of gutters.

Steps

1. Pick a visible location with a smooth surface.
2. Clean the site with a wire brush then a soft brush (collect and remove waste – don't let it go down the drain).
3. Position the stencil(s) carefully and hold or tape in place.
4. Paint inside the stencil with two light coats rather than one heavy one – don't over spray.
5. Record on a map the code of the message you have just painted.
6. Letter box houses nearby with a leaflet and talk to anyone wondering what you are doing.

To finish

- Dispose of rubbish in the right place.
- Put the tacky stencils in bags.
- Return spare materials and clean tools to their rightful place.
- Give yourself a pat on the back.

Make it fun and do a top job!

4. Marine Links package

Jennifer Pratt, Marine Links Coordinator

This upper primary curriculum package (with videos, books and posters) focuses on the Tasmanian coastal and marine environment. A copy will be sent to all schools and will also be available from the Education Department's Media Centre (September 2002).

5. Marine Links Forum

Jennifer Pratt, Marine Links Coordinator

This Tasmanian Marine Education forum enables participants to share teaching ideas, to access government and non-government staff and to link with people willing to visit schools and provide resources.

To participate, visit the Education Department website:
www.forum.discover.tased.edu.au/scripts/lyris.pl?enter=marine-links
or email: marine-links@forum.discover.tased.edu.au.

7. Fishing for fun

Pam Elliott, Marine Discovery Centre

A mock fishing activity can help students understand the importance of legal fishing sizes, which give young fish a chance to grow and reproduce.

Make fish shapes of different species and sizes and attach a metal paper clip to each. Make fishing lines with a magnet for the students to catch the fish with. Ask them to throw back the ones that are too small and the endangered species.

DPIWE leaflets about fish species and fishing regulations are available on the website:
www.dpiwe.tas.gov.au.

Tasmania's Coastal Marine Bioregions

Karen Edyvane, Research Officer (Marine Reserves, Marine Biodiversity, Giant Kelp),
Department of Primary Industries, Water & Environment

Tasmania has some of the most biologically diverse and unique marine habitats and species in the world. This is mainly due to the long coastline (relative to the landmass), the variety of coastal and marine habitats and oceanographic conditions, and Tasmania's geographical location at the southernmost extremity of Australia. Tasmania's diversity and uniqueness are enhanced by sub-Antarctic influences in the biota, the effect of oceanographic barriers (land, islands and/or shallow waters impeding ocean flow) in Bass Strait, and the isolation of large drowned river valleys and estuaries (e.g. Bathurst Harbour–Port Davey, Derwent, Huon, Tamar, Macquarie Harbour).

The drowning of Bass Strait and the effects of the winds, seas, swells and tides on Tasmania have generated a number of strikingly different marine bioregions (major biogeographic regions of similar ecology). The Bass Strait islands, and the northern, northeastern, eastern and western coasts of the main island all display markedly different marine ecosystems and habitats, largely as a response to the differing physical conditions experienced on each coastline (Edgar 1999).

Tasmania's waters comprise essentially two major biogeographical provinces (bioprovinces): the Bassian Bioprovince, which encompasses the marine ecosystems of Bass Strait; and the Tasmanian Bioprovince, which encompasses the ecosystems of eastern, southern and western coasts of Tasmania. Reef fish, invertebrate and plant communities in Bass Strait differ substantially from those further south along the Tasmanian coast (Edgar et al. 1997).

Based on the distribution of reef plants and animals, the Bassian and Tasmanian marine bioprovinces and regions of overlap or biotones are each further divided into eight distinct inshore bioregions (marine biogeographical regions) – see Figure 1 and Table 1). Because bioregions extend for hundreds rather than thousands of kilometres, the 'distinctiveness' of bioregions relates to the mix of common species rather than the presence of unique species; most species present in each bioregion generally also occur in several other regions, but in different combinations. Two Tasmanian bioregions, Davey and Bruny, nevertheless differ from other bioregions around Australia because they possess numerous species confined to that area.

Each bioregion generally has a different proportion of major marine habitats. Seagrass meadows are most prevalent in the Boags and Flinders bioregions, whereas extensive reef areas occur in the Franklin bioregion. Surveys of reef habitat also indicate major differences in numbers of species between bioregions. Highest numbers of fish species occur on reefs in the Twofold bioregion, extremely low numbers of invertebrates are recorded in the Davey and Franklin bioregions, and high plant species richness is recorded in the Bruny, Davey and Otway bioregions.

Further reading and resources

Edgar, G J, 1999, Tasmania. In Andrew, N (ed.), *Under Southern Seas: the Ecology of Australia's Rocky Reefs*, pp.30–39, University of New South Wales Press, Sydney.

Edgar, G J, Moverley, J S, Barrett, N S, Peters, D, and Reed, C 1997, 'The conservation-related benefits of a systematic marine biological sampling program: the Tasmanian bioregionalisation as a case study', *Biological Conservation*, vol. 79, pp. 227–240.

Interim Marine & Coastal Regionalisation of Australia Technical Group 1998, *Interim Marine and Coastal Regionalisation of Australia: an Ecosystem Classification for Marine and Coastal Environments. Version 3.3*, Environment Australia, Canberra.

www.dpiwe.tas.gov.au (Sea Fishing and Aquaculture/The Marine Environment)

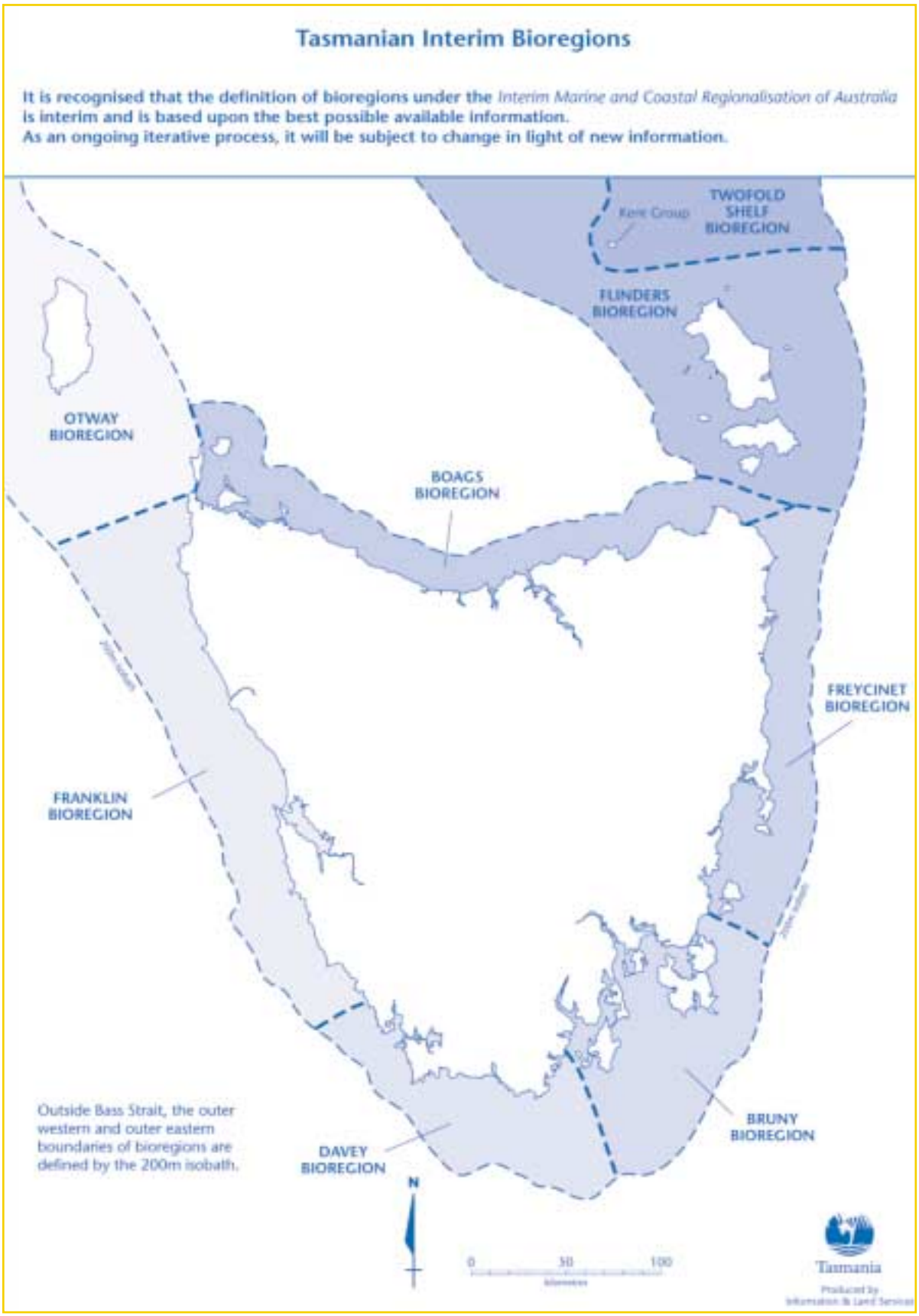


Figure 1. Bioregions of Tasmania as defined under the Interim Marine and Coastal Regionalisation of Australia (MCRA Technical Group 1998).

Table 1. Description of the IMCRA bioregions of Tasmania (based on IMCRA Technical Group 1998).

Province/ Biotone	Bioregion	Total area of Bioregion + (km^2)	Boundaries	Description
West Bassian Biotone	Otway (OTW)	37,331	Cape Jaffa (SA) to slightly north of Apollo Bay (VIC); King Island environs	(TAS) High wave energy coastline with headlands predominantly of Palaeozoic granite. Moderately strong currents through entrance to Bass Strait. Some species typical of South Australia, particularly intertidal invertebrates and fish (e.g. the queen morwong *Nemadactylus valenciennesi*).
Tasmanian Province	Franklin (FRA)	10,363	Svenor Point to Cape Grim	Extremely exposed open coastline with long sandy beaches broken by rocky headlands of diverse geology. Moderate tidal range (1.5 m). Low biological diversity (fish, algae) compared with the rest of Tasmania.
	Davey (DAV)	6,794	Southport to Svenor Point	Very exposed coastline, extensive quartzitic headlands separated by sandy beaches. Includes large Port Davey–Bathurst Harbour estuary. Low tidal range (≈ 1 m). Cold tannin-stained waters. Fish species richness low, plant species richness moderately high. Extensive stands of giant kelp (*Macrocystis pyrifera*). Only location where striped trumpeter (*Latris lineata*) is regularly recorded. Some endemic species, including new species of fish, molluscs and cnidarians, are restricted to Port Davey.
	Bruny (BRU)	7,287	Cape Bernier to Southport	Strongly dissected ria coastline (predominantly dolerite and sandstone) with extensive bays protected from swell by islands and peninsulas. Low tidal range (≈ 1 m). Fish species richness low compared to other Tasmanian regions, plant species richness extremely high. Unusually large component of endemic species, including fishes *Forsterygion gymnotum*, *Brachionichthys hirsutus* and *Brachionichthys politus*, seastars *Patiriella vivipara* and *Smilasterias tasmaniae*, and algae *Aeodes nitidissima* and *Cirrulicarpus polycoelioides*.
	Freycinet(FRT)	8,078	Tree Point to Cape Bernier	Submaximally exposed predominantly granitic coastline with approximately equal areas of rocky headland and sandy beach, and numerous coastal lagoons. Moderate tidal range (ª 1.5 m). Influenced by warm East Australian Current. Contains some warm temperate species common in New South Wales, but rare in Bass Strait (and further south), that recruit in variable numbers each year, including the fish *Parma microlepis*, the sea urchin *Centrostephanus rodgersii*, the crustaceans *Austromegabalanus nigrescens* and *Penaeus plebejus*.
Bassian Province	Boags (BGS)	8,270	Near Kangaroo Island to Tree Point (Little Musselroe Bay)	Sheltered open coastline of diverse geology (granite, dolerite, basalt, quartwacke, sandstone, quartzite) with long sandy beaches broken by rocky headlands that extend under sand in relatively shallow depths (normally < 20 m). High tidal range (≈ 3 m). Fish diversity high compared to other Tasmanian regions, algal diversity moderate. Differs substantially from other Tasmanian coastal waters by possessing large beds of the seagrasses *Posidonia australis* and *Amphibolis antarctica*, and a number of dominant species on reefs that are rare or absent further south, including the macroalgae *Cystophora monilifera* and *Sargassum varians*, the sea star *Plectaster decanus*, and the fishes *Parma victoriae*, *Meuschenia hippocrepis* and *Meuschenia flavolineata*.
	Central Bass Strait (CBS)*	49,310	Offshore Central Bass Strait	No coast within this region. The sea floor is shaped like an irregular saucer about 80 m deep at its centre and 50 m on the margins. The substrate is mainly mud. Tidal velocities range from <0.05 ms-1 in the centre to 0.5 ms-1 at the margins where the islands and promontories form the western and eastern entrances to Bass Strait. Water mass characteristics are complex and vary seasonally with the mixing of the different water masses on the west and east of the Strait. Diverse infaunal biota, consisting predominantly of crustaceans, polychaetes and molluscs.
	Flinders (FLI)	20,951	Eastern entrance to Bass Strait, includes Wilson's Promontory (VIC), Flinders Island and other islands (but not the Kent Group)	Rapid changes in offshore gradient. Granitic coastline exposed to moderate/strong swells on east-facing shores of Flinders Island and moderate to low swells elsewhere. Sandy beaches, with seagrass beds in shallow water. High tidal range (≈ 3 m) and strong tidal currents. Sea-surface temperature is representative of Bass Strait waters. Waves highly variable. Fish and plant species-richness both high compared with Tasmanian regions. The biota is typical of the Bassian province, with warm-temperate species commonly found in New South Wales also present in low numbers.
	Twofold Shelf (TWO)	32,197	East of Wilson's Promontory (VIC) and north to Tathra (NSW), including the Kent Group of islands	(TAS) Submaximally exposed granitic islands (Kent Group). Moderate tidal range (≈ 2 m). Influence of warm water from the East Australian Current. Variable wave energy. The fauna is characterised by distinctive species assemblages of reef fish, echinoderms, gastropods and bivalves. Reefs are generally dominated by warm temperate species that occur commonly in southern NSW, particularly the large sea urchin *Centrostephanus rodgersii*.
	Total	180,586		

+ Seaward edge of bioregions defined by the 200 metre isobath. * Not shown on Map 1, which refers only to bioregions within Tasmania's jurisdiction.

Flotsam and jetsam – resources & contacts

Books

A.B.Sea: A Cross-curricular Coastal and Marine Studies Planning Guide Level 1–5 (Prep–Year 8), N Tsernjavski, 2001, Gould League of Victoria, Moorabbin, Victoria.

A Guide To Squid, Cuttlefish and Octopuses of Australasia, M Norman & A Reid, 2000, Gould League of Australia, Moorabbin & CSIRO Publishing, Collingwood, Victoria.

An Introduction to Marine Studies, B Moffatt, 1997, Wet Paper Publications, Ashmore, Queensland.

Arts and the Environment, T Keyt, T Sansom, B McClish & S Glenie, 1994, Gould League of Victoria, Moorabbin, Victoria.

Australian Guide to Seashores, S Marris, 1998, Gould League of Victoria, Prahran, Victoria.

Australian Marine Habitats in Temperate Waters, G Edgar, 1997, Reed/New Holland Publishers, Frenchs Forest, NSW.

Australian Marine Life: the Plants and Animals of Temperate Waters, G Edgar, 1997, Reed Books, Kew, Victoria.

Australian Seashores, I Bennett, 1992, Collins Eyewitness Handbooks, Angus & Robertson, Pymble, NSW.

Australia's Southern Shores, H Breidahl, 1997, Lothian Books, Port Melbourne, Victoria.

Beach Life, J Somerville, (nd), Teaching Aids Centre Publication No. 9, Education Department of Tasmania (out of print but in many school libraries).

Between Tasmanian Tide Lines, Tasmanian Field Naturalists Association & Tasmanian Museum and Art Gallery, 1999, Hobart, Tasmania.

Blueback, T Winton, 1999, Pan McMillan, Sydney, NSW (a delightful story for all ages).

Coastal Wildlife, H Breidahl, 1988, Gould League of Victoria, 1988, Prahran, Victoria.

Coasting: Activities for coastal excursions and beach holidays, A Reid, 1992, Gould League of Victoria, Prahran, Victoria.

Common Venomous Animals in Tasmania: A guide to their identification, habitat, venom effects and first aid, L McGowan & P Pielage, 1996, Queen Victoria Museum and Art Gallery, Launceston, Tasmania.

Derwent River Wildlife Guide, V Thorp, 2001, Tasmanian Environment Centre, Hobart, Tasmania.

Environmental Learning Outcomes: Activities for Teachers using Gould League Posters, J Grant & D Avano, 1997, Gould League of Victoria, Moorabbin, Victoria.

Environmental Starters, G Byrt (nd), Gould League of Victoria, Prahran, Victoria.

Exploring the Oceans, M Rodrigue, 1998, Gould League of Victoria, Moorabbin, Victoria.

Field Activities for Coastal and Marine Environments, (ed) J Oliver, 1997, Marine Education Society of Australasia, Department of the Environment, Sports and Territories, Canberra (available free by contacting: www.ea.gov.au/about/publications/list.html#marine)

Field Guide to Tasmanian Birds, D Watts, 1999, New Holland, Sydney, NSW.

Marine Environment Student's Manual, B Moffatt, 1997, Wet Paper Publications Ashmore, Queensland (companion to the text book above).

Marine Reader Series: Kids and Water, B Moffatt & J Grant, 2000, Wet Paper Publications, Ashmore, Queensland (student readers and teacher resource books).

Marine Teachers Friend, B Moffatt, 1998, Wet Paper Publications, Ashmore, Queensland.

My Patch, N Smit, (nd), Department of the Environment, Sport and Territories, Canberra, ACT.

Riding the Tide: Activities for marine studies, J Swartz, J & N Tsernjavski, 1994, Gould League and Victorian Institute of Marine Sciences, Victoria.

Seaweeds of Australia, I G Christianson, M N Clayton, & B M Allender (eds), 1988, Reed Books, Sydney.

State of the Environment Tasmania, Sustainable Development Advisory Council, 1996, Department of Environment and Land Management, Tasmania.

Tasmanian Port Guide & Tide Tables, The Hobart Ports Corporation (available from fishing/boating shops and DPIWE).

Tasmanian Sea Shells, M H Richmond, 1990, Richmond Printers, Devonport (at museum shops).
Tasmanian Shells, J Somerville, 1963, Teaching Aids Centre Publication No. 1, Education Department of Tasmania (out of print but in many school libraries).
The Australian Marine Project Guide, C Bohm & C Woodfield, 2001, Marine and Coastal Community Network, St Leonards NSW.
The Blue Planet: A natural history of the oceans, A Byatt, A Fothergill and M Holmes, 2001, BBC Worldwide Ltd, London, England.
The Fauna of Tasmania: Birds, R H Green, 1995, Potoroo Publishing, Launceston, Tasmania.
The Hidden Forest, J Baker, 2000, Walker Books, London (story about Tasmanian kelp forests).
Where the Land Meets the Sea, V Thorp, 1995, Tasmanian Environment Centre, Hobart, Tasmania.

Educational kits and videos

Be Boat Safe Teacher Resource Kit, Marine and Safety Tasmania (MAST). Grades 3–4. A copy been sent to all primary schools in Tasmania.
The Blue Planet, 2001, BBC Worldwide Ltd (boxed set of 3 videos available from ABC and other bookshops). Released as a DVD in 2002.
Marine Debris Education Kit, H Pryor, (nd), Tasmanian Environment Centre, Coastcare and Marine Education Society of Australasia (available from TEC ph: 6234 5566).
Wilderness under the Waves (with CD ROM), J Bryan, 1998, Tasmanian Environment Centre, Hobart, Tasmania.
Marine Natural History Slides and Videotapes, 2000, Tasmanian Marine Naturalists Association, Hobart:
1. Common plants and animals in a Tasmanian rock pool – how they fit into the food web
2. Common plants and animals you might find when beachcombing in Tasmania
3. Diversity of plants and animals in marine habitats in Tasmania.
(These slide sets and videos, with notes, can be borrowed from the Tasmanian Environment Centre and Coastcare coordinators. The videos can also be borrowed from the Education Department's Media Centre).

Websites

www.abc.net.au/oceans/jewel/default.htm (*Jewels of the Sea* – sea life and habitats e.g. sea mounts).
www.beyondescape.com (Tasmanian Coastcare voyage and marine debris survey).
www.coastview.com.au (lots of information about Tasmanian marine science, Coastcare, tides, maps and more)
www.classroomantarctica.aad.gov.au (good activities).
www.csiro.gov.au (research divisions/marine research/information sheets (e.g. marine pests, ocean currents).
www.derwentriver.tas.gov.au (information about habitats, pollution, spotted handfish and whaling in the Derwent estuary).
www.dragonsearch.asn.au (monitoring sea dragons and seahorses).
www.ea.gov.au/coasts/coastcare (Coastcare information).
www.education.tas.gov.au (curriculum information and outdoor education guidelines).
www.discover.tased.edu.au/landcare/teachingideas.htm (*River Life* interactive stories by Nel Smit),
www.forum.discover.tased.edu.au/scripts/lyris.pl?enter=marine-links (Marine Links Forum for sharing teaching ideas and access to marine education experts).
www.gould.edu.au (the Gould League is an excellent source of materials and resources).
www.kelpwatch.tas.gov.au (a community monitoring project for giant kelp).
www.mesa.edu.au (includes Seaweek and other teaching activities, and links to useful sites such as the Coasts and Marine School Project – Marine Studies Field Guide, Harry Breidahl's Beachcombing and Keith Davey's Life on Australian Seashores).
www.ntf.flinders.edu.au (tide predictions for the current week in Tasmania).
www.wetpaper.com.au (Bob Moffatt's resources).

Gould League of Victoria Posters

Creatures of the Deep, Rockpool Life, Common Seabirds, Common Shells of S.E. Australia, Beachcombing and *Penguins.*

Contacts (March 2002)

Educational focus

Aboriginal Education Unit (Department of Education, Tasmania)
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Email: restec@southcom.com.au
Borrow or buy books, CDs, posters, slide sets and Marine Debris Kit
Website: www.tased.edu.au/tasonline/tec

Jon Bryan (slideshow and beach walks)
For school bookings, Ph: 6235 3552
PO Box 1836 Launceston 7250
Email: jonbryan@southcom.com.au
Website: www.seanature.southcom.com.au

Seahorse World
Ph: 6383 4111 Beauty Point Wharf, Tamar Valley.
Group tours must be booked.
Website: www.seahorseworld.com.au

Community/conservation focus

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Marine Naturalists Association
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Website: www.tased.edu/tasonline/tasmarine

National Oceans Office
Ph: 6221 5000
Website: www.oceans.gov.au

Surfriders Association
Michael Paxton Ph: 6229 8398

Riverkeeper (School excursions, coastal cleanup, marine debris)
Dave Turner Ph: 0408 172 898
Email: riverk@bigpond.net.au

Waterwatch
Michael Cassidy Ph: 6336 5254
Email: Michael.Cassidy@dpiwe.tas.gov.au

Antarctic Adventure
Ph 6220 8220

Natural Heritage Trust

Helping Communities Helping Australia

A Commonwealth Government Initiative