MarineWatch
counting on people

Rocky Reef Snorkel Survey

Resource kit and teaching guide

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Department of Conservation
Te Papa Atawhai

Rocky Reef Snorkel Survey

RESOURCE KIT AND TEACHING GUIDE

by Rika Milne

Department of Conservation
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FROM SIR PETER BLAKE'S LOG

Tuesday 4 December 2001

With nearly 50 per cent of all of the peoples of the world now living in towns or cities, we wanted to begin the process of bringing people back the appreciation of nature that may be missing from many daily lives.

We want to restart people caring for the environment, as it must be cared for.

And at the same time we want to do this through adventure, through participation, through education and through enjoyment.

To win, you have to believe you can do it. You have to be passionate about it. You really have to "want" the result - even if this means years of work.

The hardest part of any big project is to begin. We have begun - we are underway - we have passion. We want to make a difference. We hope that you and as many of your friends as possible will join us.

Kind regards

Peter

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INTRODUCTION

MarineWatch is about building relationships between people and the sea. Increasingly we are recognising the importance of the ocean as a taonga or treasure that must be cared for. Acting with a spirit of Kaitiakitanga or guardianship is one way in which we may work towards resolving the oceans environmental problems. MarineWatch combines science, experience and action for the environment and aims to encourage connectedness and sensitivity with the sea.

MarineWatch was initiated by DOC in 2003. Several MarineWatch training packages were developed and piloted by the Bay of Plenty Polytechnic Marine Studies Department. This kit is the product of further development and trials conducted in celebration of SeaWeek 2003 – 2006. MarineWatch programmes aim to:

- Develop individual and collective knowledge about the marine environment through observation, experience, surveying and monitoring
- Empower local communities with knowledge, experience and strategies for action to achieve marine conservation aims
- Encourage environmental education and action for the environment

For more information about MarineWatch or any aspect of the training detailed in this resource either contact your local Department of Conservation office or Indigo Pacific, P O BOX 11-378, Papamoa 3151; Phone: 07 572 4315; or email info@indigopacific.co.nz.

Guide to using the resource kit and running MarineWatch programmes

QUICK GUIDE TO THE PROGRAMME

The MarineWatch rocky reef snorkel survey involves the following:

- Learning about marine life, species identification and survey methodology
- Swimming pool snorkel training and survey practice
- A marine survey in the field of the local rocky reef environment
- Learning about data entry and data manipulation
- Presentation to the school or local community about what has been learnt – including a plan of action for protecting the local environment

The teaching and learning resources have been divided into individual activities to allow teachers to determine which aspects of the programme they wish to deliver. To assist teachers in working out which activities require prior learning, this is indicated under the heading 'prior learning' at the top of each activity. Extension activities and possible next steps are also suggested (and are located at the bottom of each activity).

HEALTH AND SAFETY

Given the health and safety issues associated with snorkelling activities, it is suggested that these parts of the programme be conducted under the supervision of a qualified skin diving instructor. It is recommended that those participating in these aspects of the programme are water confident. For areas where snorkelling is not an option, an alternative shore based activity is offered.

"He aroaro ka huri ki te wa kainga e kore e tau ki raro"
"If an objective is compelling, one pursues it without pausing"

WHAT'S IN THE KIT?

The MarineWatch rocky reef snorkel survey CD contains:

- This teaching and learning resource (including a range of learning activities)
- PowerPoint slides for teaching about marine life and marine surveying
- Spreadsheets for data entry
- A template for creating MarineWatch underwater slates
- Species ID PowerPoint slides for different regions
- Identification aids for underwater slates for different regions
- A PDF of a MarineWatch Certificate (for issue on completion of the programme)

STRUCTURE OF THIS TEACHING AND LEARNING RESOURCE

This teaching and learning resource is broken into a number of activities. They are structured around the following themes:

A – Marine life and surveying

B – Snorkelling

C – Field survey

D – Data entry

E – Kaitiakitanga & taking action

WHERE DOES THE KIT FIT INTO THE CURRICULUM?

The MarineWatch rocky reef snorkel survey activities fit into a number of different curriculum areas including:

- Science
- Mathematics
- Physical education and health
- English
- Social science
- The arts
- Literacy and numeracy

It is strongly recommended that the MarineWatch programme is integrated around a theme such as sustainability and included in a large integrated unit of work which is purposeful, rich learning and based on a meaningful and motivational context.

SUGGESTED CURRICULUM LEVEL

These activities have been designed to cater for a range of learning levels and can be adapted for use for level 3 to 8 of the New Zealand curriculum. Most activities are suitable without modification for levels 4 to 5.

EDUCATION FOR SUSTAINABILITY

Education for sustainability (formerly known as environmental education) is a multidisciplinary approach to learning that develops an action component – the ability of individuals and the community to take action towards sustainability.

KEY ASPECTS OF EDUCATION FOR SUSTAINABILITY UTILISED IN THIS KIT

Key aspects of education for sustainability (EfS) within the context of this resource involve education occurring:

About the rocky reef environment, the animals and plants that live there and the people that go there.

In the rocky reef environment where valuable learning occurs from visiting the sea and experiencing first hand the magic of marine life

With the rocky reef environment enhancing the environment and take actions in partnership with the environment

Key concepts of education for sustainability utilised in this kit

The following key concepts underpin the learning outcomes for this resource kit:

- Interdependence – acknowledging the interrelationships that exist between life, systems and organisms (including humans) of the rocky reef and wider environment
- Biodiversity – recognising the variety of life that utilise and depend on the rocky reef ecosystem
- Sustainability – using the rocky reef environment in a way that they are safeguarded for the future
- Personal and Social Responsibility for Action – recognising that each one of us has a role to play in caring for our marine environment

Consistent with the aims of education for sustainability, the activities presented in this teaching and learning resource aim to develop:

- **Awareness and sensitivity** to the quality and biodiversity of our local coastal environments. Experiencing the wonder of the marine environment provides opportunity for students to feel their connectedness with the sea. Students are emotionally affected by the experience which develops their awareness and sensitivity towards the ocean and the life that lives there.
- **Knowledge and understanding** of our marine environment and the impact people have on the marine environment. Students learn about biodiversity, marine species and the characteristics of different habitats. Learning about how animals live in the sea and what they need to survive (such as habitat and water quality) helps students understand the impact of human activity. The interconnectedness of the environment is highlighted and connections made with students own actions and their impact on the ocean.
- **Attitudes and values** that reflect feelings of interest, excitement and concern for our marine environment. Children become excited and interested in the sea as a consequence of experiencing the magic of the underwater world! Being there develops concern and passion for conserving the world they have encountered. Students learn and practice the MarineWatch kaupapa of minimal impact and caring for the sea and the life that lives there.
- **Skills** involved in identifying, investigating and problem solving associated with the marine environment. Marine surveying, environmental data collection and species identification skills are developed. Students investigate their local marine environment, collect information about that environment, and then present what they have found to their school and/or community. As part of this presentation, students are encouraged to develop solutions for problems they see facing their local marine environment.
- **A sense of responsibility through participation and action** as individuals and as members of a group when addressing issues facing our marine environment. Through developing a sense of connectedness with the local marine environment, MarineWatch encourages students to adopt the area, care for it and consider it with a 'spirit of Kaitiakitanga'. MarineWatch encouraged children to investigate and instigate action that can be taken to protect and conserve their local coastline.

"He panahe toki, ka tu te tangitangi kai"
"Minimal effort with patience and perseverance can result in big returns"

LEARNING STRATEGIES EMPLOYED IN THE KIT

A variety of learning strategies are promoted through this resource. Students centred learning approaches are encouraged - where the teacher acts as the facilitator of learning. Students are encouraged to actively participate in their own learning. The following teaching and learning pedagogies are those that meet the requirements of the New Zealand National Curriculum and have been effective in education for sustainability. .

Inquiry learning – A teaching practice that involves exploration, question asking, discovering, testing and understanding of new learning developing new skills such as observation, reasoning, critical thinking and the ability to justify or negate existing knowledge.

Action learning – A teaching practice that employs inquiry learning strategies with an emphasis on students taking action and reflecting on the resulting changes.

Co-operative learning – A teaching approach that encourages students to work together in groups developing interpersonal skills and shared responsibility for learning.

Experiential learning – Where students are actively involved in activities designed to offer an experience from which new learning can emerge.

VALUE OF REFLECTION

Reflection is an important part of the learning process in all models of learning described above and is encouraged throughout the teaching and learning resource for example, through reflective questioning.

Karakia

This Karakia may be said at the start of each MarineWatch session acknowledging our Whakapapa and connection with the environment including Tangaroa, the sea.

Ko Rangi
Ko Papa
Ka Puta ko Rongo
Ko Tanemahuta
Ko Tāwhirimātea
Ko Tangaroa
Ko Haumietiketike
Ko Tumatauenga
Ko te Rangi ki runga
Ko te Papa ki raro
Ka Puta te ira tangata
Ki te whaiao, ki te ao marama
Tīhei mauri ora

ACTIVITY SET A – MARINE LIFE AND MARINE SURVEYING

A Marine life and marine surveying						
Activity Title	Nature of Activity	Focussing Question	Environmental Education aspect and concept	Curriculum Area	Suggested Curriculum Level	Page
A1 What do we know about Tangaroa and his domain the sea?	Brainstorm & discussion	What do we know about Tangaroa and the sea? What do we know about the estuary environment?	About the Environment Interdependence; Biodiversity	English Science Social Science	Any	14
A2 Marine animal groups and habitat	PowerPoint presentation Small group poster making activity Discussion	What groups of animals live in the sea? What is a species and what is a species habitat?	About the Environment Interdependence; Biodiversity	English Science	Any	17
A3 Marine animal biology and ecology	Research exercise	What features and life characteristics have animals developed to enable them to live in the sea?	About the Environment Interdependence; Biodiversity	English Science The Arts	Any	19
A4 Species ID	ID recognition ID test Matching card game	What species live in our local rocky reef environment?	About the Environment Biodiversity	Science	Any	21
A5 Species abundance and diversity	PowerPoint Presentation and discussion	What is species diversity? What is species abundance?	About the Environment Interdependence; Biodiversity; Sustainability	English Science	Any	22
A6 MarineWatch	Worksheet and information sheet exercise	What is MarineWatch?	About and With the environment Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability	Social Science	Any	23

A Marine life and marine surveying						
Activity Title	Nature of Activity	Focussing Question	Environmental Education aspect and concept	Curriculum Area	Suggested Curriculum Level	Page
A7 Marine surveying	PowerPoint presentation, worksheet and information sheet exercise	What are 'marine surveying' and 'marine monitoring'? How can we survey a local rocky reef?	About the environment Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability	Science English	Any	26
A8 Rocky Reef Snorkel Survey	Worksheet and information sheet exercise	Why observe and survey marine life? What are the aims of the rocky reef survey?	About and With the environment Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability	Science English	Any	31
A9 How to do the survey	Worksheet and information sheet exercise	How do we conduct the rocky reef survey?	About and With the environment Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability	Science	Any	36
A10 Estimating abundance	Practical exercise	How can we estimate abundance for seaweed?	About and With the environment Biodiversity, Sustainability	Maths Science	Any	44
A11 Survey site research	Research and map making exercise	What are the physical characteristics of the survey site area?	About the environment Biodiversity; Interdependence; Sustainability	Social Science English Science	Any	46
A12 Survey site – past and present human activity	Research and Venn diagram exercise	What are the past and current uses of the MarineWatch survey site and surrounding land and water? What impact has changing use had on the site?	About and With the environment Sustainability; Interdependence	Social Science English Maths	Any	47

A Marine life and marine surveying						
Activity Title	Nature of Activity	Focussing Question	Environmental Education aspect and concept	Curriculum Area	Suggested Curriculum Level	Page
A13 Alien marine species	Discussion, worksheet and information sheet exercise	What are alien marine species? How do alien marine species pose a threat to our local marine environment?	About and With the environment Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability	Science English	Any	50
A14 Survey site – current and past management	Research exercise	How is the survey site currently managed and by whom?	About and With the environment Interdependence; Sustainability	Social Science English	Any	56

ACTIVITY: A1

Activity Title:	What do we know about Tangaroa and his domain the sea?
Environmental Education Aspect:	About the environment
Environmental Education Concept:	Interdependence; Biodiversity
Curriculum Links:	Social Science, English; Science
Suggested Curriculum Level:	Any

Focusing Questions

What do we know about Tangaroa and the sea? What do we know about the rocky reef environment?

Resources

- Large sheets of paper and pens
- Tangaroa teacher information resource

Prior Learning

Students will need to know the basics of brainstorming to complete this activity to ensure students are able to work in cooperative and supportive ways. If the class or groups are not used to brainstorming, some basic instructions will be required to ensure:

- Everyone's ideas count equally
- Only positive comments or discussion should occur when an idea is put forward
- Where the board or paper is used, the person who came up with the idea can choose to write it down

Method

1. The objective of this activity is to inquire into Tangaroa (Atua kaitiaki of the sea) and his domain – the sea; and to explore what students already know about the rocky reef environment.
2. Explain to students that before starting a new area of learning it is useful to look at what we already know.
3. Brainstorm as a class what we know about the sea and Tangaroa (Atua kaitiaki of the sea) (some information about Tangaroa is included on the Tangaroa teacher information sheet).
4. As a class, come up with a definition for the sea OR; put the class into groups. Each group brainstorms a definition of 'the sea' using large sheets of paper. After fifteen minutes of brainstorming ask groups to report back their definition of 'the sea'. These can be written on the white board or their large sheets of paper stuck to the classroom wall.
5. Investigate:
   - Has each group used the same words? Or included the same concepts in their definition?
6. Then as a class brainstorm the different marine environments that exist. These might include: the sandy beach, rocky shores or estuaries.
7. In small groups brainstorm the characteristics of the rocky reef environment. Use the following questions as a guide:
   - Write a list of words that describe the physical characteristics of the rocky reef?
   - What animals and plants would you find on the rocky reef?
   - What activities might people do on this type of coast line?
   - What type of sea water movement is there around rocky reefs? Is the water rough, calm, moving or still?

ACTIVITY: A1 (CONTD.)

8. Groups report back to the class.
9. Reflection:
    - Were you surprised by how much you already knew?
    - What new things did you learn?
10. Discussion:
    - What kawa or protocols do you follow when visiting the realm of Tangaroa?
    - What experiences have you had around the rocky reef environment?
    - How many people have been snorkelling or exploring around rocky reefs?
    - Where did you go snorkelling and what did you see?

Extension exercises and possible next steps

- A2 – Marine animal groups and habitat – Activities and a set of PowerPoint slides introducing some of the main groups of animals that are found in the realm of Tangaroa.
- Create a play that acts out the emergence of Tangaroa as Atua Kaitiaki of the sea and marine life.

TANGAROA – TEACHER INFORMATION RESOURCE

The information on this information sheet has been reproduced with kind permission from Department of Conservation, Te Papa Atawhai

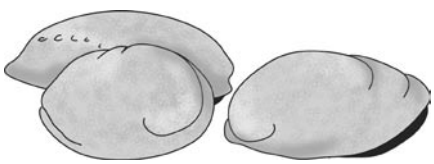
Tangaroa is an important Atua kaitiaki.

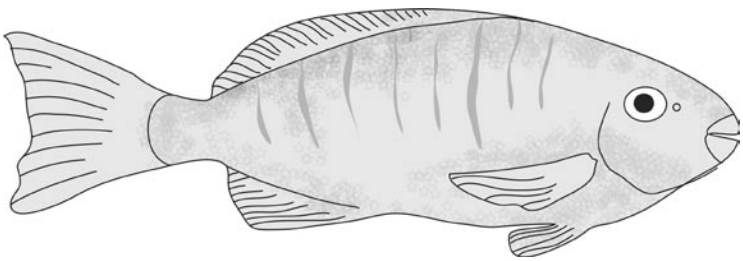
According to the Maori view of creation, Tangaroa and the other Atua Kaitiaki were brought into the world as their parents separated to bring light into the world. Te Ao Mārama or the world of enlightenment occurred after the separation of Ranginui (the sky father) and Papatūanuku (earth mother) who had lain in parental embrace leading to the procreation of the line of lesser (male) deity. This was the start-point for whakapapa, the common descent line for supernatural beings and for human kind.

Rangi and Papa had seventy sons who lived in a world of perpetual darkness. It was Tāne who successfully separated Rangi and Papa – creating light. Six brothers (including Tāne and Tangaroa) emerged as dominant deities from competition and conflict within the family. These are the Atua Kaitiaki or spiritual guardians.

Tangaroa presides over the beings of the ocean and inland waters, that is to say, marine ilfe. Tangaroa is often referred to as Tangaroa-whakamau-tai (Tangaroa – controller of the tides).

It is important to note that not all oral and written accounts of the creation agree. According to Te Wai Pounamu (South Island) traditions, Tangaroa took Papa the earth mother to wife and Rangi the sky father was her second husband.





ACTIVITY: A2

Activity Title:	Marine animal groups and habitat
Environmental Education Aspect:	About the environment
Environmental Education Concept:	Interdependence; Biodiversity
Curriculum Links:	Science, English
Suggested Curriculum Level:	Any

Focusing Questions

What groups of animals live in the sea? What is a species and what is a species habitat?

Resources

- PowerPoint slide set – A2
- Large poster paper and materials for poster making

Prior Learning

A1 – What do we know about Tangaroa and his domain the sea?

Method

1. The objective of this activity is to begin investigating groups of animals that live in the sea (and around the rocky reef environment). This activity also explores the concept of 'species' and 'species habitat'.
2. View the PowerPoint slide set A2 before using it with the class. Identify good places to stop for discussion.
3. Use the PowerPoint Presentation to overview the different groups of animals that live in the marine environment and introduce the concepts of species and species habitat.
4. Having viewed the PowerPoint slides, divide into small groups. Allocate to each group one or two of the animal groups looked at in the slides (Including: sea anenomes, chitons, snails, slugs, bivalves, cephalopods, crustracea, echinoderms, sea-squirts, sponges, bony fish, cartilaginous fish, birds and mammals). In small groups create a poster about what you now know about the group of animals. Use the following questions as a guide:
   - What do these animals look like? (shape, colour, size, texture - draw an example)
   - Write down 2 examples of species that belong to this group of animals?
   - Where do these animal live? - What type of habitat?
   - How do these animals live? (do they move around or are they stationary)
   - What other distinguishing and interesting characteristics does this group of animals have?
5. Present the poster to the rest of the class.
6. Discussion and reflection
   - What new things did you learn from this activity?
   - What was surprising about the group of animals you researched?
   - What would you still like to learn about these animals?

ACTIVITY: A2 (CONTD.)

Extension exercises and possible next steps

- Extend the exercise into a research exercise where students collect information from the library, books, internet etc and include this information on their poster.
- Create paintings, poems, songs, or other artwork illustrating the characteristics of a group of marine animals.
- A3 Marine animal biology and ecology activity - builds on the knowledge from this activity, encouraging students to investigate further the biology and ecology of an individual species of animal from the groups investigated here.

ACTIVITY: A3

Activity Title:	Marine animal biology and ecology
Environmental Education Aspect:	About the environment
Environmental Education Concept:	Interdependence; Biodiversity
Curriculum Links:	Science, English, the Arts
Suggested Curriculum Level:	Any

Focusing Questions

What features and life characteristics have animals developed to enable them to live in the sea?

Resources

- Research material – books, websites...

Prior Learning

A1 – What do we know about Tangaroa and his domain the sea?

A2 – Marine animal groups and habitat

Method

1. The objective of this activity is to explore the biology and ecology of a marine animal found in New Zealand or in the local marine environment.
2. Research independently (using websites, books, magazines and other research material) the biology and ecology of a New Zealand marine animal from one of the animal groupings studied in activity A2. Ideally this should be an animal found in the local marine environment. Use the following tasks as a guide:
   - What is the common, Māori and scientific name of the animal?
   - What animal grouping does this animal belong to (eg is it an echinoderm or a shellfish?)?
   - Find pictures or draw pictures of the inside and outside of the animal and label its various parts?
   - How does the animal move?
   - Describe the place the animal lives (habitat) and draw a map of where it is found in New Zealand.
   - What does the animal eat and what eats it? Draw a simple food chain.
   - How does the animal reproduce itself?
3. Present the research in one of the following forms: poster, seminar, written report, scrapbook, collage, information pamphlet, picture story or other.
4. Discussion and reflection
   - What new things did you learn from this activity?
   - What was surprising about the animal you researched?
   - What would you still like to learn about this animal?

ACTIVITY: A3 (CONTD.)

Extension exercises and possible next steps

- Create a kaupapa or set of guidelines for interacting with the animal
- Investigate human activities that impact on the habitat of this marine animal
- Write a page about "My life as a ?" – describe what it would be like to be the marine animal that was researched
- Draw a picture of the animal identifying the adaptations the animal has made to be able to live in the marine environment
- Write a story about the interactions of the animal and another animal that it interacts with (eg. As predator and prey)
- Study the physiology of an animal such as a starfish (conduct a dissection?)
- Write a poem about the animal and its habitat or adaptations to live in the sea
- "3 things that are most interesting about this animal" – write a 1 minute speech and present it to the class
- Write a song about the animal and it's home
- Make a poster showing the animal, it's distribution and habitat, predators, life cycle, feeding and reproductive cycle
- Play the "guess what animal I am" game. A charades type game where you silently act out the behaviour of your animal and are able to answer only yes or no to questions. The rest of the class must guess what animal you are.
- Write a story written as though you are the animal about a day when a group of school children come to visit – what would it be like having all those people looking at you?
- Create papier-mâché models of the animals and label the different body parts
- A4 – Species ID – An activity aimed to develop identification skills for species found in the local environment.

ACTIVITY: A4

Activity Title:	Species ID
Environmental Education Aspect:	About the environment
Environmental Education Concept:	Biodiversity
Curriculum Links:	Science
Suggested Curriculum Level:	Any

Focusing Questions

What species live in our local rocky reef environment?

Resources

- ID slides (for your area)
- Print out of id images and species names, cut and made into cards. One set of cards with pictures on them and one set with names on them (laminate for future use).

Prior Learning

A3 – Marine animal biology and ecology

A2 – Marine animal groups and habitat

Method

1. The objective of this activity is to investigate what animals and plants can be found in the local rocky reef environment and to gain skill at identifying these species for conducting a marine survey.
2. View the PowerPoint Species ID slides before using them with the class. You may wish to alter the species to suit a specific site that you plan to visit. Identify good places to stop for discussion.
3. Go through the ID slides as a class.
4. Conduct the identification test at the end of the slides.
5. Print out the pictures of the species (in black and white is fine), cut out the images and make into cards that can be laminated for future use. Do the same with the names of the species. Mix them up and practice matching the pictures to their correct names.
6. Discussion and reflection
   - How many of these species have you seen before? Were you aware that these species live in the local marine environment?

Extension exercises and possible next steps

- Practice the ID test and matching game regularly leading up to the marine survey
- A5 – Species abundance and diversity – an activity that investigates the concepts of species abundance and diversity using PowerPoint slides, information sheets, worksheets and class discussion.
- A6 – What is MarineWatch? – a brief activity introducing the concept of MarineWatch.

ACTIVITY: A5

Activity Title:	Species abundance and diversity
Environmental Education Aspect:	About the environment
Environmental Education Concept:	Interdependence; Biodiversity; Sustainability
Curriculum Links:	Science, English
Suggested Curriculum Level:	Any

Focusing Questions

What is species diversity? What is species abundance?

Resources Required

- PowerPoint slides – A5

Prior Learning

A1 – What do we know about Tangaroa and his domain the sea?

A2 – Marine animal groups, species and habitat

A3 – Marine animal biology and ecology

Method

1. The objective of this activity is explore the concepts of species diversity and abundance
2. View the PowerPoint slide set A5 before using it with the class. Identify discussion and reflection questions.
3. Use the PowerPoint Presentation to overview the concepts of diversity and abundance.
4. Discussion and reflection
    - Once upon a time, before people ventured into the water as much as they do today - people thought the sea was devoid of life and very low in bio-diversity. Why do you think people could have thought this?
    - Why might diversity be an important thing to protect?

Extension exercises and possible next steps

- Extend the exercise to research biodiversity and the different values of marine biodiversity.
- Look at pictures of different marine habitats and evaluate them for their diversity
- A6 – MarineWatch – a short information and work sheet activity introducing the concept of MarineWatch
- A7 – Marine surveying – an activity investigating the concepts of marine surveying and monitoring
- E1 – Conservation of marine biodiversity and marine protected areas – this activity includes PowerPoint slides on marine biodiversity – what we do and don't know and looks at marine biodiversity in the wider context of marine conservation.

ACTIVITY: A6

Activity Title:	MarineWatch
Environmental Education Aspect:	About the environment; With the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability
Curriculum Links:	Social Science
Suggested Curriculum Level:	Any

Focusing Questions

What is MarineWatch?

Resources Required

- Copies of the MarineWatch Information sheet (or to save paper - make one copy onto an OHT)
- Copies of the MarineWatch Worksheet (or to save paper - make one copy onto an OHT)

Prior Learning

A2 – Marine animal groups and habitat

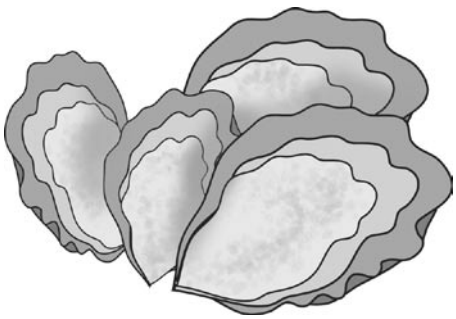
A4 – Species ID

Method

1. The objective of this activity is to investigate the concept of MarineWatch.
2. Read the MarineWatch information sheet and answer the questions on the worksheet.
3. The correct answers form the word 'SEA'
4. Discussion and reflection
   - Why do you think keeping an eye on the animals and plants that live around the coast might be a good thing?

Extension exercises and possible next steps

- A7 Marine surveying – an activity investigating the concepts of marine surveying and monitoring



INFORMATION SHEET

What is MarineWatch?

WHY HAVE MARINEWATCH?

New Zealanders are surrounded by sea. But many people don't realise there is a whole other world to explore beneath the oceans surface. The sea is full of weird and wonderful underwater creatures. Being part of MarineWatch is one way for us to explore the ocean. MarineWatch is about learning what marine creatures live along our coast.

There are many different reasons for being part of MarineWatch. It can be fun and interesting to learn new things about marine life. MarineWatch is also about collecting information about the creatures living in our ocean backyard.

The aims of MarineWatch are

- To learn more about the sea and the life that lives there
- To get wet and into the ocean
- To collect useful information about the ocean, marine animals and plants
- To keep an eye on what's happening to marine life

WHAT IS MARINEWATCH?

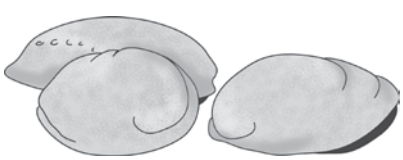
MarineWatch is about looking in the sea to find out more! We are interested in what animals and plants are living there, how many of them there are and in what sort of conditions they live. Scientists call this "marine surveying".

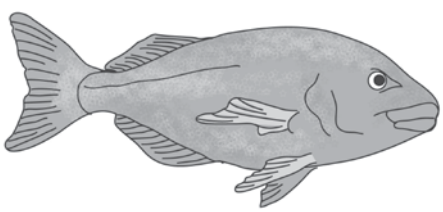
WHAT CAN WE DO WITH MARINEWATCH INFORMATION?

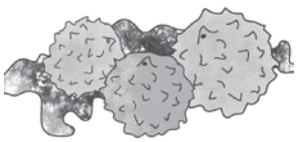
Information collected in MarineWatch surveys can be entered onto a computer. Knowing what marine life lives in an area means we have a better chance of seeing any changes that may occur.

WHAT IS INVOLVED IN MARINEWATCH TRAINING?

MarineWatch training starts in the classroom. Here we will learn about marine animals and plants and how to do the MarineWatch rocky reef snorkel survey. We will see pictures of animals and plants that we might if conducting a marine survey.







WORKSHEET

WHAT IS MARINEWATCH?

Instructions:

Read the information sheet called "What is MarineWatch?" and answer the following questions. Circle the letter of the correct answer to each question like this: (r) If you put all the letters together at the bottom of the worksheet you will find they spell a word. To find out what the word is, write each letter in the space provided.

Questions

1. Which of the following is a reason for being part of MarineWatch?
   S. It can be fun and interesting to learn new things about marine life.
   B. It is boring and horrible and there are no animals living in the sea.

2. Which of these statements is NOT an aim of MarineWatch?
   J. To learn more about the sea and life that lives there
   K. To get wet and into the ocean
   B. To collect useful information about the ocean, marine animals and plants
   E. To teach people how to swim
   P. To keep an eye on what's happening to marine life

3. Which one of these statements best describes MarineWatch training?
   J. MarineWatch training starts in the field. Here we will learn how to do the MarineWatch rocky reef snorkel survey.
   A. MarineWatch training starts in the classroom. Here we will learn about marine animals and plants and how to do the MarineWatch rocky reef snorkel survey. We will see pictures of animals and plants that we might if conducting a marine survey

The letter circled for each correct answer spells:

_____ _____ _____

ACTIVITY: A7

Activity Title:	Marine surveying
Environmental Education Aspect:	About the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability
Curriculum Links:	Science, English
Suggested Curriculum Level:	Any

Focusing Questions

What do we mean by 'marine surveying' and 'marine monitoring'? How can we survey a local rocky reef?

Resources required

- PowerPoint slide set A7
- Copies of the information sheet – Marine life and marine surveying (or to save paper – make one copy on an OHT)
- Copies of the work sheet – Marine life and marine surveying (or to save paper – make one copy on an OHT)

Prior Learning

A2 – Marine animal groups and habitat

A4 – Species ID

A5 – Species abundance and diversity

A6 – What is MarineWatch?

Method

1. The objective of this activity is to investigate the concepts of marine surveying and monitoring.
2. View the PowerPoint slide set A7 before using it with the class. Identify discussion and reflection questions for each slide.
3. Use the PowerPoint Presentation to review information about MarineWatch and investigate the concept of marine surveying and monitoring.
4. To reinforce key points – read the 'Marine life and marine surveying' information sheet and answer the questions on the worksheet.
5. The correct answers form the word 'PINK MAOMAO'
6. Discussion and reflection
   - What types of information might we gather from a marine survey?
   - Why might it be important to monitor the marine environment over time?
   - How might we overcome some of the problems identified on the final slide?

Extension exercises and possible next steps

- Investigate which government agencies have responsibilities that might lead them to conduct marine surveying and monitoring (such as DOC or Ministry of Fisheries)
- A8 – Rocky reef snorkel survey – an activity that introduces the method for conducting the Rocky Reef Snorkel Survey.

INFORMATION SHEET

Marine life and marine surveys

WHAT IS A MARINE SURVEY?

Marine surveying means looking in the sea to find out what marine organisms (animals and plants) live there, how many of them there are and what sort of conditions they live in. Some marine surveys measure the size or number of certain animals or plants living in an area. Others look at what animals and plants live in a given area of sea.

A marine survey is a single one off snapshot of marine life. When several snapshots are taken over time, for example once a year, this is known as marine monitoring. If you go back to the same site week after week, month after month or year after year you will be monitoring the marine life and looking for changes.

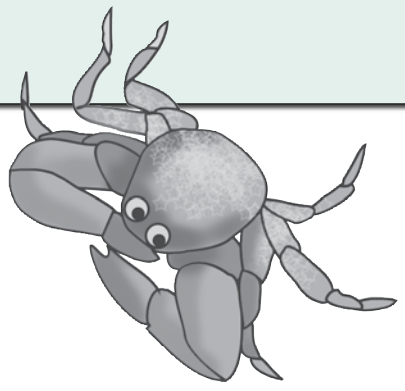
SURVEYING SPECIES DIVERSITY AND NUMBER

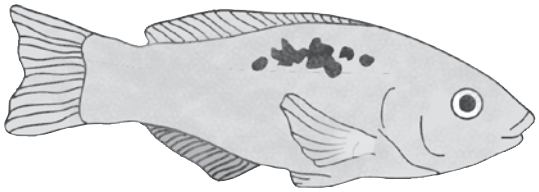
There are lots of different species of animals and plants in the ocean. Species is the scientific term for a group of animals or plants that are able to breed together. For example, a mussel and a paua cannot breed together. They are two different species.

In this MarineWatch survey we are especially interested in variety of species. Scientists call this species diversity. In other words the variety of animals and plants living in an area is known as species diversity.

In the rocky reef snorkel survey we are also interested in how many individuals from a species live in an area. Species abundance is the scientist's term for the number of individuals of a species living in a certain place. For example, surveying abundance might mean looking at the number of snapper in a harbour or the number of mussels on a rock.

One other thing you might be interested to know about species is that they have different types of names. Take spotties for example. Spotties are small fish that live around shallow rocky reefs. Spotty is the common name for these fish because they have a big spot on their body. Spotties also have a Maori name which is pākirikiri and they have a scientific name: *Notolabrus celidotus*. Scientific names sound funny as they are written in Latin. The reason scientists use scientific names is that no two scientific names are the same. Even if people call two or three different types of fish spotties, scientists can tell them apart by their scientific names.





Marine life and marine surveys (contd.)

SPECIES AND THEIR HABITAT

The number and diversity of animals and plants living in a place is influenced by the type of home they have. Just like we can be affected by our home environment, the air we breathe, the food we eat, the water we drink, so too are marine animals and plants. Protecting marine animals and plants often means looking after their home or habitat.

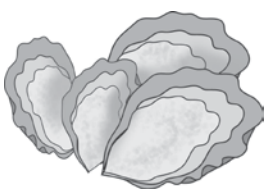
Habitat is the word used by scientists to describe the natural environment where an animal or plant lives. There are lots of different types of habitats – for example, sandy seafloors, mangrove forests, estuarine mudflats, kelp forests and rocky reefs.

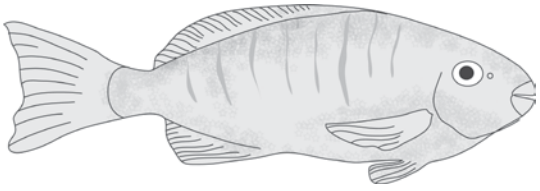
What type of animals and plants live in a place will be determined by their habitat or home and whether it is sandy, rocky, cold, warm, dark, light, rough, calm, shallow or deep. Here are some examples of the different types of habitats marine animals have. Some starfish like the spiny starfish (whose scientific name is *Coscinasterias calamaria*) live on sandy bottoms whilst others like the reef star (whose scientific name is *Stichaster australis*) live on rocky reefs. Kina (whose scientific name is *Evechinus chloroticus*) like living in rocky places often at the base of kelp forests. Black footed paua (*Haliotis iris*) like boulders too especially in the shallows amongst big waves. Mud snails (*Amphibola crenata*) prefer to live on mudflats in between the high and low tide. Some fish species like orange roughy (*Haplostethus atlanticus*) live in deep offshore ocean trenches hundreds of metres below the surface whilst others, like kahawai (*Arripis trutta*), live in shallow coastal waters.

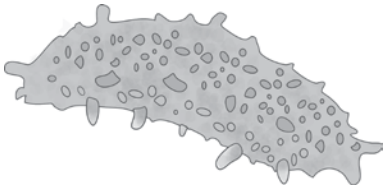
WHY SURVEY SHALLOW ROCKY REEFS?

Shallow rocky reef habitats can be full of interesting marine organisms. There is often great diversity of species living amongst rocky reefs. What life exists there and how it changes over time can tell us a lot about the health of the marine environment. The number or abundance of some animals or seaweeds can act as an indicator of an areas health. For this reason some organisms are known by scientists as indicator species.

There are many threats facing New Zealand's oceans, these include: over-harvesting and overfishing of fish and shellfish species; pollution from storm water, sewage and industrial outlets and coastal developments such as the building of marinas and causeways that result in disturbing marine life and habitats.







WORKSHEET

MARINE LIFE AND MARINE SURVEYS

Instructions:

Read the information sheet called "Marine life and marine surveys" and answer the following questions. Circle the letter of the correct answer to each question like this: (r) If you put all the letters together at the bottom of the worksheet you will find they spell a word. To find out what the word is, write each letter in the space provided.

Questions

1. Which words below correctly fill the gaps in this sentence? 'Marine surveying means looking in the _____ to find out what _____ live there, how many of them there are and what sort of _____ they live in.'

   P. sea, marine organisms, conditions

   M. sky, birds, trees

   R. rivers, freshwater weeds, caves

2. Which words correctly fill the gap in this sentence?

   'A marine survey is _____.'

   S. Looking many times at the state of the whole environment

   I. A single one off snapshot of marine life

   T. Counting freshwater crayfish or koura in a lake

3. Find the correct word to fill in the gap: 'When several snapshots are taken over time, for example once a year, this is known as _____.'

S. Freshwater surveying

N. Marine monitoring

I. Intertidal surveying

4. Is this statement true or false? 'Species is the scientific term for a group of animals or plants that are able to breed together.'

   K. True

   P. False

5. Which words correctly complete this sentence?

'The variety of different animals and plants living in an area is known as _____ _____.'

   X. Genetic abundance

   U. Ecosystem diversity

   M. Species diversity

WORKSHEET

6. Which words correctly complete this sentence?

   'Species _____is the scientist's term for the number of individuals of a species living in a certain place.'

   A. Abundance

   K. Colour

   E. Latin name

7. Species have different types of names. The three different types of names that a species has are:

   O. Common names, Maori names and scientific names

   Y. Latin names, scientific names and common names

   B. Common names, English names and Maori names

8. Why do scientific names sound so funny?

   M. Because they are written in Latin.

   H. Because they are written in Italian.

   L. Because they are written in German.

9. _____ is the word used by scientists to describe the natural environment where an animal or plant lives.

   Z. House

   A. Habitat

   J. Home

10. There are many threats facing New Zealand's oceans, these include: over-harvesting and overfishing of fish and shellfish species; pollution from storm water, sewage and industrial outlets and

    O. Coastal development such as causeways that result in disturbing marine life and habitats

    G. A build up of algae in freshwater lakes

    P. Landslides caused by deforestation

The letter circled for each answer spells:

__ __ __ __ __ __ __ __ __ __

These have bright pink and red-orange markings on their face and light blue margins around their fins. They are fish that are found mid-water around islands, pinnacles and archways in the upper north island.

ACTIVITY: A8

Activity Title:	Rocky reef snorkel survey
Environmental Education Aspect:	About the environment, With the environment
Environmental Education Concept:	Interdependence; Biodiversity, Sustainability, Personal and social responsibility for action
Curriculum Links:	Science, English
Suggested Curriculum Level:	Any

Focusing Questions

Why observe and survey marine life? What are the aims of the rocky reef snorkel survey?

Resources required

- PowerPoint slide set A8
- Copies of the information sheet – MarineWatch rocky reef snorkel survey (or to save paper – make one copy on an OHT)
- Copies of the work sheet – MarineWatch rocky reef snorkel survey (or to save paper – make one copy on an OHT)

Prior Learning

A2 – Marine animal groups and habitat

A4 – Species ID

A5 – Species abundance and diversity

A6 – What is MarineWatch?

A7 – Marine surveying

Method

1. The objective of this activity is inquire into why we might observe and survey marine life. The activity also investigates the aims of the rocky reef snorkel survey.
2. View the PowerPoint slide set A8 before using it with the class. Identify discussion and reflection questions for each slide.
3. Use the PowerPoint Presentation to explore why we might observe and survey marine life.
4. Read the MarineWatch Rocky Reef Snorkel Survey information sheet and answer the questions on the worksheet.
5. The correct answers form the word 'SPONGE'
6. Discussion and reflection
   - What interesting things might you learn from just observing marine life?
   - What might we learn from conducting the rocky reef snorkel survey?

Extension exercises and possible next steps

- A9 – How to do the survey – An activity that outlines the methodology for conducting the survey.

INFORMATION SHEET

MarineWatch rocky reef snorkel survey

AIM OF THE ROCKY REEF SNORKEL SURVEY

The aim of the MarineWatch rocky reef snorkel survey is not just to get wet and have fun. It's about experiencing what it's like in the sea where the animals of the rocky reef live. Using this survey we can look at diversity and abundance of key rocky reef organisms.

Every scientific survey has a question that it aims to answer. For example, the question might be, how many mussels are there per metre of rock? Or how many species of reef fish can we find on a section of reef? In the case of this survey we are interested in the variety of animals. We are also interested in how many of each of these animals there are.

RECORDING CHANGES OVER TIME

If we repeat the survey more than once we can look at changes occurring in our area with time. Surveying marine life for changes over time is called monitoring. By monitoring an area we may find for example, a reduction in snapper or a complete absence of mussels where once there were many. Ideally we will survey the same site at least once a year to look for changes.

If we are to monitor changes over time then we need to make sure that:

- The survey is conducted in the same way each time
- The same site is surveyed
- The survey is done at roughly the same time each month or year (for example, this might mean doing the survey at the beginning of every March.)

From the rocky reef snorkel survey we might discover:

- The presence or absence of different species at our chosen site
- Whether the mix of species alters over time
- How many individuals of different animal and plant species live at our site
- How the number of different animals and plants changes over time

WHEN TO SURVEY?

When comparing data over time we want to keep things the same. This way, if changes are found (like for example, all of a sudden there are no mussels where in the past there were lots) it's more likely these changes can be said to be due to the number of a species present rather than other factors such as time of year.

CONDUCTING THE SURVEY

Special equipment will be needed to do the MarineWatch rocky reef snorkel survey. We will need:

- A pencil
- A MarineWatch underwater slate; and
- Snorkelling gear

WHAT DO WE COUNT AND MEASURE?

We will be looking for a variety of shellfish, sponges, fish and seaweed species. For each species we will need to count how many individuals we find. But before we can do this, we need to practice snorkelling.

WORKSHEET

THE MARINEWATCH ROCKY REEF SURVEY

Instructions:

Read the information sheet called 'The MarineWatch rocky reef snorkel survey' and answer the following questions. Circle the letter of the correct answer to each question like this: (r) If you put all the letters together at the bottom of the worksheet you will find they spell a word. To find out what the word is, write each letter in the space provided.

Questions

1. Which is the correct word to complete this sentence? 'Every scientific survey has a _____ that it aims to answer".

   S. Question

   L. Answer

   E. Marine survey

2. In the MarineWatch rocky reef snorkel survey which of the following is NOT something we are interested in?

   Y. The variety of animals and plants

   B. How many of each of these animals and plants there are

   P. The colour of the water

   Z. Finding out how much rubbish is in our marine environment

3. If we repeat the survey more than once we can look at changes occurring in our area with time. Surveying marine life for changes over time is called _____.

   O. Monitoring

   U. Abundance

   R. Diversity

4. If we are to monitor changes over time then which of the following is something we DON'T want to do:

   D. Conduct the survey in the same way each time

   K. Survey the same site

   N. Count different animals at a different time of year

   W. Conduct the survey at the same time each month or year

5. Which of the following is something we WON'T discover from the rocky reef snorkel survey:
   T. The presence or absence of different species at our chosen site
   U. Whether the mix of species alters over time
   G. How many babies reef fish have
   P. How many individuals of different animal and plant species live at our site
   K. How the number of different animals and plants changes over time

6. Is this statement true or false:
   'In this rocky reef snorkel survey we will be looking for a variety of shellfish, sponges, fish and seaweed species. For each animal or plant species we will need to count how many individuals we find.'
   E. True
   S. False

The letter circled for each answer spells:

— — — — — —

Many people don't realise that this colourful life form is actually an animal rather than a plant. This animal comes in a big range of shapes and colours and does not move around. It attaches itself to the seafloor or rocks or boulders.

ACTIVITY: A9

Activity Title:	How to do the survey
Environmental Education Aspect:	About the environment, With the environment
Environmental Education Concept:	Interdependence; Biodiversity, Sustainability, Personal and social responsibility for action
Curriculum Links:	Science
Suggested Curriculum Level:	Any

Focusing Questions

How do we conduct the rocky reef snorkel survey?

Resources required

- PowerPoint slide set A9
- Copies of the information sheet – How to do the survey (or to save paper – make one copy on an OHT)
- Copies of the work sheet – How to do the survey (or to save paper – make one copy on an OHT)
- MarineWatch underwater slates (with identification aids) for recording data and pencils (see the underwater data recording slate teacher instructions and template on the following page)

Prior Learning

A2 – Marine animal groups and habitat

A4 – Species ID

A5 – Species abundance and diversity

A6 – What is MarineWatch?

A7 – Marine surveying

A8 – MarineWatch rocky reef snorkel survey

ACTIVITY: A9 (CONTD.)

Method

1. The objective of this activity is to investigate how to do the rocky reef snorkel survey.
2. View the PowerPoint slide set A9 before using it with the class. Identify discussion and reflection questions for each slide.
3. Use the PowerPoint Presentation to investigate how to do the survey.
4. Practice on dry land demonstrating how the survey would be conducted.
5. Practice estimating distances from a transect line – place a transect line across the ground and put objects (or pictures of marine species) at different distances from the line. Estimate how far each object or species is from the line
6. Read the 'how to do the survey' information sheet and answer the questions on the worksheet.
7. The correct answers form the word 'IGUANO'
8. Discussion and reflection
   - What might be hard or difficult about conducting the survey?
   - What are some of the things we will need to do to stay safe?

Extension exercises and possible next steps

- A10 – Estimating abundance – A simple practical exercise to practice estimating abundance when conducting the survey
- A11 – Survey site research – an activity investigating the physical characteristics of the survey site.
- B1 – Snorkel theory – an activity that introduces snorkelling and leads into practicing the survey in the pool.

UNDERWATER DATA RECORDING SLATES

Follow the following steps to obtain or create your own data recording slates:

- EITHER contact DOC to see if they have a set of slates with identification aids for you to use

OR

- Follow the following steps to make your own:

1. To create the data recording slate – Use the template provided on the following page (these templates are also on the MarineWatch CD) and either copy the template onto waterproof paper and attach to a hard surface (such as a breadboard) using rubber bands, or get each student to copy the information onto plastic (breadboards or plastic that is the same texture as an ice cream container lid works well).
2. Attach a pencil to the slate with string
3. Side 2 of the slate requires the attachment of species identification aids. The CD contains PDF identification aids for your region. Print out the strips of images for your region, laminate them and attach using Velcro OR create your own laminated identification aids. The finished product should look something like picture 1. Rubber bands are helpful to stop the identification aids from detaching and floating away!

Picture 1 – species identification aids attached to a MarineWatch slate for data recording

MarineWatch Underwater Slate Template (side one)

MARINE WATCH ROCKY REEF SNORKEL SURVEY

Snorkeller names:	Date:	Site name:
Time of todays high tide:	Site location: (GPS co-ordinates or landmarks)	

Wind strength: (tick one)
☐calm ☐light breeze ☐moderate breeze ☐strong wind

Weather: (tick one)
☐Sun ☐Overcast ☐Rain

Sea state: (tick one)
☐ flat ☐.5m ☐1m ☐1.5m ☐2m+

Wind direction: (tick one)
☐N ☐NE ☐E ☐SE ☐S ☐SW ☐W ☐NW

1st Transect

Time count started _____ Time count completed_____

Depth range: (tick one) ☐0— 5 or other ☐_____m—____m

Habitat type: (tick habitat MOST often encountered)
☐Mixed weed zone ☐Ecklonia forest ☐Kina barren

Substrate type: (tick substrate MOST often encountered)
☐ Sand ☐ Rock ☐ Boulders

In-water visibility (tick one)
☐< 5m ☐6m—10m ☐11m—15m 16m—20m ☐20m+

Used rope provided to measure visibility? ☐Yes ☐No

Number of Rubbish articles sighted:

Unusual sightings:

2nd Transect

Time count started _____ Time count completed_____

Depth range: (tick one) ☐0—5m or other ☐_____m—____m

Habitat type: (tick habitat MOST often encountered)
☐Mixed weed zone ☐Ecklonia forest ☐Kina barren

Substrate type: (tick substrate MOST often encountered)
☐ Sand ☐ Rock ☐ Boulders

In-water visibility (tick one)
☐< 5m ☐6m—10m ☐11m—15m 16m—20m ☐20m+

Used rope provided to measure visibility? ☐Yes ☐No

OPTIONAL: Number of Rubbish articles sighted:

Unusual sightings:

MarineWatch counting on people

Department of Conservation *Te Papa Atawbai*

MarineWatch Underwater Slate Template (side two)

Record the number of each species seen in the columns below							
Identification Image	Species Name	Transect 1	Transect 2	Identification Image	Species Name	Transect 1	Transect 2

MarineWatch counting on people

Department of Conservation *Te Papa Atawhai*

INFORMATION SHEET

How to do the rocky reef snorkel survey

How to do the survey

We will be recording animals and plants that we find within two metres of a line that will be laid on a shallow rocky reef. (A line such as this is known by scientists as a transect line). Coloured floats mark the start and finish of the line. Swim along the line between the floats recording marine organisms that are pictured on our underwater slates.

Swim side by side with a buddy. One way to do the survey is for one of buddy to record organisms up to 1m from the left side of the line while the other buddy looks for organisms up to 1m from the right side of the line. We will need to practice estimating how far away 1m is! There are pictures on the underwater slate of the animals and plants we are looking for.

We will need to record how many of each species we see. We might want to record individual animals or plants as marks on our slate like this IIII. It is likely that for some animals like star fish or octopus we won't see very many – like maybe only 1 or 2 or maybe 5. But for other animals like oysters or mussels or pupu there might be hundreds or thousands of them! Count a small area of them and then multiply this number to estimate how many there are. It is VERY important for the survey that we do this accurately and without exaggeration.

Where we are surveying sea weed – record the abundance (how many) as a percentage of the total cover. Imagine there is a square 1m by 1m. The transect line forms one edge to this square. Decide what percentage of the square is covered by that particular sea weed and write this down with a % sign next to it.

What else do we record?

We'll need to fill in the top part of the underwater slate before getting in the water. Look at this now and see what information we need to fill out (there is a copy on the following page).

Remember the MarineWatch kaupapa

When we are surveying remember the MarineWatch kaupapa of minimal impact and caring for the sea and the life that lives there. This means not kicking the rocks or seafloor with our fins and not disturbing sea weed or any marine animals.

How many times do we do the survey?

Once we have completed the first snorkel transect, there is space on the slate to conduct a second. It will be interesting to see whether results differ between the first and second transects.

How to do the rocky reef snorkel survey (contd.)

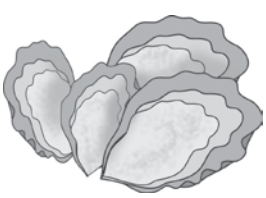
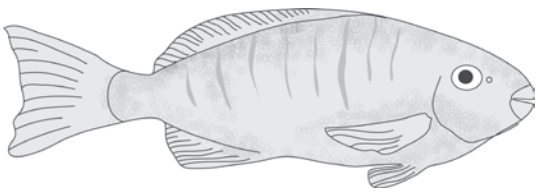
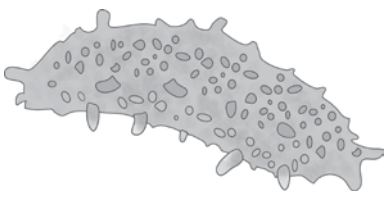
What else do we record?

There is also space to record any unusual sightings. Sometimes unusual animals such as squid or octopus can be seen. Other times it might be a more bizarre un-ocean like thing such as a bicycle or letterbox that someone has dumped at sea. (One time I even found a television set!) We can also count the number of rubbish items seen during the survey. It's best to score rubbish articles on the slate using tally marks like these: IIII .

Being a safe MarineWatcher

The most important thing about MarineWatch is being safe. We need to look after ourselves and our buddies. To do this we have to stay with our buddies. If we lose a buddy then it's important to tell an adult immediately.

The most important thing is to be safe, have FUN and enjoy the magic of the marine world!

WORKSHEET

HOW TO DO THE ROCKY REEF SURVEY

Instructions:

Read the information sheet "How to do the rocky reef snorkel survey" and answer the following questions. Circle the letter of the correct answer like this: (r) If you put all the letters together at the bottom of the page you will find they spell a word. To find out what the word is write each letter in the space provided.

Questions

1. Choose the sentence that describes best how to conduct this survey?
   - G. We will be recording animals and plants found within one metre either side of a line
   - H. We will be recording animals that are found 10m away from a line floating on the surface
   - B. We will be randomly counting and measuring kina for 10 minutes.

2. Which answer best completes this sentence? "A line such as this is known by scientists as a ...".
   - I. Tape measure
   - U. Transect line
   - A. Underwater line
   - W. Washing line

3. Which sentence best describes what we will do to count animals found in large numbers.
   - A. Count the animals in a small area, then multiply this to get an true estimate of the total number
   - X. Count each animal one by one
   - H. Just guess

4. Is this statement true or false? "You will need to fill in the top part of the underwater slate before getting in the water".
   - N. True
   - P. False

5. What should you do if you lose your buddy?
   - O. Tell an adult immediately
   - W. Keep snorkelling and don't worry about them

WORKSHEET

The letter circled for each answer spells:

__ __ __ __ __ __

(Have you ever walked around the coast beneath Pohutukawa canopy or around the rocks of a gannet colony and smelt an acrid and horrid smell? This word describes the origin of that smell. This word is used by scientists to describe a build up of seabird 'excrement' or 'poo'!).

ACTIVITY: A10

Activity Title:	Estimating abundance
Environmental Education Aspect:	About and With the environment
Environmental Education Concept:	Biodiversity, Sustainability
Curriculum Links:	Maths, Science
Suggested Curriculum Level:	Any

Focusing Questions

How can we estimate abundance for seaweed?

Resources required

- Sticks, bamboo or lengths of plastic piping
- Leaves, flowers or seaweed
- Pen and paper
- Calculators

Prior Learning

A5 – Species abundance and diversity

A7 – Marine surveying

A8 – MarineWatch rocky reef snorkel survey

A9 – How to do the survey

Method

1. The objective of this activity is to practice estimating percentage cover of seaweeds in a 1m x 1m square
2. Make a 1m x 1m quadrat (square frame) (see figure 1, picture (1)). You could use sticks, bamboo or lengths of plastic piping to do this. Scatter leaves or flowers on the ground and then complete the following: Place the 1m x 1m quadrat or square over the flowers or leaves.
3. Estimate how much of the ground is covered by leaves or flowers and write down the estimate.
4. Then divide the square into four equally sized smaller squares by placing sticks or piping or string in a cross shape over the original square. Get students to estimate and write down what percentage of each of these squares is covered by plants or flowers. (see figure 1, picture (2)).
5. Divide squares again using sticks or string so that you now have 16 smaller squares and repeat the estimation exercise. (see figure 1, picture (3)).
6. Compare the results of (1), (2) and (3)
7. Calculate the mean percentage cover of (2) and (3) and compare with (1).

ACTIVITY: A10 (CONTD.)

(1) (2) (3)

Figure 1. Imagine the first box above is a 1m x 1m square or quadrat. Estimate the percentage of the square that is filled with seaweed (1). The second square (pictured in the middle) is divided into four (2) and the third (on the right) is divided into 16 (3) –

8. Discussion and reflection

- Did you get the same answer for each of the three approaches to estimating percentage cover?
- Which size quadrat or square do you think would yield the most accurate result? Would this always be the case? Why or why not?

Extension exercises and possible next steps

- Extend the activity to for example, work out the different areas of the squares.
- Repeat the exercise with different percentage cover.
- A11 – Survey site research – an activity investigating the physical characteristics of the survey site.

ACTIVITY: A11

Activity Title:	Survey site research
Environmental Education Aspect:	About the environment
Environmental Education Concept:	Interdependence; Sustainability; Biodiversity
Curriculum Links:	Social Science, English; Science
Suggested Curriculum Level:	Any

Focusing Questions

What are the physical characteristics of the survey site area?

Resources required

- Research material – books, magazines, websites, city plans, maps etc
- Poster paper and materials for creating maps

Prior Learning

A1 – What do we know about Tangaroa and his domain the sea?

A2 – Marine animal groups and habitat

A4 – Species ID

A7 – Marine surveying

A8 – MarineWatch rocky reef snorkel survey

Method

1. The objective of this activity is to investigate the physical characteristics of the survey site and its surrounding area.
2. As a class (or in small groups) research any information that is known about the physical characteristics of the site including:
   - Geology of the area
   - Characteristics of the water catchment (including incoming streams, stormwater outlets and rivers)
   - Characteristics of the shoreline (including topography, substrate, habitats, flora and fauna) – high tide and above
   - Sub-tidal characteristics (including topography, substrate, habitats, flora and fauna) – high tide and below
3. As a class create a map showing the physical characteristics of the area
4. Discussion and reflection
   - How might the physical characteristics of the land affect the underwater environment?
   - In what ways are the land and sea interrelated?

Extension exercises and possible next steps

- Draw a diagram showing what happens to water in the catchment area you will survey – think about rain, streams, rivers, stormwater and seawater
- A12 – Survey site – past and present human activity – an activity that inquires into past and present human activities and the impact these activities have had on the area.
- A14 – Alien species – an activity investigating the impact of introduced species in the marine environment.

ACTIVITY: A12

Activity Title:	Survey site – past and present human activity
Environmental Education Aspect:	About the environment, With the environment
Environmental Education Concept:	Interdependence; Sustainability
Curriculum Links:	Science, English, Maths
Suggested Curriculum Level:	Any

Focusing Questions

What are the past and current uses of the MarineWatch survey site and surrounding land and water? What impact has changing use had on the site?

Resources required

- Scrap book
- Local kaumatua, kuia, grandparents and residents
- Venn diagram template

Prior Learning

A1 – What do we know about Tangaroa and his domain the sea?

A11 – Survey site research

Method

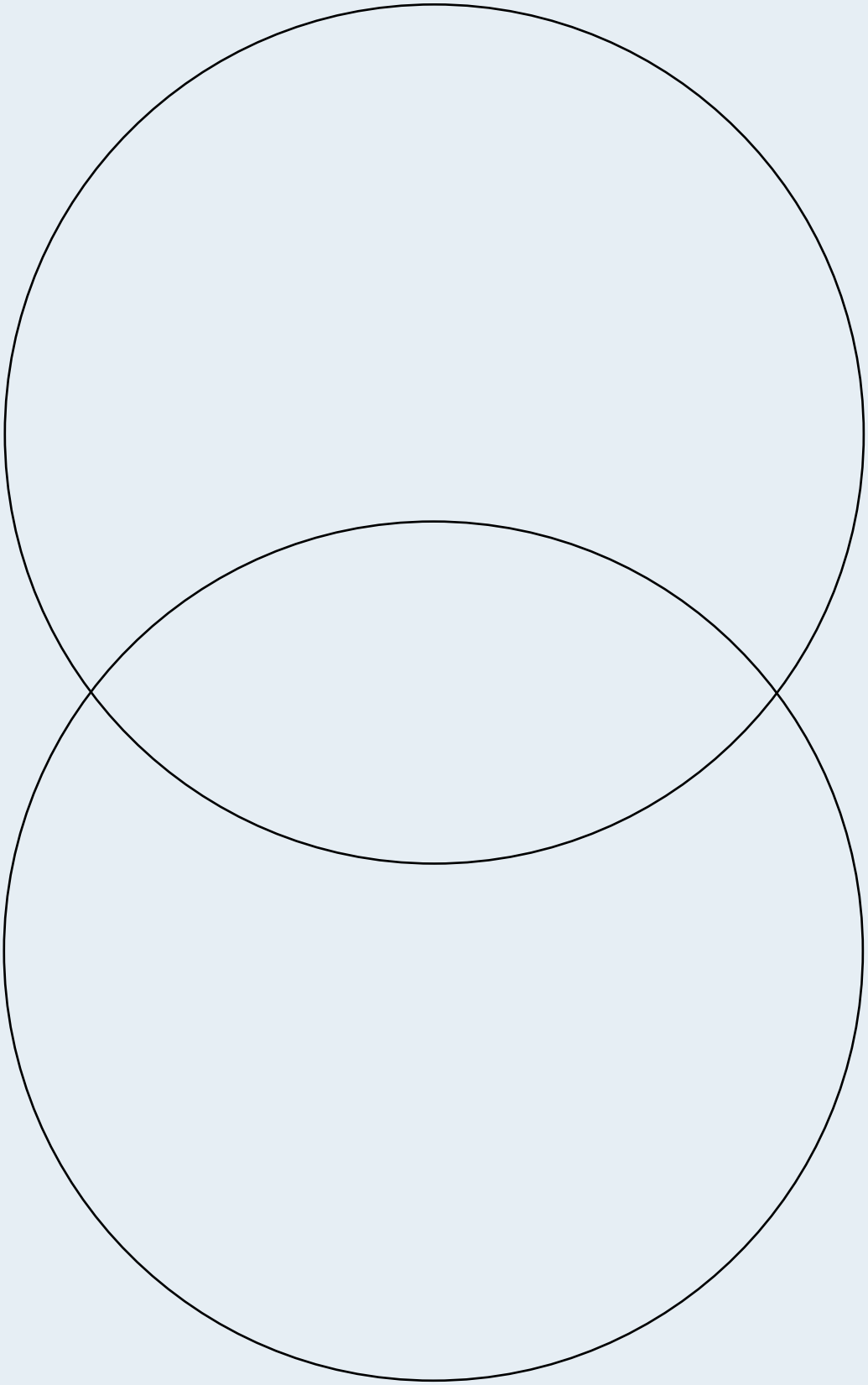
1. The objective of this activity is to investigate past and current uses of the MarineWatch survey site and surrounding land and water and to explore what impact this changing use might have had on the area.
2. Research current and past uses of the area creating a class scrapbook filled with newspaper articles, pictures and information
3. Invite local kaumatua and kuia and long time residents of the area to visit and speak about legends, history, stories, kawa and tikanga associated with the local marine environment
4. Invite grandparents to your school and listen to their oral histories of the area
5. Interview local people who fish and collect shellfish in the survey area? Do they know what the catch limits are and what do they catch and how many?
6. Using information from the scrapbook, kaumatua and grand-parents, as a class (or in small groups) make a list of past uses of the area - land and sea. And then write a list of current uses of the area - land and sea. Compare the two lists and consider the following:
   - How has the areas use changed over time
   - How many of these uses have stayed the same?
7. Use the venn diagram template to compare current uses with past uses.
8. Discussion and reflection
   - How have uses changed over time?
   - What impact has changing use had on the area?

ACTIVITY: A12 (CONTD.)

Extension exercises and possible next steps

- Write an essay about human impacts on the area - past and present
- Make a bibliography of books and written resources that have useful information in them about your area
- Having interviewed people who are knowledgeable about current fishing and shellfish collecting that occurs in your area, work out the number of people who harvest each different species and the average catch for different species and generate graphs and tables to illustrate these.
- Make a play that dramatises the human history of the area.
- A14 – Survey site – current and past management – an activity that investigates management agencies and methods for the survey site area

VENN DIAGRAM WORKSHEET



ACTIVITY: A13

Activity Title:	Alien marine species
Environmental Education Aspect:	About the environment, With the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability
Curriculum Links:	Science, English
Suggested Curriculum Level:	Any

Focusing Questions

What are alien marine species? How do alien marine species pose a threat to our local marine environment?

Resources required

- Copies of the 'Alien Species – Looking for the Big Eight' information sheet – (or to save paper – make one copy on an OHT)
- Copies of the 'Alien Species – Looking for the Big Eight' worksheet – (or to save paper – make one copy on an OHT)

Prior Learning

A4 – Species ID

Method

1. The objective of this activity is to investigate what are alien marine species and how these species pose a threat to our local marine environment
2. Read the 'Alien Species – Looking for the Big Eight' information sheet and answer the questions on the worksheet
3. The correct answers form the word 'UNDARIA'
4. Discussion and reflection
   - What is one new thing you have learnt from this exercise?
   - What alien species have been introduced on land that have had an impact?
   - Do you know of any alien marine species that have already been introduced or become established in your local marine environment? What impact have these organisms had?

Extension exercises and possible next steps

- Research what alien marine species have already been introduced or become established in your local marine environment and investigate the impact these organisms have had?.
- Check out the biosecurity website – www.biosecurity.govt.nz
- A14 – Survey site – current and past management – an activity that investigates management agencies and methods for the survey site area.

INFORMATION SHEET

Alien Species – Looking for the Big Eight

(Information and images on this sheet are reproduced with kind permission from Biosecurity New Zealand. You can check out their website at: www.biosecurity.govt.nz)

When a species is introduced into New Zealand from overseas it can have devastating consequences for our environment. Think about the possum for example. The possum is not a native. In other words it was brought here by humans.

This animal was introduced into New Zealand from Australia. It is responsible for destroying our native forests. New Zealand bush provides the possum with lots of food and the possum has no natural predators here. These two factors mean we have a booming possum population in New Zealand! Each year we spend lots of money trying to control the number of possums so we can save our bush. Once a species is introduced here it is almost impossible to get rid of and very expensive to try and control.

In the marine environment there are eight species of marine organisms that have been identified as potential baddies! Each of these organisms is not native to our marine environment. Two of them have already arrived but are only found in a few places. If the others were brought here they could have a very bad impact on the sea – just like the possums did on land.

These species are unwanted because we have seen how they have multiplied and destroyed native marine environments in other countries where they are not native. It is likely that each of these marine species could arrive here at any time. These species are all ones that like living in environments just like ours. So they could easily settle here. We know that two of them are already here. The others might already be here and we might just not know it. We do know that each of these organisms could cause significant impact.

The pests are:

Chinese mitten crab, *Eriocheir sinensis*

The Chinese Mitten Crab could pose a serious threat to both our marine biological communities and the stability of our river banks. It's native to the rivers and estuaries of China and Korea along the Yellow Sea. It burrows into river banks and causes accelerated erosion and slumping. It can also carry a lung fluke that can infect humans.

Northern Pacific seastar, *Asterias amurensis*

If this seastar arrives in New Zealand it could have a serious impact on our aquaculture industry and our marine environment generally. It is currently found in huge numbers in southern parts of Australia. It has a huge appetite. It likes to eat wild and farmed shellfish and a wide variety of other marine animals. It is generally found on muddy, sandy or pebbly surfaces and doesn't like living where there are big waves.

Mediterranean fanworm, *Sabella spallanzanii*

This worm is not yet found in New Zealand although it is found on the south and south-west coasts of Australia, and in Tasmania. It lives in the open seas at depths of one to 30 metres. It has a rapid growth rate and can form high-density beds, displacing other species that are already there. It can live on the hulls of boats and other marine structures. The fanworm could be a threat to our marine ecosystem and cause problems for marine farmers and boaties.

European shore crab (or Green crab), *Carcinus maenas*

If this predator came to New Zealand it could reduce the number of different organisms (diversity) we see in our environment. It would also have a bad effect on our scallop and mussel industries. It has moved into a number of countries outside its original home. It adapts well to new places.

Asian clam, *Potamocorbula amurensis*

This clam could reduce the number of different clam and bivalve species in our seas. It can live in a wide variety of different types of marine environments. It has already spread from China, Japan and Korea to the west coast of the United States.

Caulerpa taxifolia (a marine aquarium weed)

This species readily invades new locations and is now found on the northern coast of Australia. If it arrived here it could cause serious problems to our marine ecosystem. It smothers other plant life and reduces the habitat available for fish and other animals.

Undaria pinnatifida (Japanese seaweed)

This seaweed is now well established throughout mainland New Zealand and pest management programmes for the species are under development. Do you know if this seaweed is in your area?

Alien Species (contd.)

Sea squirt the clubbed tunicate, *Styela clava*

This sea squirt is already present in New Zealand. It is in Auckland's Hauraki Gulf and Christchurch's Lyttelton Harbour. It has also been found in Tutukaka in Northland. It poses a threat to aquaculture.

What to do if you see any of these creatures?

We will be looking out for these creatures when we do the MarineWatch survey. If you see any of these unwanted creatures (either during the survey or at any other time) then report them to Biosecurity New Zealand's hotline: 0800 80 99 66

WORKSHEET

ALIEN SPECIES – LOOKING FOR THE BIG EIGHT

Instructions:

Read the information sheet "Alien Species - Looking for the Big Eight" and answer the following questions. Circle the letter of the correct answer like this: (r) If you put all the letters together at the bottom of the page you will find they spell a word. To find out what the word is write each letter in the space provided.

Questions

1. An alien or introduced species that is not native and has been brought here by humans can cause problems for our native environment. Which of the following is NOT true?

   R. Introduced species might nave no predators in their new environment and may multiply fast

   K. Species introduced into New Zealand might like eating our native plants and animals too much - so our native populations suffer

   L. Introduced species might carry diseases that can threaten native species

   U. Once a species is introduced it is easy to get rid of

2. Possums are not native to New Zealand. Where were possums introduced from?

   O. Africa

   P. America

   N. Australia

   X. England

3. Of the eight marine species that have been identified - how many are already here?

   D. Two

   W. All of them

   B. Six

   S. None

4. Which of the following best completes this sentence about the big 8 unwanted marine species: "Each of these eight species likes to live in an environment just like ours which means that _____"

   A. These species could easily settle here

   E. These species are unlikely to settle here

   I. There is no way these species will settle here

5. Is this statement true or false? "These eight species are unwanted because we have seen how they have multiplied and destroyed marine environments in other countries where they are not native"

   R. True

   T. False

6. Which of these seastars is the Northern Pacific seastar – which could pose a serious threat to our marine environment should it be introduced?

I.

Y.

E.

7. What should you do if you see any of the eight unwanted marine creatures?

   A. Phone the biosecurity hotline – 0800 80 99 66

   R. Nothing

   I. Tell your best friend

The letter circled for each answer spells:

__ __ __ __ __ __ __

(This is the name of a marine organism that is not native to New Zealand. It is edible and can be used to make several popular Japanese dishes).

ACTIVITY: A14

Activity Title:	Survey site – current and past management
Environmental Education Aspect:	About the environment, With the environment
Environmental Education Concept:	Interdependence; Sustainability
Curriculum Links:	Social Science, English
Suggested Curriculum Level:	Any

Focusing Questions

How is the survey site currently managed and by whom?

Resources required

- Poster making material
- Research material – books, websites, magazines...
- Representatives from local management agencies

Prior Learning

A1 – What do we know about Tangaroa and his domain the sea?

A11 – Survey site research

A12 – Survey site – past and present human activity

A13 – Alien marine species

Method

1. The objective of this activity is to investigate how the MarineWatch survey site and wider area are managed and by whom
2. Find out which government agencies have responsibility for different aspects and activities conducted at the survey site. Include in your investigation the role of:
   - Department of Conservation
   - Ministry of Fisheries
   - Regional Council
   - District Council
3. Research whether there are any relevant planning documents such as: district plan, coastal plan, land plan and any relevant management plans for the area – learn how these affect the area. You could ask representatives from the council, local Department of Conservation or Ministry of Fisheries to visit and discuss management of the area.
4. In small groups make a poster showing the various responsibilities of the different government agencies in the area and the different planning documents that affect the area.
5. Discussion and reflection
   - What issues have you uncovered that are currently affecting the area?
   - Do you think the current management of the area is working well?
   - What improvements could you suggest to agencies with responsibilities for managing the area?

ACTIVITY: A14

Extension exercises and possible next steps

- Create a plan of action for acting on any issues that have been highlighted through this research (see activity E2 for an action planner template)
- E2 Taking action to improve the local marine environment - an activity to reflect on the unit of learning and create an action plan for taking action to improve the quality of the local marine environment

ACTIVITY SET B – SNORKELLING

B Snorkelling						
Activity Title	Nature of Activity	Focussing Question	Environmental Education aspect and concept	Curriculum Area	Suggested Curriculum Level	Page
B1 Snorkel theory	Worksheet, information sheet & group discussion	What equipment do we need to go snorkelling What do we need to know to snorkel safely?	In the environment Taking personal and social responsibility for action; Interdependence	Physical education and health	Any	59
B2 Snorkel practice	Practical swimming pool based exercise	How can we snorkel safely when doing a MarineWatch survey?	In the Environment Taking personal and social responsibility for action; Interdependence	Physical education and health	Any	65
B3 Snorkel survey practice	Practical swimming pool based exercise	How do we snorkel and conduct the MarineWatch survey?	In the Environment Taking personal and social responsibility for action; Interdependence	Physical education and health Science	Any	67

ACTIVITY: B1

Activity Title:	Snorkel theory
Environmental Education Aspect:	In the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Interdependence
Curriculum Links:	Physical education and health
Suggested Curriculum Level:	Any

Focusing Questions

What equipment do we need to go snorkelling and what do we need to know to snorkel safely?

Resources required

- Masks, snorkels, fins
- Snorkelling information sheet – How to do the survey (or to save paper – make one copy on an OHT)
- Snorkelling worksheet – How to do the survey (or to save paper – make one copy on an OHT)

Prior Learning

A4 – Species ID

A8 – MarineWatch rocky reef snorkel survey

A9 – How to do the survey

Method

1. The objective of this activity is investigate what equipment we need to go snorkelling and what we need to know to snorkel safely. If planning to conduct the field survey (activity C1) then this and the following two activities are essential pre-requisites. This lesson should be co-ordinated by a qualified skin diving instructor or similar.
2. In the classroom – check who has been snorkelling before, how often and where. How confident are people feeling about snorkelling? Check whether anyone has any medical conditions to prevent them from snorkelling safely or whether anyone has contact lenses or ear problems.
3. Teach students and get them to practice the following three signals:
   - I am in urgent distress (wild arm waving and shouting)
   - I require non-urgent assistance (arm straight up in the air)
   - I am ok (hand on head)
4. Discuss different scenarios in which they might use each of these three signals.
5. Discuss the importance of having a snorkel buddy.
6. Discuss how to keep ears healthy whilst snorkelling.
7. In the classroom, introduce snorkelling equipment to students. Get them to practice putting on a fins and a mask and snorkel and adjusting mask straps for size. Introducing snorkelling equipment during the classroom lesson is not essential but will help swimming pool training run more smoothly!
8. Read the 'snorkelling' information sheet and answer the questions on the worksheet.
9. The correct answers form the word 'MOLLUSCS'

ACTIVITY: B1 (CONTD.)

10. Discussion and reflection

- What signal will you use if you are getting a little cold?
- What signal will you use if you have lost your buddy and are getting seriously concerned?
- What signal will you use if you are ok?
- What signal will you use if you lose your pencil?

Extension exercises and possible next steps

- B2 – Snorkel practice

INFORMATION SHEET

Snorkelling

Snorkel equipment

There are three pieces of equipment required for snorkelling. These are:

- A mask
- A snorkel
- A pair of fins

Marine surveying would be pretty difficult without being able to see beneath the surface. If you have ever opened your eyes in the bath you will know that things look rather blurry. Masks allow us to see clearly underwater.

Unfortunately we humans can't breathe underwater. Snorkels let us breathe air without having to take our faces from the water.

Fins let us move with power and speed through the water. It is important to always snorkel with fins on. There are special types of kicks that we can do using fins, like the dolphin kick.

When snorkelling you will find that you get cold easily and you will need to wear a wetsuit. Humans are warm-blooded creatures who get colder much faster in water than in air. This is because water conducts heat away from our bodies faster than air does. Water is a better heat conductor than air.

Wetsuits are made from neoprene rubber and are designed to keep us warm by trapping a thin layer of water close to our bodies. This water gets warmed by our body and helps to keep us warmer than if we had no wet suit on. Wetsuits come in different thicknesses. Scuba divers wear 7mm wetsuits whilst to go snorkelling we might only use a 2 or 3mm wetsuit. Because wetsuits are made from rubber, if they are thick enough, they will also make you float! If you are not confident in the water you might also want to wear a lifejacket or a very thick wetsuit.

SNORKEL BUDDIES

Even when just snorkelling in the pool, it's cool to have a "snorkel buddy". Having a buddy is especially important when we get into the ocean. Snorkel buddies stick together like glue. It's more fun snorkelling with a friend and it is also safer.

It's important to talk to your snorkel buddy so you know how much snorkelling they have done and whether they are a confident swimmer. You will need to make a plan on how to stay together. You might want to make up some signals to use in the water and you'll need to discuss what to do if you get separated. If this happens use the MarineWatch signal for I need assistance and tell your adult helper straight away.

SNORKEL SIGNALS

Make sure you and your buddy know and practice the special MarineWatch signals for:

- I am OK
- I need assistance (non-urgent)
- I need HELP!

SNORKEL SKILLS

In order to do the MarineWatch rocky reef snorkel survey you will need to know how to do each of the following things:

- Test to make sure that your mask is the right size for your face
- Put on a mask with no hair trapped around the edges (hair trapped like this will let in water)
- Stop a mask from fogging up (Do you know the secret "spit but no goobies" trick?)
- Adjust the strap of a mask to the right length to fit your head
- Attach your snorkel to your mask
- Put on your fins properly making sure they are the right size
- Breathe through a snorkel
- Use your tongue as a "splashguard" whilst breathing through a snorkel
- Do the "super smooth MarineWatch snorkel kick" (which is energy efficient without splash)
- Snorkel the length of a pool with your face in the water whilst breathing from a snorkel
- Snorkel with a snorkel buddy
- Give the three special MarineWatch rocky reef snorkel survey signals to show that you are (1) OK, (2) in need of non-urgent assistance and (3) needing HELP!
- Look after your ears whilst snorkelling

Once you have shown that you can do all these things you might want to try and duck dive below the surface. Once you've done this a few times you can try to dive down to the bottom of the shallow part of the pool. Who knows what you might find there! Before you do this make sure you ask your teacher first.

SNORKELLING

Instructions:

Read the information sheet called 'Snorkelling' and answer the following questions. Circle the letter of each correct answer like this: (r) If you put all the letters together at the bottom of the worksheet you will find they spell a word. To find out what the word is, write each letter in the space provided.

Questions

1. Which word correctly completes this sentence:
   '_____ allow us to see clearly underwater.'
   S. Snorkels
   F. Fins
   M. Masks

2. Which word correctly completes this sentence:
   '_____ let us breathe without having to take our faces out of the water.'
   O. Snorkels
   S. Fins
   I. Masks

3. Which word correctly completes this sentence:
   '_____ let us move with power and speed through the water.'
   N. Snorkels
   L. Fins
   T. Masks

4. Is this statement true of false?
   'Humans are cold blooded creatures who don't get cold at the same rate in water and in air.'
   D. True
   L. False

5. Which answer has the correct words in the right order to complete this sentence correctly?
   '_____ is a better heat conductor than _____.'
   U. Water, Air
   E. Air, Water
   Q. Sand, Sea

WORKSHEET

6. Wetsuits are made from _____ and are designed to keep us warm by trapping a thin layer of water close to our bodies.
   S. Neoprene rubber
   U. Milk bottle plastic
   D. Furry fleece

7. Is this statement true or false?
   'If you are not confident in the water you should wear a lifejacket or a thick wetsuit.'
   C. True
   J. False

8. Is this statement true or false?
   'Snorkel buddies should stick together like glue.'
   S. True
   Y. False

The letter circled for each answer spells:

— — — — — — — —

This is the name for a group of marine animals that includes: marine snails, clams and octopuses. There are more of these animals in the ocean than any other group of animals. All these animals have a soft body and a calcium carbonate shell. Sometimes the shell is inside the body (like in an octopus) and sometimes it is outside the animal (like on paua and mussels).

ACTIVITY: B2

Activity Title:	Snorkel practice
Environmental Education Aspect:	In the environment
Environmental Education Concept:	Taking personal and social responsibility for action, Interdependence
Curriculum Links:	Physical education and health
Suggested Curriculum Level:	Any

Focusing Questions

How can we snorkel safely when doing a MarineWatch survey?

Resources required

- Masks, snorkels, fins
- Togs and towels
- Swimming pool

Prior Learning

B1 – Snorkel theory

A4 – Species ID

A8 – MarineWatch rocky reef snorkel survey

A9 – How to do the survey

Method

1. The objective of this activity is explore and learn through experience how we can snorkel safely when doing a MarineWatch survey. If planning to conduct the field survey (activity C1) then this, the previous and following activities are essential pre-requisites. Students should be able to complete each of the following skills with little or no assistance. These activities should be co-ordinated by a qualified skin diving instructor or similar.
2. Test to make sure that a mask is the right size. Place masks on faces (without straps) and breathe in through the nose. If the mask is a good fit it should suck on to the face. If the mask is not a good fit air will enter the mask and the mask will fall off the face.
3. Put on a mask with no hair trapped around the edges (hair trapped like this will let in water). Practice putting on a mask and removing hair from around the 'skirt' of the mask. Explain the importance of this – that it will stop their masks from leaking.
4. Stop a mask from fogging up (Do you know the secret "spit but no goobies" trick?). Practice defogging masks. To do this, put a small bit of spit (not a big goobie), on the inside glass of the mask and rub it around, then rinse in water (i.e. dip in the pool). This needs to be done immediately prior to putting on the mask – or use a chemical defogger. (If using new masks – cleaning with toothpaste prior to use will help prevent fogging).
5. Adjust the strap of a mask to the right length to fit the head. Try adjusting the mask strap. Masks don't need to be too tight as the pressure of water holds them on the face.
6. Attach a snorkel to a mask. Some spare 'snorkel keepers' can be handy here! These are small inexpensive rubber bands that attach snorkels to masks – alternatively use strong thick rubber bands or hair bands. Scuba diver protocol is to attach snorkels to the left hand side of masks.

ACTIVITY: B2 (CONTD.)

7. Put on fins properly making sure they are the right size. Fins should not be tight as this will cause cramp, but they should be tight enough so as not to fall off the foot.
8. Breathe through a snorkel. Practice breathing through the snorkel on land first. Once in the water demonstrate ability to comfortably put faces in the water and breathe through snorkels.
9. Use tongues as a "splashguard" whilst breathing through a snorkel. Explain the use of a tongue as a splashguard. This means putting the tongue at the front of the mouth when breathing through a snorkel to protect the airway from any water that may enter the snorkel.
10. Do the "super smooth MarineWatch snorkel kick" (which is energy efficient without splash). Fins are designed to be used just below the water's surface. Students will find they save energy and swim faster by keeping their fins just below the surface rather than making a big splash.
11. Snorkel the length of a pool with faces in the water whilst breathing from a snorkel. Demonstrate being comfortable enough to swim the length of the pool with faces in the water whilst breathing from a snorkel. Practice this several times.
12. Snorkel with a snorkel buddy. Practice swimming with faces in the water keeping snorkel buddies along side.
13. Give the three special MarineWatch Rocky Reef Snorkel Survey signals to show that you are (1) OK, (2) in need of non-urgent assistance and (3) needing HELP! Practice giving the three signals whilst in the water.
14. Look after ears whilst snorkelling. Make sure students know about equalisation and the importance of taking care of their ears whilst snorkelling.
15. Discussion and reflection
    - How can we look after our ears when snorkelling?
    - Why do we snorkel with a buddy and not alone?
    - Why do we kick with our feet just below the surface?
    - What signal will you use if you are getting a little cold?
    - What signal will you use if you have lost your buddy and are getting seriously concerned?
    - What signal will you use if you are ok?

Extension exercises and possible next steps

- NOTE: These activities should be conducted by a qualified skin diving instructor or similar. Once students have shown that they can do all these things, try duck dives below the surface. Then try duck diving to the bottom of the shallow part of the pool. Who knows what they might find there! Whether you choose to do this part of the exercise or not will depend on the confidence of your group. You could place weighted hoops on the bottom of the pool and get them to practice retrieving them. Breath holding activities may also be conducted. No hyperventilation should be encouraged prior to breath holding (to avoid shallow water black-out). Encourage students to take only three breaths before breath holding.
- B3 – Snorkel survey practice – an activity that builds on the skills gained here and introduces the elements of observation and data recording whilst snorkelling.

ACTIVITY: B3

Activity Title:	Snorkel survey practice
Environmental Education Aspect:	In the environment
Environmental Education Concept:	Taking personal and social responsibility for action, Interdependence
Curriculum Links:	Science, Physical education and health
Suggested Curriculum Level:	Any

Focusing Questions

How do we snorkel and conduct the MarineWatch survey?

Resources required

- Masks, snorkels, fins
- Togs and towels
- Swimming pool
- Laminated pictures of animals weighted down on the bottom of the pool
- Transect line (sinking rope or line)
- MarineWatch underwater slates with identification aids for recording data and pencils (see activity A9 for instructions on how to create or obtain these)

Prior Learning

B1 – Snorkel theory

B2 – Snorkel practice

A4 – Species ID

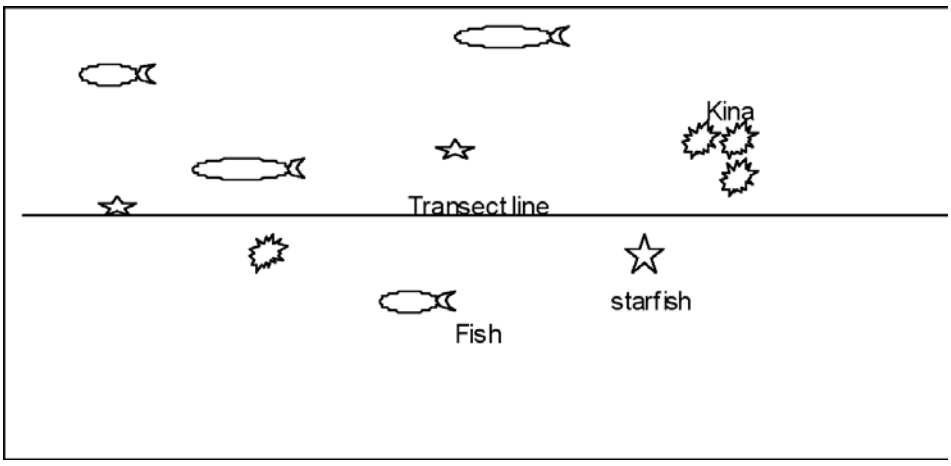
A8 – MarineWatch rocky reef snorkel survey

A9 – How to do the survey

Method

1. The objective of this activity is to practice snorkelling and conducting a MarineWatch survey in a swimming pool environment. If planning to conduct the field survey (activity C1) then both this and the previous two activities are essential pre-requisites to going into the field. Students should be able to complete the activity with little or no assistance. These activities should be co-ordinated by a qualified skin diving instructor or similar.
2. Having completed activity B2 – demonstrate the ability to swim 25m with a buddy whilst breathing from a snorkel.
3. Once students have demonstrated the ability to snorkel, the next step is to introduce the concepts of making observations and recording observations whilst snorkelling. Use a transect line (sinking rope or line) and large laminated images of marine organisms laid on the bottom of the swimming pool to enable students to practice the survey. In buddy pairs students practice observing marine species, identifying them and recording them on their slate (see C1 for more detail). Figure 1 illustrates how laminated images might look during pool training.
4. Conduct the activity for a second time placing emphasis on estimating 1 metre from the line. Record only those animals and plants that are within the survey area.

ACTIVITY: B3 (CONTD.)



5. Discussion and reflection
   - How far from the line do we survey?
   - What did you find easy or difficult about conducting the survey?
   - Having practiced it in the pool, how do you feel about conducting the survey in the sea?
   - What do you think will be different about doing the survey in the sea?

Extension exercises and possible next steps

- C1 MarineWatch rocky reef snorkel field survey – which involves conducting the same exercise but in the open water environment!

ACTIVITY SET C – FIELD SURVEY

C Field Survey						
Activity Title	Nature of Activity	Focussing Question	Environmental Education aspect and concept	Curriculum Area	Suggested Curriculum Level	Page
C1 MarineWatch rocky reef snorkel field survey	Field activity	What is it like to conduct a survey of marine life? What is it like to snorkel in the rocky reef environment?	In the Environment Taking personal and social responsibility for action; Biodiversity; Interdependence	Science, Maths, Physical education and health	Any	70
C2 MarineWatch field survey (non-snorkel alternative)	Field activity	What is it like to conduct a survey of marine life? What is it like to explore the intertidal rocky reef environment?	In the Environment Taking personal and social responsibility for action; Biodiversity; Interdependence	Science, Maths, Physical education and health	Any	77

ACTIVITY: C1

Activity Title:	MarineWatch rocky reef snorkel field survey
Environmental Education Aspect:	In the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Biodiversity; Interdependence
Curriculum Links:	Science, Maths, Physical education and health
Suggested Curriculum Level:	Any

Focusing Questions

What is it like to conduct a survey of marine life? What is it like to snorkel in the rocky reef environment?

Resources required

NB Transect lines need to be laid and buoys attached prior to starting the survey

Students will need:

- Snorkel equipment
- Wetsuits
- Buoyancy aids for unconfident swimmers
- Togs and towels
- Sun block
- Warm clothes for afterwards

Teacher/activity co-ordinator will need:

- Pencils with many spares
- Underwater slates with identification aids attached
- A visibility measuring device (optional)
- Transect line[s]
- Floats to mark start and end of survey
- Weights to weigh down the float lines and ends of the transect line[s]
- Adult helper dive equipment - mask, snorkel, wetsuit, weight belt, fins
- Identification books
- Refreshments
- Spare sets of snorkel equipment
- Adult supervision
- Log in/ log out sheet
- Dive flag
- First aid kit
- Rescue craft
- Paper copies of data sheets

ACTIVITY: C1 (CONTD.)

Prior Learning

A4 – Species ID

A8 – MarineWatch rocky reef snorkel survey

A9 – How to do the survey

B1 – Snorkel theory

B2 – Snorkel practice

B3 – Snorkel survey practice

Method

1. The objective of this activity is to conduct a MarineWatch rocky reef snorkel survey in the sea. Activities B1, B2 and B3 MUST be conducted prior to attempting this activity. This activity should be co-ordinated by a qualified skin diving instructor or similar. Where environmental conditions prevent snorkelling the survey can be conducted on a rocky shore at low tide – use activity C2.
2. SPECIAL NOTE: Experiencing the wonders of the marine world is a rich and emotionally rewarding experience. The simple act of looking underwater through a mask can be a magical experience – like being in another world! The MarineWatch Rocky Reef Snorkel Survey provides opportunity for students to experience marine life first hand. Whilst the survey has scientific aims (outlined in PowerPoint slide set A8), the wider aim is to expose children to the magic of the marine world.
3. Read the risk management guidelines on the following page.
4. Select a site. Considerations for site selection may include:
   - Habitat – is it a rocky reef?
   - Depth – can the entire survey be run in water shallow enough for all students to stand up in?
   - Physical safety – is the area safe? Consider for example: current – ensure there is an absence of strong currents; swell – avoid areas with swell (this makes surveying difficult, visibility bad and could be dangerous); class control and other relevant features of the area.
   - Cultural and conservation safety – it would pay to contact your local kaumatua and Department of Conservation to ensure the site chosen is not waahi tapu or other protected status!
   - Impact – is the area changing due to human impact? E.g. the implementation of a rahui or marine reserve or recent or proposed development. This can make the site particularly good to survey as it is likely you will see changes from year to year.
   - Facilities – is there adequate parking and are there toilet facilities nearby?
   - Relocation – is the site easily relocatable?
5. Before commencing the survey conduct a safety briefing with adults and students (suggested briefing topics are outlined in the risk management guidelines on the following page).
6. Complete the top part of the underwater slate before getting in the water (this includes information such as GPS co-ordinates, site name, buddy name, wind strength and wave height etc).
7. Ensure all participants have a buddy and all buddy pairs have adult helpers. Buddy pairs work out with their adult helper how they plan to stay together, what to do if they get separated and what signals they will use in the water.
8. Before entering the water and commencing the survey participants log in with the adult supervisor who records names and time of entry. Entry into the water should be staggered to ensure participants are spread out along the transect line.

ACTIVITY: C1 (CONTD.)

9. Field survey method (as outlined in PowerPoint Slide set A9):
    - One or two 50m transect line(s) are laid along the seafloor in a depth of 0–5m. Coloured buoys mark the start and finish of each transect.
    - Participants swim along the transect line from start to finish recording the abundance of species pictured on their underwater slates. Participants conduct the survey in buddy pairs (buddy a and buddy b). Buddy a swims on the left of the line and buddy b on the right of the line. Species 1m either side of the line are recorded. Buddy a records species seen within 1m (roughly a child arm span) of the left hand side of the line and buddy b records species seen within 1m of the right hand side of the line.
    - Where there is one slate per buddy pair the simplest way is for buddies to take turns in looking and recording. Alternatively, the participant without a slate gives their information to their buddy to record. Another way of conducting the survey with one slate is to get participants to swim up the line recording animals from the left side of the line, then swim back recording animals from the right side of the line. Alternatively you could allocate the left and right sides of the line to different buddy pairs. If participants have a slate each they can record their own results.
    - Up to 20 species can be surveyed. Species are benthic (bottom dwelling) marine organisms, reef fish and seaweed species common to shallow coastal waters. Species lists suitable for each region of New Zealand have been developed. These can be used OR based on your knowledge of the survey site you may wish to develop your own species list. To do this, you will need images of approximately 20 species. These images can be inserted into the blank PowerPoint Presentation for identification training. Images can also be inserted into the blank template for identification aids for attachment to underwater slates.
    - Individual organisms are recorded using a tally mark system. Where large numbers of organisms are present participants count the number of organisms in a small part of the whole area then multiply this number to estimate the number of organisms present in the whole area. Where seaweeds are observed these should be recorded as percentage cover of an imagined 1m x 1m square.
    - Where possible the total time spent searching can also be recorded for each buddy pair. (Comparing abundance as a function of time spent searching provides another estimate of abundance).
    - The use of at least two 50m transect lines is suggested. Those who get cold quickly can complete one transect line and those able to stay in the water for longer can complete more than one. Try to ensure a similar number of participants complete the survey along each transect line. More transects means a more accurate estimate of presence/absence and abundance across the beach, bay or survey area.
10. After the survey, participants names and the time they exited the water are recorded by the adult supervisor. Participants are provided with a paper copy of the underwater slates and data is transferred from the slate onto the paper copy. The remainder of information on the slate is completed (including for example: information such as habitat type and substrate). Data is taken back to school for entry, viewing and analysis.
11. Repeating the survey – for best results, the survey can be repeated once a year – preferably at the same time of year. Repeating the survey is also recommended after a major event such as storm, pollution spill or establishment of a marine reserve.

ACTIVITY: C1 (CONTD.)

12. Discussion and reflection
    - What are some of the animals and plants you saw today?
    - What is one thing you will remember from today?
    - What is one new thing you learnt from today?
    - Was the environment like you imagined it would be – what was different to what you imagined?

Extension exercises and possible next steps

- Collect and record the number of rubbish articles found by each student
- D1 – About data entry activity – this activity introduces the concept of data entry and explores using a worksheet and information sheet what we might learn from a MarineWatch survey
- D2 – Entering data and the presence and absence of species – this is a practical activity requiring the input of data into a master spreadsheet and investigation into presence and absence of species.
- Draw a picture that illustrates what you saw and experienced on your MarineWatch survey
- Write a poem that describes one of the most interesting things you saw during your MarineWatch survey
- Make a poster that describes your kaupapa for caring for the sea
- Write an essay that describes what you thought about the sea before you did MarineWatch compared with what you think about it now

RISK MANAGEMENT GUIDELINES – STAYING SAFE

GENERAL GUIDELINES FOR CONDUCTING THE ACTIVITY:

- The MarineWatch rocky reef snorkel survey field activity should be co-ordinated by a qualified skin diving instructor or similar.
- The activity must be conducted in a manner that meets the safety requirements for activities outside the classroom as outlined in the school Charter.
- Adult to student in water ratios for the activity should be consistent with the school Charter.
- Ensure a first aid kit is on site.
- Adult supervision will be required. Adults assisting with the activity must be water confident. Permission from parents or guardians to attend and participate in the field survey is required.
- Obtain relevant medical information for participants – especially with respect to asthma, epilepsy, diabetes, recent head injury, ear problems, heart or lung problems or any other disability, serious illness or recent injury. Snorkelling can have significant implications for any of these illnesses and injuries.

SITE ASSESSMENT

- Environmental conditions must be assessed prior to the survey commencing. Particular attention should be paid to wind and waves. The survey should not be attempted with an on-shore wind or where any (even small) waves are present. Consult up to date weather reports and conduct a pre-site inspection on the morning of the survey and use these for the basis any decision to postpone or go ahead with the survey. Postpone or cancel where any doubt exists about the appropriateness of a site or conditions on the day.

SAFETY BRIEFINGS

Before the survey commences a SAFETY BRIEFING is conducted with all adult helpers addressing each of the following points:

- The level of experience and confidence of all adult helpers – gauged through questioning
- Aims of the exercise and summary of training conducted to date
- Survey methods and procedure
- Survey site familiarisation – what they are likely to see, currents, bottom topography etc
- Hazard identification – for example, boat propeller, currents and rips, broken glass, sunburn, and hypothermia
- Procedure for participants getting in and out of the water that includes log in/out
- Other things to look out for: unconfident students, buddy system, and buddy separation procedure
- Signals to be used
- A recall system
- Boundaries within which the survey will operate
- Location of facilities – such as toilets and the procedure for children leaving the survey area

RISK MANAGEMENT GUIDELINES – STAYING SAFE (CONTD.)

Before the survey commences a SAFETY BRIEFING is conducted with the students (adults should listen to this too!) addressing each of the following points:

- Karakia
- Survey methods and procedure (revision)
- MarineWatch kaupapa – of minimal impact and caring for the sea and the life that lives there
- About the survey site – what they are likely to see, currents, bottom topography etc
- Hazard identification – for example, current, broken glass, sunburn, and hypothermia
- Procedure for participants getting in and out of the water that includes log in/out
- Things to remember: buddy system, and buddy separation procedure
- Signals to be used
- Recall system
- Boundaries within which the survey will operate
- Location of facilities – such as toilets and the procedure for children leaving the survey area
- Allocate one adult helper to each two buddy pairs (4 students)

Adult helper roles

- Allocate one adult the role of surface supervisor.
- This person performs the function of logging people in and out of the water. All students must log in and log out with this person when they get in and out of the water. Depending on the number of participants it may be best to stagger their entry and exit times. This ensures an accurate head count can be conducted at all times.
- In the unlikely event of an emergency it will be helpful knowing what skills and experience exists among adult helpers. It will be useful to know for example: who has a current first aid certificate, water safety qualifications (for example: rescue diver or Bronze Surf Lifesaving certificates), NZ Mountain Safety Council outdoor risk management certificates etc or boating qualifications (such as IRB operator, commercial skipper or Coastguard Boat Master qualified).

USE OF SAFETY VESSEL

- On water vessel support is vital for safely conducting this survey. Local surf clubs can assist here.
- If you plan to use a boat to access a survey site off shore, then a boat person, marine charts, adequate fuel and all boat safety equipment (eg. VHS radio, GPS, flares, EPIRB, life jackets) will also be required).

RISK MANAGEMENT PLAN

The following risk management plan is provided as a starting point for you to adapt and use:

RISKS	CAUSAL FACTORS	RISK MANAGEMENT STRATEGIES	
Accident, injury, other forms of loss	Hazards, perils, dangers	Normal Operation	**Emergency**
• Drowning • Barotrauma - ears • Sunburn • Hypothermia • Cut feet from glass • Missing person	• Lack of fitness, water confidence • Congestion • Inappropriate snorkelling style • No buddy system • Swept away by tide • Surface conditions deteriorate due to weather • Not enough adult supervision • Too long spent in water without exposure suits • Too long in water without sunblock • Glass on seafloor	• Ensure good level of fitness and only water confident kids participate • Check weather forecast and tides prior to starting snorkel • Teach appropriate snorkelling style in pool • Check water confidence and fitness in pool prior to entering open water environment • Check for glass and warm students about glass • Get students to keep fins on at all times • Never duck dive with a cold • Have a rescue boat on site • Use buddy system • Give clear boundaries within which to operate • Adult supervision ratio in the water 1:4 • Log snorkellers in and out of the water • Tell kids to exit water when cold and limit time spent in water – appropriate for conditions of the day	• Have CPR and first aid trained staff on site • Have emergency phone numbers • Have boat and vehicular transport • Have cellphone and vhf radio on site • Have scuba gear present and search / rescue trained staff on site • Have class list and log of students in and out times

ACTIVITY: C2

Activity Title:	MarineWatch field survey (non-snorkel alternative)
Environmental Education Aspect:	In the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Biodiversity; Interdependence
Curriculum Links:	Science, Maths, Physical education and health
Suggested Curriculum Level:	Any

Focusing Questions

What is it like to conduct a survey of marine life? What is it like to explore the intertidal rocky reef environment?

Resources required

Students will need:

- Sun block
- Warm clothes / sun protection
- Appropriate foot wear

Teacher/activity co-ordinator will need:

- Sun block
- Pencils with many spares
- Masks and snorkels (for peering into rock pools where environmental conditions allow)
- MarineWatch underwater slates with identification aids for recording data and pencils (see activity A9 for instructions on how to create these)
- Transect line[s]
- Refreshments
- Adult supervision
- First aid kit

Prior Learning

A4 – Species ID

A8 – MarineWatch rocky reef snorkel survey

A9 – How to do the survey. Conduct the activity for a second time placing emphasis on estimating 1 metre from the line. Record only those animals and plants that are within the survey area.

ACTIVITY: C2 (CONTD.)

Method

1. The objective of this activity is to conduct a MarineWatch survey in the marine environment. Experiencing the wonders of the marine world is a rich and emotionally rewarding experience. The simple act of looking underwater through a mask can be a magical experience – like being in another world! The MarineWatch Survey provides opportunity for students to experience marine life first hand. Whilst the survey has scientific aims (outlined in PowerPoint slide set A8), the wider aim is to expose children to the magic of the marine world.
2. Where environmental conditions prevent snorkelling the survey can be conducted on a rocky shore at low tide. To experience the sense of being a part of the marine world encourage students to peer into larger rock pools using a snorkel mask!)
3. Site selection – If you don't already have a site, then selecting a site is the first step to conducting the MarineWatch survey. Where environmental conditions prevent snorkelling – sites should be selected away from significant swell action. A rock pooled area at low tide would be ideal. To include the concept of zonation the transect line could be laid perpendicular to the shoreline rather than horizontal to the shoreline. Alternatively two sites could be selected – with one transect horizontal to the shoreline and one perpendicular to it.
4. Where environmental conditions prevent snorkelling – species surveyed will be those common to the rocky shore (i.e. the above low tide line). Choose a small number of species to survey and laminate pictures of these for students to use as identification guides.
5. Before commencing the survey conduct a safety briefing with adults and students.
6. All participants must have a buddy.
7. Field survey method:
    - A minimum of two 50m transect line(s) are laid along the shore
    - Students work their way along the transect line from start to finish recording the abundance of species pictured on their identification guides. Students conduct the survey in buddy pairs
    - Individual organisms are recorded using a tally mark system. Where large numbers of organisms are present students count the number of organisms in a small part of the whole area then multiply this number to estimate the number of organisms present in the whole area. Where seaweeds are observed these should be recorded as percentage cover of an imagined 1m x 1m square.
    - Where possible the total time spent searching can also be recorded for each buddy pair. (Comparing abundance as a function of time spent searching provides another estimate of abundance).
8. After the survey. Collect paper copies of data sheets for data entry, viewing and analysis back at school.
9. Repeating the survey – for best results, the survey can be repeated once a year – preferably at the same time of year. Repeating the survey is also recommended after a major event such as storm, pollution spill or establishment of a marine reserve.
10. Discussion and reflection
    - What are some of the animals and plants you saw today?
    - What is one thing you will remember from today?
    - What is one new thing you learnt from today?

ACTIVITY: C2 (CONTD.)

- D1 – About data entry activity – this activity introduces the concept of data entry and explores using a worksheet and information sheet what we might learn from a MarineWatch survey.
- D2 – Entering data and the presence and absence of species – this is a practical activity requiring the input of data into a master spreadsheet and investigation into presence and absence of species.
- Collect and record the amount of rubbish located at the site by each student.
- Draw a picture that illustrates what you saw and experienced on your MarineWatch survey.
- Write a poem that describes one of the most interesting things you saw during your MarineWatch survey.
- Make a poster that describes your kaupapa for caring for the sea.
- Write an essay that describes what you thought about the sea before you did MarineWatch compared with what you think about it now.

ACTIVITY SET D – DATA ENTRY

D Data entry						
Activity Title	Nature of Activity	Focussing Question	Environmental Education aspect and concept	Curriculum Area	Suggested Curriculum Level	Page
D1 About data entry	Information sheet and worksheet and discussion	What is data? What can we learn from data collected?	About and With the environment Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability	Maths Science English	Any	81
D2 Entering data and the presence and absence of species	Practical data entry activity	How do we enter data from a marine survey? How can we analyse presence and absence of species over time?	About and With the environment Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability	Maths Science	Any	90
D3 Working out species abundance	Practical data entry and applied mathematics activity	How do we work out the abundance of a species?	About and With the environment Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability	Maths Science	Any	93

ACTIVITY: C1

Activity Title:	About data entry
Environmental Education Aspect:	About the environment; With the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability
Curriculum Links:	Science, Maths, English
Suggested Curriculum Level:	Any

Focusing Questions

What is data? What can we learn from data collected?

Resources required

- Copies of the MarineWatch data information sheet – How to do the survey (or to save paper – make one copy on an OHT)
- Copies of the MarineWatch data worksheet – How to do the survey (or to save paper – make one copy on an OHT)

Prior Learning

A4 – Species ID

A8 – MarineWatch rocky reef snorkel survey

A9 – How to do the survey

SPECIAL NOTE. This activity can be conducted before or after the MarineWatch snorkel and field activities.

Method

1. The objective of this activity is to investigate what is data and can be learnt from manipulation of MarineWatch data.
2. Read the 'MarineWatch data' information sheet and answer the questions on the worksheet.
3. The correct answers form the word 'NUDIBRANCH'
4. Discussion and reflection
   - What is one new thing you have learnt from this exercise?
   - Why is data collection an important part of marine surveying?
   - What can we learn from data collected in marine surveys?
   - How do you think the way that data is collected in a marine survey might be important?

Extension exercises and possible next steps

- D2 – Entering data and the presence and absence of species – this is a practical activity requiring the input of data into a master spreadsheet and investigation into presence and absence of species.

INFORMATION SHEET

MarineWatch data

Information collected in a scientific survey like this one is known as data. Data is taken from the underwater slate and entered onto a computer in a 'spreadsheet' or computerised table. From this graphs can be made. Graphs make pictures out of numbers. Adults and kids find data easier to understand when it's made into pictures or graphs.

All data from MarineWatch surveys is entered onto a master spreadsheet that might look like this one:

Table 1: Master spreadsheet

Buddy Pair (student names)	Data entered by	Data verified by	date of survey	time spent searching	Number of rubbish articles located	depth	habitat	substrate	visibility	KINA Evechinus chloroticus
Jordan and Shannon	Jordan and Shannon	Micheal and Max	3-Mar-06 Moturiki		20	2 0-5	mw	r, s, b	6 - 10	1
Emma and Betty	Emma and Betty	Jordan and Shannon	3-Mar-06 Moturiki		**24**	0 0-5	mw	r, s, b	6 - 10	2
Carleen and Alyssa	Carleen and Alyssa	Emma and Betty	3-Mar-06 Moturiki		**19**	0 0-5	mw	r, s, b	6 - 10	2
Emma and Rebekah	Emma and Rebekah	Carleen and Alyssa	3-Mar-06 Moturiki		**26**	0 0-5	mw	r, s, b	6 - 10	2
Leah and Sarah	Leah and Sarah	Emma and Rebekah	3-Mar-06 Moturiki		**24**	0 0-5	mw	r, s, b	6 - 10	2
Micheal and Max	Micheal and Max	Leah and Sarah	3-Mar-06 Moturiki		20	5 0-5	mw	r, s, b	6 - 10	2
Alex and Thomas	Alex and Thomas	Milan and Tim	3-Mar-06 Moturiki		15	0 0-5	mw	r, s, b	6 - 10	2
Haydon and Michael	Haydon and Michael	Alex and Thomas	3-Mar-06 Moturiki		20	0 0-5	mw	r, s, b	6 - 10	2
Paige and Georgia	Paige and Georgia	Haydon and Michael	3-Mar-06 Moturiki		**30**	2 0-5	mw	r, s, b	6 - 10	2
Ryan and Finn	Ryan and Finn	Paige and Georgia	3-Mar-06 Moturiki		16	0 0-5	mw	r, s, b	6 - 10	1
Jordan and Cole	Jordan and Cole	Ryan and Finn	3-Mar-06 Moturiki		15	0 0-5	mw	r, s, b	6 - 10	2
Taylor and Jordan	Taylor and Jordan	Jordan and Cole	3-Mar-06 Moturiki		**26**	0 0-5	mw	r, s, b	6 - 10	2
Milan and Tim	Milan and Tim	Taylor and Jordan	3-Mar-06 Moturiki		24	2 0-5	mw	r, s, b	6 - 10	2
Average					**21.46**	**0.85**				**1.85**

There are lots of different things maths games we can play using this data. For example we might work out what percentage of students saw two kina? What percentage of students saw one kina? What percentage of students spent 20 minutes or longer searching on their survey? What was the average time spent searching by students? What was the average time spent searching by the boys compared with the average time spent searching by the girls?

In the MarineWatch rocky reef survey we are particularly interested in

- the presence and absence of species and
- the abundance of species

Presence & Absence

A simple table like the one below can be used to show the presence and/or absence of species over time.

Table 2 – presence and absence

PRESENCE AND ABSENCE OF SPECIES OVER TIME		
SPECIES LIST		
GOLF BALL SPONGE Tethya sp	yes	yes
KINA Evechinus chloroticus	yes	yes
CUSION STAR Patiriella regularis	yes	yes
SPINY STAR (Eleven Armed) Coscinasterias calamaria	yes	yes
SNAKESKIN CHITON Chiton pelliserpentis	yes	yes
NOBLE CHITON Eudoxochiton nobilis	no	no
ROCK OYSTER or TIO Saccostrea cucullate	yes	yes
CATS EYES or PUPU Turbo smaragdus	yes	yes
SPECKLED WHELK Cominella adspersa	yes	yes
Cooks turban Cookia sulcata	yes	yes
GREEN LIPPED MUSSELS Perna canaliculus	yes	yes
WHITE ROCK SHELL Thais orbita	yes	yes
SPOTTED TOP SHELL Melagraphia aethiops	yes	yes
LINED WHELK Buccinulum sp	yes	yes
OCTOPUS Octopus maorum	yes	yes
SEA SQUIRT Cnemidiocarpa bicornuta	yes	yes
SPOTTY OR PAKIRIKIRI Notolabrus celidotus	yes	yes
TRIPLE FINS Family: Tripterygiidae	yes	yes
PARORE Girella tricuspidate	yes	yes
FLAP JACK Carpophyllum maschalocarpum	yes	yes
EEL GRASS Zostera capricorni	yes	yes
CORALLINE ALGAE Corallina sp	yes	yes

Average number kina sighted by students

Looking at the abundance of species involves working out the average number of kina seen and the size of the area surveyed. To work out the average number of kina seen by students on each transect, add up the number of kina seen by all students on that transect and divide this number by the number of students who collected data.

An example is done for you below:

Kina results student survey:

	transect 1	transect 2
student 1	70	50
tudent 2	60	40
student 3	60	45
student 4	68	41
student 5	65	40
total =	323	216

average no. of kina counted by students for transect 1 = $\frac{\text{total (323)}}{\text{No. of students (5)}}$ = 64.6

MarineWatch data (contd.)

Abundance of kina

To work out the abundance of a species (such as kina for example) we need to work out the area that was surveyed.

An example of this is done below:

To determine the area of one transect:

Area surveyed = 2m x 50m x 1 = $100m^2$

2m = width of transect (1m either side of line)

50m = length of transect

1 = number of transects

To work out the abundance of kina, divide this by the average number of animals counted.

An example of this is done below:

Transect 1

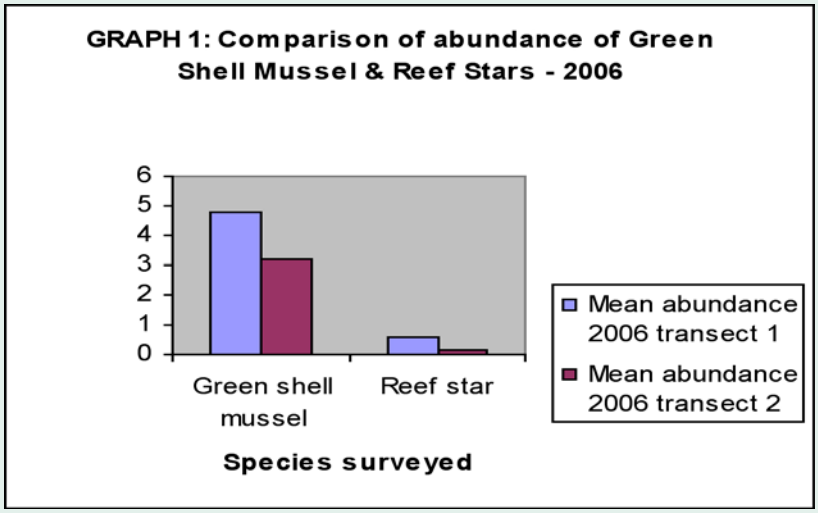
$$\text{Average} = \frac{64.6}{10.0} = 0.646 \quad \text{kina per square metre}$$

Comparing species abundance

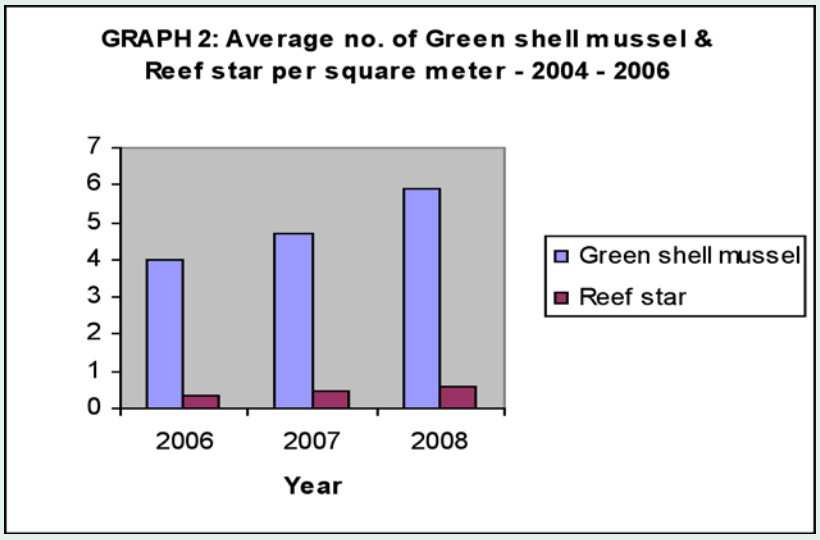
Once we have worked out the abundance of species we can look for relationships between data about different species. For example, reef stars feed on molluscs such as green lip mussels. By looking at data about these two species we might see a possible relationship between an increase in mussels and an increase in reef stars. Why do you think the reef stars might increase as the mussel population increases. Graph 1 shows what a graph comparing reef stars and mussel populations might look like.

Comparing species abundance

Once we have worked out the abundance of species we can look for relationships between data about different species. For example, reef stars feed on molluscs such as green lip mussels. By looking at data about these two species we might see a possible relationship between an increase in mussels and an increase in reef stars. Why do you think the reef stars might increase as the mussel population increases. Graph 1 shows what a graph comparing reef stars and mussel populations might look like.

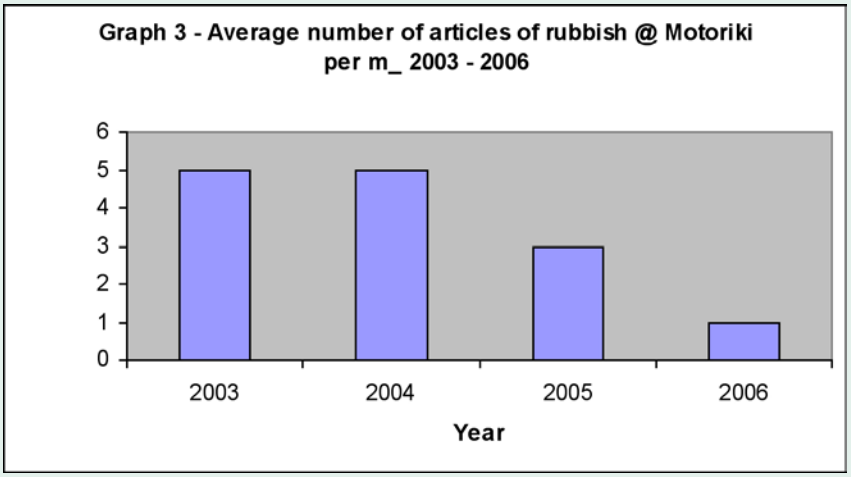


Population numbers might also alter where an area that was once harvested is now protected. Protection might be in the form of a rahui (ban on shellfish gathering) or a marine reserve. Where an area becomes protected it can be interesting to monitor what changes occur over time, for example see graph 2. Graph 2 compares species abundance over time.



The amount of rubbish found (optional addition to the survey)

The number of rubbish articles sighted can also be recorded and shown in a graph. After several years a graph can be generated to compare results over time (see graph 3).



MARINEWATCH DATA

Instructions:

Read the information sheet called "MarineWatch data". And answer the following questions. Circle the letter of the correct answer to each question like this: (r) If you put all the letters together at the bottom of the page you will find they spell a word. To find out what the word is write each letter in the space provided.

Questions

1. What word is used to describe information collected in a scientific survey like this one?

   N. Data

   R. Numerical undergarments

   F. Fishy numbers

2. Which answer most correctly completes this sentence?

   "Information is taken from your underwater slate or data sheet and entered onto a computer in a computerised table known as a _____."

   T. Wide sheet

   N. Long sheet

   U. Spreadsheet

   M. Clean sheet

3. From table 1, the master spreadsheet, what percentage of students saw kina?

   D. 100%

   R. 90%

   S. 99%

   T. 10%

4. The average time spent searching by students was 21 minutes and 46 seconds. Which of the following sums would give you this answer?

   I. Add up the times spent searching and divide by the number of students who searched

   P. Multiply the times spent searching and divide by the number of students who searched

   X. Pick the time that is in the middle of all the other search times

   L. Add up all the times spent searching and multiply by the number of students who searched

WORKSHEET

5. In the MarineWatch rocky reef snorkel survey, what are the two things we are particularly interested in?

   B. The presence and absence of species and the abundance of species

   H. The abundance of species and the size of the area surveyed

   R. The average time spent in the water by students and the presence of fish

6. If six students conducted a survey and three students each saw 5 and three students saw 6 kina, what would be the average number of kina seen by students on that survey?

   Y. 6

   Q. 5

   R. 5.5

   B. 7

7. Looking at graph 1 – why do you think the reef stars might increase as the mussel population increases?

   A. Because reef stars feed on mussels – an environment with more mussels can support a large number of reef stars

   R. Because the mussels gang up and feed on reef stars – so there is more food for the mussels

8. From graph 2 – what can you tell about the population of green lipped mussels

   M. The mussel population is staying the same over time

   G. The population of mussels is decreasing over time

   N. The population of mussels is increasing over time

9. In graph 3, what trend can you see in the number of rubbish articles found between 2003 and 2006. Select the letter that best describes you answer:

   Y. Between 2003 and 2006 the amount of rubbish found remained the same

   C. Between 2003 and 2006 the amount of rubbish decreased

   R. Between 2003 and 2006 the amount of rubbish increased

10. From graph 3 – what was the average number of rubbish articles found per m^2 in 2003 and 2006?

    H. In 2003 it was 5 and 2006 it was 1

    T. In 2003 it was 1 and 2006 it was 5

    E. In 2003 it was 3 and 2006 it was 3

The letter circled for each answer spells

— — — — — — — — —

(This is a funny sounding word that is the scientific name for an animal that is sometimes called a sea slug. This animal is a mollusc but it does not have a shell outside its body. Many of these animals are very colourful and quite beautiful.)

ACTIVITY: D2

Activity Title:	Entering data and the presence and absence of species
Environmental Education Aspect:	About the environment; With the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability
Curriculum Links:	Science, Maths
Suggested Curriculum Level:	Any

Focusing Questions

How do we enter data from a marine survey? How can we analyse presence and absence of species over time?

Resources required

- MarineWatch data (from field survey activity C1 or C2)
- Computer access
- Excel software
- MarineWatch CD with master spreadsheet file (Filename: D2.1Master Spreadsheet) and presence and absence file (D2.2Presence and Absence)

Prior Learning

A4 – Species ID

A8 – MarineWatch rocky reef snorkel survey

A9 – How to do the survey

C1 – MarineWatch rocky reef snorkel field survey (or C2)

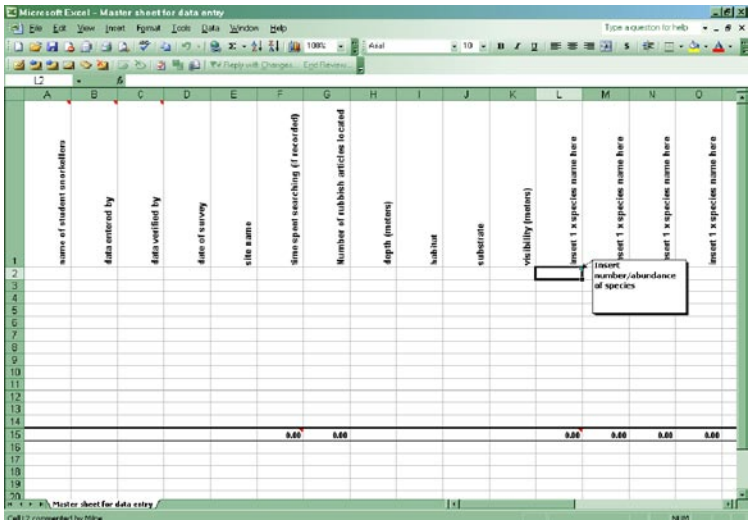
D1 – About data entry

Method

1. The objective of this activity is to enter data from a marine survey and explore how to analyse presence and absence of species over time.
2. Enter data from the MarineWatch survey onto the 'Master' spreadsheet (File D2.1) provided (or adapt the spreadsheet to create your own). Columns are provided to record the names of those collecting, entering and verifying (checking) data – encouraging a sense of ownership over the data set. All data from MarineWatch surveys is entered onto a master spreadsheet like the one shown in figure 1. Pop up comments have been inserted with additional information about data entry – these are identified by a small red mark in the top right hand corner of a cell. Data from each year can be entered into this sheet.

ACTIVITY: D2 (CONTD.)

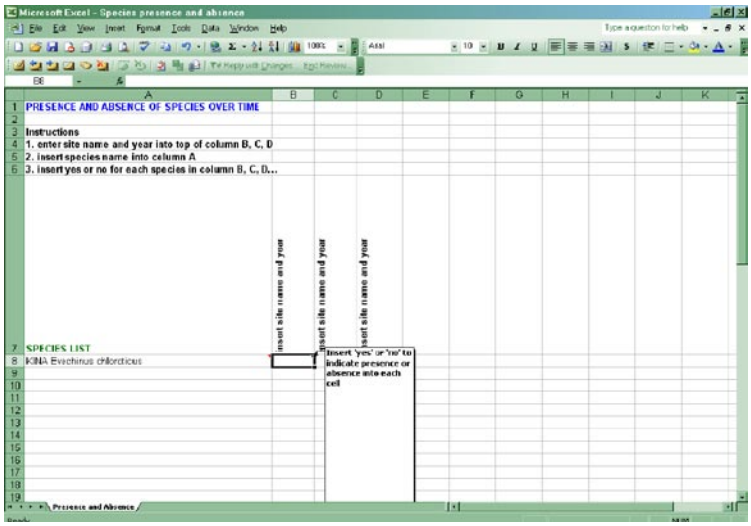
Figure 1. Master spreadsheet for data entry (D2.1)



compare data over time.

4. Explore the basic concept of presence and absence of species and how this might be a useful environmental indicator over time.
5. Enter presence and absence data from the survey. A very basic presence and absence spreadsheet (File D2.2) with a simple table like the one shown in figure 2 is provided. Pop up comments have been inserted with additional information about how to enter data - these are identified by a small red mark in the top right hand corner of a cell.

Figure 2. Species presence and absence spreadsheet



ACTIVITY: D2 (CONTD.)

6. Discussion and reflection
   - What have you learnt about collecting and entering data from this activity?
   - Why is data entry an important aspect of a marine survey?
   - What reasons can you think of for having a master data entry sheet?
   - Why might we look at the presence and absence of species?
   - Are there large variations in numbers of a species recorded by different buddy pairs and why might this be?

Extension exercises and possible next steps

- D3 – Working out species abundance – this activity uses marine survey data to work out species abundance.
- Use data to create a table or pie chart showing the presence or absence of species
- Use data to work out percentages, such as the number of students that spent longer than fifteen minutes or thirty minutes in the water
- Determine the average time spent in the water by students – compare how long boys were in the water with how long the girls were in the water!
- Compare body fat (do the pinch test!) with time spent in the water!
- Compare results from different students and draw conclusions about the confidence we can have in those results (high or low variability)
- Calculate the average number of rubbish articles found per square metre
- Generate a graph that compares the average number of rubbish articles found per square metre at one site with another or over years

ACTIVITY: D3

Activity Title:	Working out species abundance
Environmental Education Aspect:	About the environment; With the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability
Curriculum Links:	Science, Maths
Suggested Curriculum Level:	Any

Focusing Questions

How do we work out the abundance of a species?

Resources required

- MarineWatch data (from field survey activity C1 or C2)
- Computer access
- Excel software
- MarineWatch CD containing the following two files: 1. calculating abundance instructions (Filename D3.1Calculating abundance instructions) spreadsheet and 2. species abundance graph spreadsheet (Filename: D3.2Abundance graphs)

Prior Learning

A4 – Species ID

A8 – MarineWatch rocky reef snorkel survey

A9 – How to do the survey

C1 – MarineWatch rocky reef snorkel field survey (or C2)

D1 – About data entry

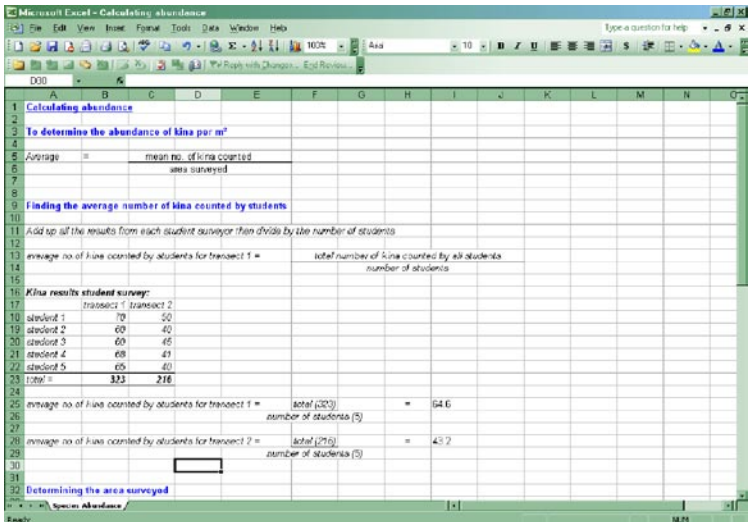
D2 – Entering data and the presence and absence of species

Method

1. The objective of this activity is to work out the abundance of a species using data collected from a marine survey.
2. Review the 'calculating abundance instructions' spreadsheet (file D3.1) (see figure 3) and calculate abundance for each species surveyed.

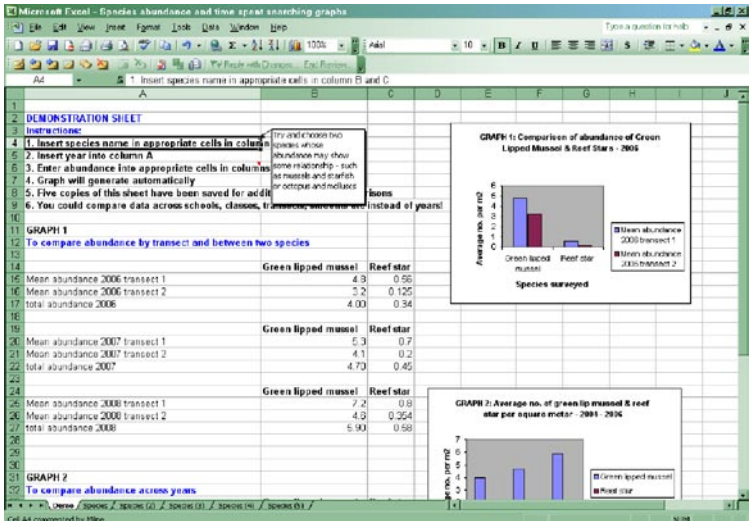
ACTIVITY: D3 (CONTD.)

Figure 2. Calculating abundance instructions spreadsheet



3. Open the abundance graphs spreadsheet (file D3.2). Follow the instructions provided. There are six sheets in this file. The first is a demonstration sheet (as pictured in figure 4) the next five sheets are set up for data entry and will automatically generate graphs like the ones shown on the demonstration sheet. The sheets are labelled Species, species (2), species (3).....and can accessed by clicking on the white tabs at the bottom left of the spreadsheet.
4. Comparing species abundance between transects are the only single species comparisons that can be made in the first year of the survey. For an excellent lesson in ecology and the interconnectedness of the things we can also look for relationships between species. For kina and macro algae, octopus or star fish and molluscs. We might find a relationship between these species. Comparisons can be made across transects, sites and schools and after a second set of data is collected, over time.

Figure 4. Species abundance and time spreadsheet



ACTIVITY: D3 (CONTD.)

5. Discussion and reflection
   - Why might we want to work out species abundance?
   - What can we learn about a species by comparing its abundance year by year?
   - Why do you think regimenting data collection procedures might be important in terms of data and results of a survey?
   - Why do you think scientists place such emphasis on being highly disciplined in their collection of data?
   - What relationship would we expect to see between mussel and starfish abundance?

Extension exercises and possible next steps

- Calculate the mean, medium and mode number of kina (or any other species) counted by students
- Determine the size of the area surveyed in m_
- Calculate the average number of kina (or any other species) per square metre
- Generate a graph that compares the average number of kina (or any other species) found per square metre with other sites or over years, title graphs and label the axes.
- Compare abundance between species such as kina and macro algae, octopus and molluscs, starfish and molluscs
- Conduct a species identity test the day before the field day to assess the level of species recognition. After data collection, look at their mean level of recognition and the accuracy (i.e. variability) of their data collection to find a possible correlation
- Discuss the concept of outliers and their effect on data interpretation
- Use ratios to look at the relationship between predator and prey – for example you could use a specie of mollusc and a starfish or octopus
- E1 – Conservation of marine biodiversity and marine protected areas – a set of PowerPoint slides exploring what we know about marine biological diversity and introducing the concepts of marine reserves and marine protected areas
- E2 – Taking action to improve the local marine environment – an opportunity to reflect on what has been learnt in this unit of study and to present to the local community, this learning and any actions required to protect the local marine environment

ACTIVITY SET E – KAITIAKITANGA & TAKING ACTION

E Kaitiakitanga & taking action						
Activity Title	Nature of Activity	Focussing Question	Environmental Education aspect and concept	Curriculum Area	Suggested Curriculum Level	Page
E1 Conservation of marine biodiversity and marine protected areas	PowerPoint slides and discussion	How much do we know about marine biological diversity? What are marine protected areas and how do they conserve the marine environment?	About and With the environment Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability	English Social Science	Any	97
E2 Taking action to improve the local marine environment	Brainstorm and discussion	What have we learnt about the local rocky reef environment? What action can we take to improve or maintain the quality of the local rocky reef environment?	About and With the environment Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability	English Social Science	Any	98

ACTIVITY: E1

Activity Title:	Conservation of marine biodiversity and marine protected areas
Environmental Education Aspect:	About the environment; With the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability
Curriculum Links:	Science, English
Suggested Curriculum Level:	Any

Focusing Questions

How much do we know about marine biological diversity? What are marine protected areas and how do they conserve the marine environment?

Resources required

- PowerPoint slide set E1

Prior Learning

- All relevant but none required

Method

1. The objective of this activity is to explore in more detail how much we know about marine biological diversity and the role that marine protected areas can and do play in conserving marine biodiversity in New Zealand.
2. View the PowerPoint slide set E1 before using it with the class. Identify good places to stop for discussion.
3. Use the PowerPoint Presentation to overview the marine biological diversity and marine protected areas.
4. As a class discuss and reflect on the following:
    - How much do we really know about our marine biodiversity?
    - Were you surprised to discover how little of the coastline has been surveyed?
    - Where are your local marine reserves?
    - Are there any other local marine protection mechanisms currently in place – such as marine parks or rahui?
    - Do you think marine reserves are a good idea? Why or why not?

Extension exercises and possible next steps

- Check out the Department of Conservation website for more information on marine biodiversity, marine reserves and marine protected areas – www.doc.govt.nz
- E2 – Taking action to improve the local marine environment – an opportunity to reflect on what has been learnt in this unit of study and to present to the local community, this learning and any actions required to protect the local marine environment.

ACTIVITY: E2

Activity Title:	Taking action to improve the local marine environment
Environmental Education Aspect:	About the environment; With the environment
Environmental Education Concept:	Taking personal and social responsibility for action; Biodiversity; Interdependence; Sustainability
Curriculum Links:	English, Social Science
Suggested Curriculum Level:	Any

Focusing Questions

What have we learnt about the local rocky reef environment? What action can we take to improve or maintain the quality of the local rocky reef environment?

Resources required

- Large paper and pens or white board
- Action planner template (reproduced on the following page)

Prior Learning

ALL

Method

1. The objective of this reflect on what we have learnt about the local rocky reef environment and use this knowledge to determine what action can be taken to improve or maintain the quality of the local rocky reef environment.
2. Reflect on the learning and experiences during this unit of study.
3. In small groups conduct a brainstorming exercise reflecting on what has been learnt whilst studying about the rocky reef environment. Record answers on the board or A3 paper. The following questions can be used to guide this inquiry:
   - What are the most interesting, surprising and important things you have learnt about rocky reef environment?
   - What information can you report about the state of your local rocky reef environment?
   - Develop a plan of action. (The action planner template on the following page might be useful here.) What action at an individual, group and community level do you feel can be taken to conserve your local rocky reef environment (including the animals and plants that live there)?
   - Develop an implementation strategy. How do you propose this action be taken? What will you take on as a group and as individuals to do, to help conserve your local rocky reef environment?
4. Nominate a spokesperson and present back to the rest of the class.
5. As a class discuss:
   - What actions you wish to take and develop an action plan
6. Discuss with students the idea of sharing their learning and plan of action in a presentation to be delivered to the rest of the school and/or their whanau and family and/or marae or wider local community.

ACTIVITY: E2 (CONTD.)

7. From this exercise develop the presentation and deliver to the school or local community
8. Discussion and reflection
    - How have our attitudes and knowledge about the marine environment altered through the course of this unit of learning?
    - What new things have we learnt?

Extension exercises and possible next steps

- Explore the use of marine protected areas (MPAs) & marine reserves as a marine conservation tool for your local area
- Discuss careers in the marine environment
- Make a poster illustrating the problems facing your marine environment that describes – what the problem is, what impact it has on the marine environment and how it could be remedied
- Decorate your classroom as though it was the marine environment
- Dress up, act and move to music like a marine animal – guess what animal your classmates are pretending to be
- Make a play or write a song that shows what you see is happening in your marine environment
- Write an essay about marine protected areas. What are they, where are they and what are they like?
- Draw a flow chart illustrating how to go about getting a marine reserve
- Watch a video or DVD about marine protected areas
- Take action to improve the quality of your marine environment. For example you could conduct a beach clean up, make a submission or write an article or letter for the paper

WORKSHEET

Action planner template (adapted from an Action Planner produced in Environment Bay of Plenty, Rotorua Lakes Education Resource)

What is our vision?

What skills do we need?

Who will be involved in making the final decision?

How will we know what people think and feel?

Who do we need to involve?

What resources or information do we need?

How can we communicate with others about our project?

APPENDICES

Bibliography

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Francis, M. 2001 Coastal Fishes of New Zealand, 3rd edition. Reed Publishing, Auckland.

Stace, G. 1997. What's on the beach? Penguin books, Auckland.

Stace, G. 1997. What's around the rocks? Penguin books, Auckland.

Teacher feedback form

TEACHING RESOURCES	
How useful did you find the resource kit (activities, worksheets, information sheets and PowerPoint etc)? Comments:	Please circle the appropriate number 5 4 3 2 1 Excellent ← **Average** ← Poor
FIELD SURVEY AND DATA ENTRY	
How did you find the field survey (consider the overall concept, the instructions, methodology, level for your students and quality of learning)? Comments:	Please circle the appropriate number 5 4 3 2 1 Excellent ← **Average** ← Poor
DATA ENTRY	
How useful were the data entry spreadsheets? Comments	Please circle the appropriate number 5 4 3 2 1 Very useful ← **Useful** ← Not very useful
OVERALL	
Overall how would you rate the MarineWatch rocky reef snorkel survey as a learning experience for your students? Overall comment	Please circle the appropriate number 5 4 3 2 1 Wonderful ← **Average** ← Poor

GLOSSARY – A LIST OF SCIENTIFIC WORDS

Abundance – the number of individuals of a species in a location

Common species name – names given to individual species that are commonly used by people such as snapper or gurnard (different to scientific names)

Data – a word used by scientists to describe information collected from a marine survey

Diversity – in this case we are talking about species diversity, meaning the variety of animals and plants

Habitat – the natural environment where an animal or plant lives

Indicator species – an animal or plant whose abundance or presence can be used to assess the general state of the environment

Marine survey – surveying marine life means looking at the number, size or variety of marine animals or plants in an area

Monitoring – monitoring means looking at the number, size or variety of marine animals over time

Scientific name – names given to species by scientists so that each species can be identified by it's own special name. These names are written in Latin and there are no two species names that are the same.

Species – the name for a group of animals or plants that can breed together

Survey area – survey areas are sites chosen for survey with clear boundaries

Species names – Species have common names, like 'spotty', Maori names like 'Pākirikiri' and scientific names like 'Notolabrus celidotus'. Scientific names are in Latin.

Spreadsheet – a computerised table for entry of data or information collected from a marine survey. Graphs can be created from information entered onto spreadsheets.

Transect line – a line used by scientists in marine surveying. A transect line is normally a specified length (like 50m) and has markings along it just like a tape measure.