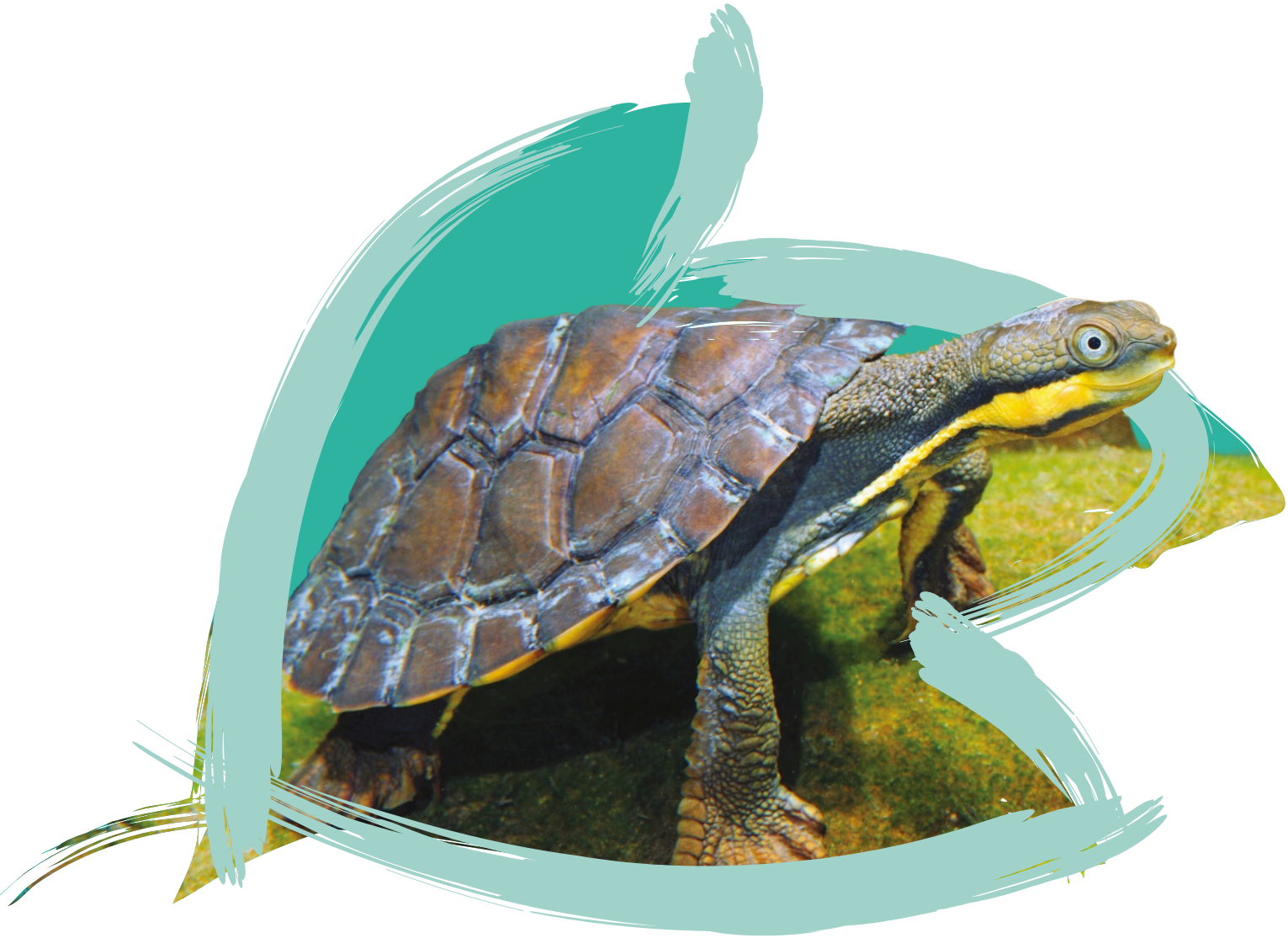
NSW GOVERNMENT

SAVING OUR SPECIES

Manning River helmeted turtle: On the edge

Teacher resource
Stage 6 Biology, Module 4: Ecosystem Dynamics



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Acknowledgement of Country

The Department of Climate Change, Energy, the Environment and Water acknowledges the Traditional Custodians of the lands where we work and live. We celebrate the diversity of Aboriginal peoples and their ongoing cultures and connections to the lands and waters of New South Wales.

We pay our respects to Elders past, present and emerging.

This resource may contain images, or names of deceased persons in photographs or historical content.

Cover photo: Manning River helmeted turtle (Gary Stephenson/DPE)

Published by:
Environment and Heritage Group
Department of Climate Change, Energy, the Environment and Water
Locked Bag 5022, Parramatta NSW 2124
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment and Heritage enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
Speak and listen users: phone 1300 555 727, then ask for 1300 361 967
Email info@environment.nsw.gov.au
Website www.environment.nsw.gov.au
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Contents

About this resource 1

Working Scientifically outcomes 2

Activities in the workbook 3

Module 1 Questioning and predicting 4

1.1 Determination of species and ecological communities as threatened 4

1.2 Influence of abiotic factors on the Manning River helmeted turtle 10

1.3 Influence of biotic factors on the Manning River helmeted turtle 12

1.4 Developing questions and hypotheses – Research 13

Module 2 Planning investigations 18

2.1 Does researching the Manning River helmeted turtle matter? 18

2.2 Site selection 20

2.3 Ethical considerations 24

2.4 Risk assessment 25

2.5 Examples of qualitative survey data 26

2.6 Examples of quantitative survey data 27

2.7 Fieldwork equipment 29

Module 3 Conducting investigations 33

3.1 Recording fieldwork 33

3.2 Recording qualitative data 36

3.3 Recording quantitative data 38

Module 4 Processing and analysing data and information 48

4.1 Interpreting qualitative data 49

4.2 Interpreting quantitative data 50

4.3 Experimental validity 54

4.4 Reproduction and population demographics 55

4.5 Threatening processes 56

Module 5 Problem solving 58
5.1 Conceptual models 58
Module 6 Communicating 63
6.1 Title 63
6.2 Abstract 63
6.3 Introduction 64
6.4 Method – planning and conducting investigations 64
6.5 Results – processing data and information 64
6.6 Results – analysing data and information 65
6.7 Discussion – problem solving and limitations 65
6.8 Conclusion 66
6.9 References 66
Glossary 67
References 68
Online resources 69
Other links in this document 71
Appendix A: *Gloucester Advocate* article 73

About this resource

This workbook is a resource to support senior students learning about how conservation agencies monitor and manage threatened species. By investigating the Manning River helmeted turtle, students will learn the status of the Manning River helmeted turtle population through their access to recent data obtained by researchers working across the upper reaches of the Manning River.

This resource is for teachers to use with senior students as part of their depth study. Each Working Scientifically outcome has been interpreted as part of a suite of learning experiences to explicitly model the Working Scientifically process with the option of extending into a depth study.

The **bolded text** throughout the workbook indicates an instruction or inquiry question.
A **(G)** beside a specific term means it is explained in the glossary at the back of this workbook.

The  icon indicates the recommended student response.

The  icon indicates a video to watch and provide responses on.

Context

The inquiry question, ***'What effect can one species have on other species?'*** guides students' investigation of secondary evidence and gathering of primary data.

Each of the 7 Working Scientifically outcomes has been interpreted as part of a suite of learning experiences to explicitly model the Working Scientifically process with the option of extending into a depth study.

Each outcome represents one of the interdependent dynamic processes that are central to the study of science and the acquisition of scientific knowledge and skills.

The resource is focused on the threatened Manning River helmeted turtle (*Myuchelys purvisi*), a medium-sized, short-necked freshwater turtle found only in the middle and upper reaches of the Manning River catchment area.

The resource includes researchers' qualitative and quantitative data and analysis from recent surveys of the Manning River helmeted turtle and suggested fieldwork for students.

Students investigate the status of the Manning River helmeted turtle population through their access to recent data obtained by researchers working across the upper reaches of the Manning River. The purpose of this research was to obtain reliable and valid data on the Manning River helmeted turtle's abundance, distribution and age classes.

The researchers also took note of threats from changes to hydrology, water quality, introduced species, disease and hybridisation with other turtles. Continued research is crucial to planning actions to secure viable future populations of Manning River helmeted turtles.

Working Scientifically outcomes

Questioning and predicting

Secondary sources inspire questions and hypotheses about changes to the conditions impacting populations of Manning River helmeted turtles.

Planning investigations

Collection of data through fieldwork requires thorough planning of risk assessments, ethical issues, methods and equipment.

Conducting investigations

Fieldwork enables collection of primary qualitative and quantitative data using methods including photos and recording of habitat indicators.

Processing data and information

Selecting and processing qualitative and quantitative data about the habitat of the Manning River helmeted turtle.

Analysing data and information

Data analysis clarifies trends, patterns and relationships determined through a valid, accurate and reliable process.

Problem solving

Apply and evaluate models to make predictions and solve problems, in this instance problems relating
to a poorly understood threatened species.

Communicating

Students create a scientific report for a specific audience or purpose; for example, a video, flyer, PowerPoint, oral presentation to inform residents of the issues and environmental impacts of threats such as human activities, a changing climate, increased predation and loss of habitat on a specific species or ecological community. They appropriately apply and use scientific language.

Students, just like scientists, learn by doing. The NSW Department of Education environmental and zoo education centre (EZEC) network can support teachers and students to conduct the fieldwork that supports the application of this study guide.

Activities in the workbook

1. Research threatened species legislation and classification
2. Identify preferred abiotic factors for a species
3. Research the influence of biotic factors on a species
4. Develop inquiry questions and hypotheses

Extension activity: NSW freshwater turtle ecology

5. Review a research program
6. Create a research location map
7. Prepare a scientific licence
8. Complete a sample risk assessment for fieldwork
9. Plan fieldwork equipment requirements

Extension activity: Fieldwork plan

10. Review fieldwork plan
11. Review collected data
12. Review site descriptions
13. Investigate the data

Extension activity: Fieldwork journal

14. Describe habitat quality at survey sites
15. Interpret and assess quantitative data
16. Evaluate experimental validity
17. Construct a conclusion
18. Research threats and threatening processes
19. Using a conceptual model
20. Prepare a report

Module 1 Questioning and predicting

BIO11/12-1 develops and evaluates questions and hypotheses for scientific investigation.

Developing, proposing and evaluating inquiry questions and hypotheses challenges students to identify an issue or phenomenon that can be investigated scientifically by gathering primary and/or secondary-sourced data. Students develop inquiry question(s) that require observations, experimentation and/or research to aid in constructing a reasonable and informed hypothesis. The consideration of variables is to be included in the questioning process (NESA 2017, p.22).

Questioning and predicting for pre-excursion learning – approximately 2 hours

1.1 Determination of species and ecological communities as threatened

Activity 1 Research threatened species legislation and classification

The NSW Threatened Species Scientific Committee is established under the *Biodiversity Conservation Act 2016*. It is an independent committee of scientists appointed by the Minister for the Environment. One of the main tasks of the committee is assessing the risk of extinction of a species in Australia and deciding which species should be listed as critically endangered, endangered, vulnerable or extinct in New South Wales. Almost 1,000 animal and plant species have been determined to be at risk of extinction in New South Wales.

1.1.1 **Use** the NSW Government website information about Species listing categories to complete Table 1 by listing and describing the categories given to threatened species and ecological communities **(G)** in New South Wales according to the level of threat they face.

Table 1 NSW threat categories

Threat category	Description
Critically endangered	Species and ecological communities are listed as critically endangered if they are facing an extremely high risk of extinction in Australia in the immediate future.
Endangered	Species or ecological communities are listed as endangered if they: • face a very high risk of extinction in Australia in the near future • are not eligible to be listed as a critically endangered species or ecological community.
Vulnerable	Species and ecological communities are listed as vulnerable if they: • face a high risk of extinction in NSW in the medium-term future, as determined by the criteria prescribed in the regulation • are not eligible to be listed as an endangered or critically endangered species or ecological community.
Extinct	Species are listed as extinct if there is no reasonable doubt that the last member of the species in Australia has died. Species that are listed as extinct in the wild are species known to survive in Australia in cultivation, in captivity or naturalised population outside the past range or that haven't been recorded in their habitat in Australia despite surveys in a timeframe appropriate to their life cycle and type.
Collapsed communities	Ecological communities where the natural occurrence of the ecological community has lost its composition, structure and function.

1.1.2 **Use** the NSW Threatened Species Scientific Committee website to list the functions of the committee in Table 2.

Table 2 Functions of the NSW Threatened Species Scientific Committee

Functions
1. Assessing the risk of extinction of a species in Australia and deciding on the threat category
2. Deciding if there are populations of species that should be listed as threatened (Note: Even though a species is not listed as threatened, it may have discrete populations that are threatened, e.g. coastal emus.)
3. Assessing the risk of extinction of an ecological community in Australia and deciding on the threat category
4. Deciding which key threats to native plants and animals should be declared key threatening processes under the *Biodiversity Conservation Act 2016* (BC Act) (see Key threatening processes).
5. Reviewing and updating the lists of threatened entities and key threatening processes under the *Biodiversity Conservation Act 2016*

1.1.3 **Read** the Threatened Fauna of the Hunter and Mid Coast – Manning River helmeted turtle resource. **Create** a profile of the Manning River helmeted turtle using Table 3.

Table 3 Profile of the Manning River helmeted turtle

Attribute	Description
Scientific name	*Myuchelys purvisi*
Other common names	Manning River turtle, *M. purvisi*
Threatened species status	Endangered
Distribution	Endemic to the middle and upper reaches of the Manning River catchment area. It has been recorded in the Barnard, Barrington, Cooplacurripa, Gloucester, Manning, Mummel, Nowendoc and Rowleys rivers as well as Bobin, Caparra, Dingo and Myall creeks.
Importance	Freshwater turtles are omnivores and top predators in their habitats. They play a critical role in maintaining the diversity of life in waterways. They help control aquatic vegetation, serve as scavengers and assist in maintaining healthy streams and rivers and are indicator species of aquatic ecosystem health.
Habitat and biology	Prefers clear streams that are 2–3 m deep, rocky rivers with in-stream boulders, logs, underwater caverns and deep pools. Diurnal (G), feeds on insects, fruit and water plants. Breed from Feb–Apr, lay up to 23 eggs in a single clutch per year. Likely restricted to aquatic environments and hibernates during winter.
Diet	They feed during the day on large insects, fruit and water plants.
Threats	Predation of nesting female turtles and nests by foxes, pigs and other predators; illegal collection; land management practices that degrade land, especially riparian zones; sedimentation of deep pools; competition and hybridisation with the introduced *Emydura macquarii*; changes to natural stream flows; invasive weeds; overgrazing by cattle and trampling of nests; disease; climate change; and poor understanding of its distribution, population size and ecology.
Identification	Medium-sized (~20 cm), short-necked turtle found in the Manning Valley. There is a distinct yellow stripe along the jaw and neckline as well as on the sides and underside of the tail. Distinctly, there are 2 short barbels (whisker-like protrusions) from the base of the lower jaw.

1.1.4 Up until 2020 the Manning River helmeted turtle was classified as a data-deficient species in the Saving our Species management structure.

What does data-deficient species mean?

We need to know more about the species before we can secure them in the wild.

There is not enough knowledge about their ecology, distribution, threats or management needs to inform an effective management strategy.

(Note: Following intensive research the Manning River helmeted turtle is no longer on this data-deficient list and is on the Saving Our Species Site-managed species list.)

1.1.5 Saving our Species is a state-wide program that aims to secure threatened plants and animals in the wild.

Watch the Saving our Species YouTube video
Read the Saving our Species program overview.
Explain how the Saving Our Species program will benefit threatened plants and animals.

The main objectives of SoS are simple: increase the number of threatened species that are secure in the wild in New South Wales for 100 years and control the key threats facing our threatened plants and animals.

The plight of the Manning River helmeted turtle inspired the community to establish the Manning River Turtle Conservation Group in 2017. **Read** the article from the *Gloucester Advocate* reproduced in Appendix A.

1.1.6 **Discuss** what the community was asked to do to contribute to the success of saving the Manning River helmeted turtle.

To report sightings to the Department of Climate Change, Energy the Environment and Water.

1.1.7 **Read** about the Manning River Turtle Conservation Group. List 3 actions they have taken to help save the Manning River helmeted turtle.

Advocacy work, winter solstice parade, restoring rivers, Waterwatch programs, educating landholders.

Figure 1. Manning River helmeted turtle. (Gary Stephenson/DPE)

1.2 Influence of abiotic factors on the Manning River helmeted turtle

Abiotic **(G)** factors provide essential non-living resources for species to exist. A species' distribution is a consequence of climate, topography and patterns of water movement over thousands of years.

Activity 2 Identify preferred abiotic factors for a species

1.2.1 **Watch** the video Manning River Turtle 2017 by Wild Aquarium and reptile specialists.
Revisit the Threatened Fauna of the Hunter and Mid Coast – Manning River helmeted turtle resource and Manning River helmeted turtle endangered species listing.
Identify the abiotic **(G)** factors preferred and/or optimal conditions for the Manning River helmeted turtle.
Complete Table 4.

Figure 2. Screenshot of YouTube video Manning River turtle 2017 by Wild Aquarium and Reptile Specialists

- Gravel and sandy loam
- Clear streams
- 2–3 m deep streams, still and flowing water
- Habitat features such as in-stream boulders, logs and deep pools
- Rainfall distributed throughout the year
- Areas protected from flooding
- Direct sunlight
- Well oxygenated
- Upper reaches 100–600 m above sea level

1.2.2 **Tick** the correct boxes in Table 4.

Table 4 Preferred abiotic factors and optimal conditions for the Manning River helmeted turtle

Abiotic factor	Which does the Manning River helmeted turtle prefer?			
Soils for nesting	Gravel and sandy loams	☐	Sandy clay	☐
Topography	Permanent headwaters with a variety of riffles, pools and adjoining alluvial flats	☐	Restricted narrow stream beds dominated by rock and boulders	☐
Water clarity	Turbid (suspended matter in the water reducing clarity)	☐	Clear	☐
Water temperature	Warm	☐	Cold	☐
Water flows	Deep, still and slow-flowing water	☐	Patchy disrupted flow patterns prone to drying up	☐
Rainfall	Distributed throughout the year	☐	Distinct wet and dry season	☐
Sunlight	Direct sunlight	☐	Deep shade	☐
Flooding	Flooding keeps banks and beaches clear of vegetation, providing nesting sites	☐	Areas that are well protected from floods	☐
Oxygen	Well oxygenated water for respiration	☐	Stagnant pools with low levels of oxygen	☐
Elevation (G)	100–600 m above sea level	☐	0–100 m above sea level	☐

1.3 Influence of biotic factors on the Manning River helmeted turtle

Biotic **(G)** factors are all the living organisms within an ecosystem and the different interactions between the same species and between different species. These interactions include predation, competition and symbiotic **(G)** relationships.

Activity 3 Research the influence of biotic factors on a species

Use the Threatened Fauna of the Hunter and Mid Coast – Manning River helmeted turtle resource and online sources such as the Manning River helmeted turtle scientific listing if necessary, to answer the following questions.

1.3.1 **Describe** the impact of predation by foxes on Manning River helmeted turtle populations.

Direct mortality to breeding females and nests, reducing the reproductive output and lowering the population.

1.3.2 Why might **hybridisation** **(G)** with the Murray River turtle (*Emydura macquarii*) be a threat to the Manning River helmeted turtle?

Loss of genetic integrity/uniqueness/evolutionary distinctiveness. May also inherit maladaptive traits (traits that are not beneficial to their survival).

1.3.3 Disease is listed as a potential threat to the Manning River helmeted turtle.

Read this article about disease in a closely related turtle species (Bellinger River snapping turtle) and describe the impacts it had on the population.

The disease attacked the internal organs of the turtles and caused rapid mortality. It was estimated to wipe out over 300 individuals.

1.3.4 **List** other biotic **(G)** factors that have an effect on Manning River helmeted turtle populations.

Food availability, nesting success, competition with invasive species.

1.4 Developing questions and hypotheses – Research

In 2019, the NSW Government commissioned a series of studies to find out more about the Manning River helmeted turtle. The 3 studies were for the northern and western catchments and the middle reaches of the Manning River (Chessman 2019; Redleaf Environmental 2019; Spark 2019).

Activity 4 Develop inquiry questions and hypotheses

1.4.1 **Read** the NSW Government aims for researchers contracted to collect primary evidence about the population dynamics of the Manning River helmeted turtle as shown in Figure 3.

Project aims, Manning River helmeted turtle survey project (Redleaf Environmental, 2019 p.2)

The aim of this project is to assist the recovery of the Manning River Helmeted Turtle (*Myuchelys purvisi*), a species endemic to the Manning River system and listed as endangered under the NSW *Biodiversity Conservation Act 2016*. It has been assigned to the Data-deficient stream of the Saving our Species program that is administered by the NSW Office of Environment and Heritage. The specific aims are:

- Build a better understanding of the distribution of [*M. purvisi*] in the Manning valley
- Build a better understanding of the distribution of *Emydura macquarii* in the Manning valley
- Understand the extent, **prevalence** and severity of threat to [*M. purvisi*]
- Provide the basis for the development of site-based management activities
- Contribution to movement of this species from the data-deficient management stream.

These objectives form part of a larger program to manage [*M. purvisi*]. Data collected as part of this scope will be used to inform a change in management streams and subsequent management and monitoring actions.

To help achieve these aims, the project aimed to undertake trapping and hand capture of *M. purvisi* at numerous locations to determine the extent of its distribution, its population **demographics** and health and the threats to the species, in particular, the distribution and abundance of, and possible hybridisation with, the Macquarie turtle, [*E. macquarii*], which is believed to have been introduced to the Manning River system. The results of these surveys will help to identify specific locations where targeted programs will be implemented to further assist the recovery of the *M. purvisi*. The surveys will provide the basis of an ongoing monitoring program where capture effort at selected locations will be replicated in subsequent years.

Figure 3. Project aims, Manning River helmeted turtle 2019 autumn survey project – Redleaf Environmental 2019, p.2

Based on these aims **develop** an inquiry question to guide researchers' primary data collection about population dynamics of the Manning River helmeted turtle.

What is the distribution of the Manning River helmeted turtle?

1.4.2 **Create** a reasonable and informed hypothesis to collect **quantitative** data to address the inquiry question.

Manning River helmeted turtles will most likely be found in the mid to upper sections of the river with the following criteria:

- relatively undisturbed areas
- clear streams 2–3 m deep
- rocky rivers where in-stream boulders are common
- logs and underwater caverns and deep pools are common
- overhanging vegetation.

Extension activity: NSW freshwater turtle ecology

Some students may be required to plan and undertake fieldwork related to this investigation. Heading into the upper reaches of the Manning River in search of Manning River helmeted turtles is neither practical nor permitted.

As an alternative set of extension activities students might choose a first-hand inquiry to assess the suitability for turtles of a freshwater habitat in their local area.

1.4.3 **Complete** Table 5 to describe the 6 other freshwater turtle species that occur in New South Wales.

Table 5 Other freshwater turtle species found in New South Wales

Species	Physical description	Distribution	Habitat / diet	Threats
Scientific name: *Chelodina longicollis* Common name: Eastern long-necked turtle (alternative: snake-necked)	Easily distinguished by its wide plastron (the under part of the shell), made up of pale-yellow shields with black margins, with webbed feet used for swimming and digging. The colour of the carapace varies through shades of brown	Occurring in freshwater bodies throughout NSW with the exception of the highest parts of the Alps, also found in Queensland, Victoria, south-eastern South Australia	Carnivorous species, feeding mostly on small invertebrates such as worms, snails and insect larvae, including mosquitoes	Crossing roads – vehicle impacts
Scientific name: *Chelodina expansa* Common name: Broad shelled turtle	Distinguished from long-necked turtles by plastron (underside of shell) being narrow and lacking black lines. Plastron does not cover limbs when retracted	Queensland: from Rockhampton southwest through the coastal and interior areas to Western New South Wales and the Murray River drainage, and on Fraser Island off Queensland; South Australia, Victoria	Carnivorous, feeds on fish, shrimps and detritus	By-catch, parasites
Scientific name: *Emydura macquarii* Common name: Macquarie River turtle	Olive green or bronze carapace, cream underneath, short neck relative to other species	Occurs in most river systems in eastern Australia, most common in the Macquarie River Basin	Omnivorous, feeds on algae, diatoms, fungi, macrophytes, shoots, leaves, fish and invertebrates	Water extraction, predation, habitat loss

Species	Physical description	Distribution	Habitat / diet	Threats
Scientific name: *Myuchelys latisternum* Common name: Eastern saw-shelled turtle	Small to medium-sized short-necked turtle with saw-toothed rear edge along its upper shell or carapace, although this feature is not always present in adults. Its plastron colour is variable. Like other species of its genus it has a hard cap on the top of its head	Inhabits deep to shallow pools and lagoons on permanently-flowing waterways, particularly in the upper reaches and side channels of larger rivers. It is found in rivers of the NSW north coast and hinterland as far south as the Richmond River system, and also occurs in Queensland and the Northern Territory	Chiefly carnivorous, however, omnivorous diet, consuming both plants and animals	No significant conservation threats identified
Scientific name: *Myuchelys bellii* Common names: Western saw-shelled turtle, Namoi River snapping turtle, Bell's turtle	A uniform light to dark brown colour with a broad oval shape. Often have pinkish or yellowish streaks and patches on the lower side of their head and body and a blackened plastron. The largest species in the *Myuchelys* genus	Found in northern NSW and just across the border in Queensland, inhabiting the upper reaches of the Border Rivers, Gwydir and Namoi river systems	Omnivorous, have been reported to eat fallen fruit as well as water plants, algae and insects	Ongoing loss of vegetation adjacent to rivers and streams Loss of lotic **(G)** habitat due to water resource development Land clearance and livestock grazing has increased turbidity and filling of deep pools
Scientific name: *Myuchelys georgesi* Common name: Bellinger River snapping turtle	Moderately large species, has pale-yellow band on side of head and neck, a marbled light plastron with greenish-blue tinge. Tail lacks bright markings, 5 claws present on both webbed forelimbs, carapace lacks central groove	Endemic to the Bellinger Catchment on the north coast of NSW. Virally infected 60 km stretch of the Bellinger River in Northern NSW. Their preferred habitat is moderate to deep pools with rocky layers	Diet is largely omnivorous, with a tendency toward carnivorous	Viral infection Habitat destruction / riparian zone degradation Predation of nests and nesting females by foxes Poaching of animals Hybridisation with Murray River turtle

1.4.4 Which turtles from Table 5 might occur in your local area? Select a local freshwater habitat and assess its suitability against a turtle that's likely to be found in your area.

Module 2 Planning investigations

BIO11/12-2 designs and evaluates investigations to obtain primary and secondary data and information.

Students justify the selection of equipment, resources chosen and design of an investigation. They ensure that all risks are assessed, appropriate materials and technologies sourced, and all ethical concerns are considered. Variables are to be identified as independent, dependent and controlled to ensure a valid procedure is developed that will allow for the reliable collection of data. Investigations should include strategies that ensure controlled variables are kept constant and an experimental control is used as appropriate (NESA 2017, p.23).

2.1 Does researching the Manning River helmeted turtle matter?

Activity 5 Review a research program

2.1.1 **Watch** the video Searching for the Manning River Turtle with Dr Bruce Chapman, NSW Office of Environment and Heritage 2013 (2:18 min.)

Figure 4. Screenshot of YouTube video Searching for the Manning River Turtle

2.1.2 **Describe** the purpose of Dr Chessman's research.

To determine the current distribution of the Manning River helmeted turtle, how abundant they are and whether they need conservation measures.

2.1.3 **List** the different variables demonstrated or most probable in Dr Chessman's research using Table 6.

Table 6 Manning River helmeted turtle research variables

Type of variable	Examples
Dependent variable/s *What was being measured?*	Abundance Area of occupancy (distribution) Extent of occurrence (distribution) Carapace length, width (age inferred) Weight, sex
Independent variable/s *What was being changed?*	Sites
Control *What was being kept the same?*	Capture methodology and measurements taken

2.1.4 **Describe** the concern Dr Chessman has about the data collected and explain the reason for his concern.

No observations of juvenile turtles to date.

This suggests there is little breeding activity.

2.2 Site selection

The 2019 survey contracted by the Office of Environment and Heritage (now the Department of Climate Change, Energy, the Environment and Water) required researchers to investigate populations of Manning River helmeted turtles in the upper reaches and more inaccessible locations of the Manning River catchment.

Sites selected needed to be suitable for trapping with deep, still or slow-flowing water to provide essential daytime habitat for the Manning River helmeted turtle (see Figure 5).

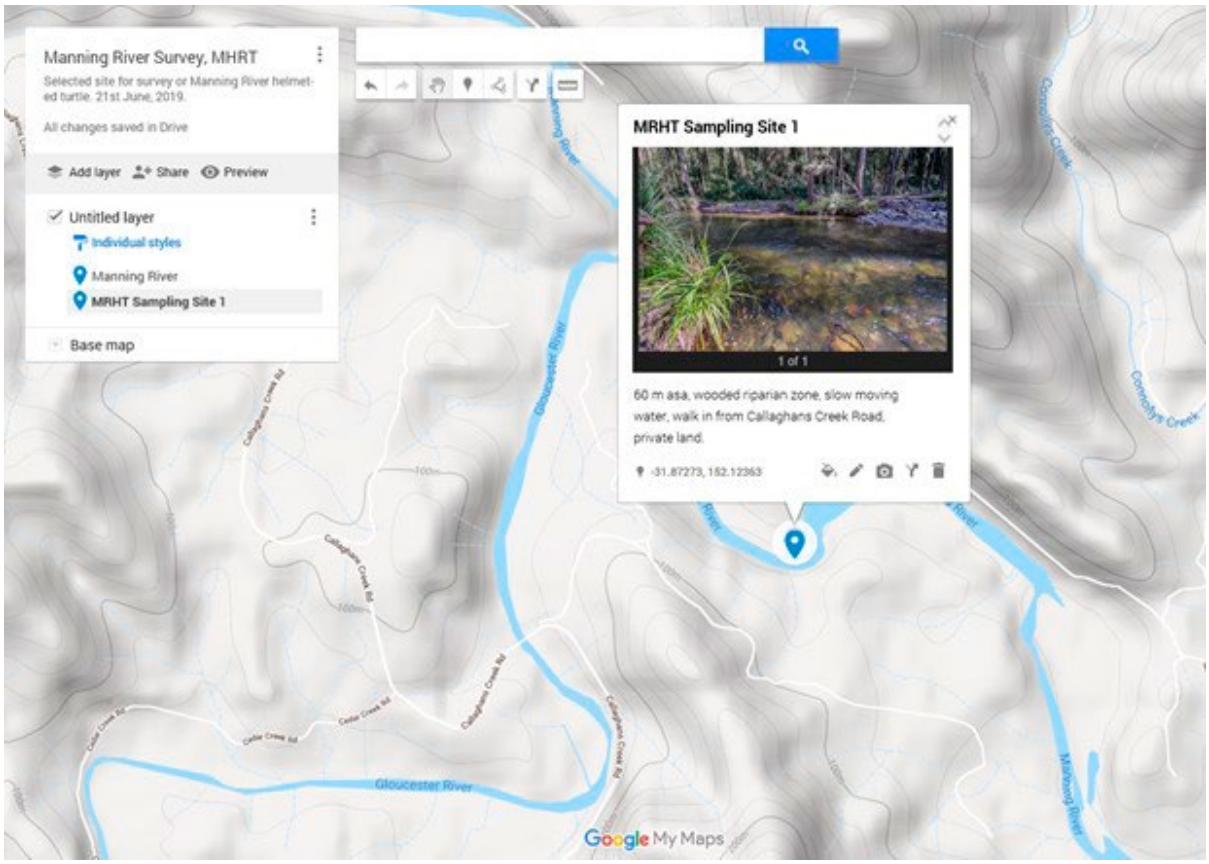


Figure 5. Screenshot of Google My Maps showing a potential Manning River helmeted turtle habitat sampling site

Activity 6 Create a research location map

2.2.1 Use the following instructions to **create** a location map of the upper reaches of the Manning River catchment using Google My Maps.

1. Sign in to Google My Maps.
2. Click 'CREATE A NEW MAP'.
3. In the search box type either Manning River or another of the Manning River catchment rivers; for example, Mummel River, Cooplacurripa River, Rowleys River or Gloucester River (Figure 6).

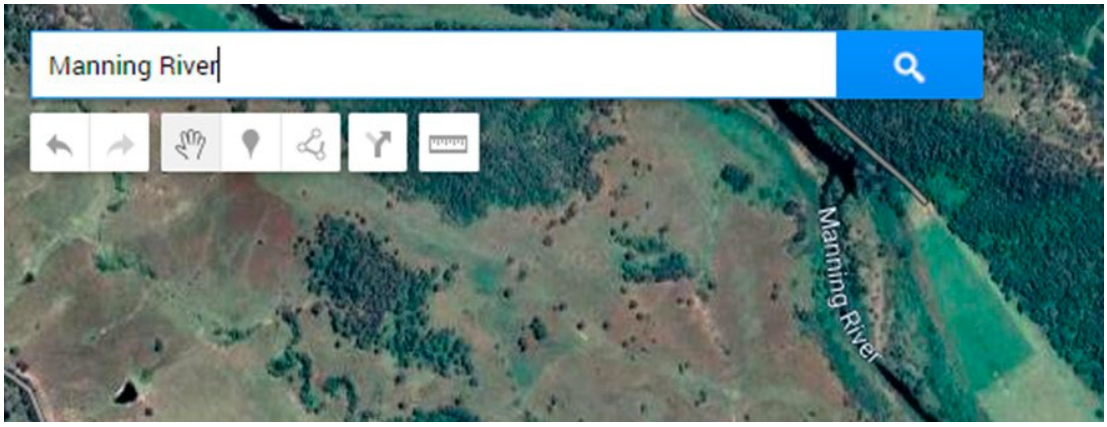


Figure 6. Screenshot of Google My Maps with one of a number of possible Manning River catchment rivers in the search box

4. **Select** 'Base Map' (Figure 7).

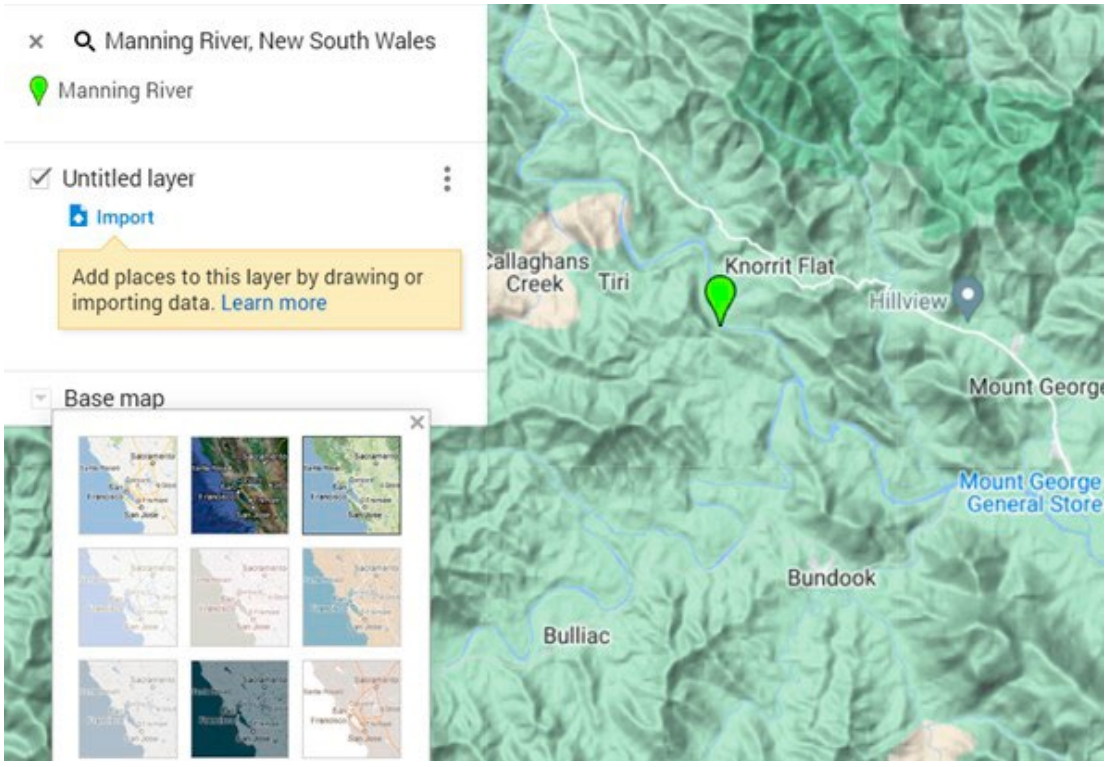


Figure 7. Screenshot of Google My Maps with 'Base map' selected

5. **Change** the style to terrain and **increase** the scale of the map until you can see details including contour lines, river names, creeks, access roads, property names, conservation (Figure 8).

Figure 8. Screenshot of Google My Maps with 'Terrain' selected, and scale increased

6. Go to the top left and click 'Untitled map'.
7. Give your map a name and description and save (Figure 9).

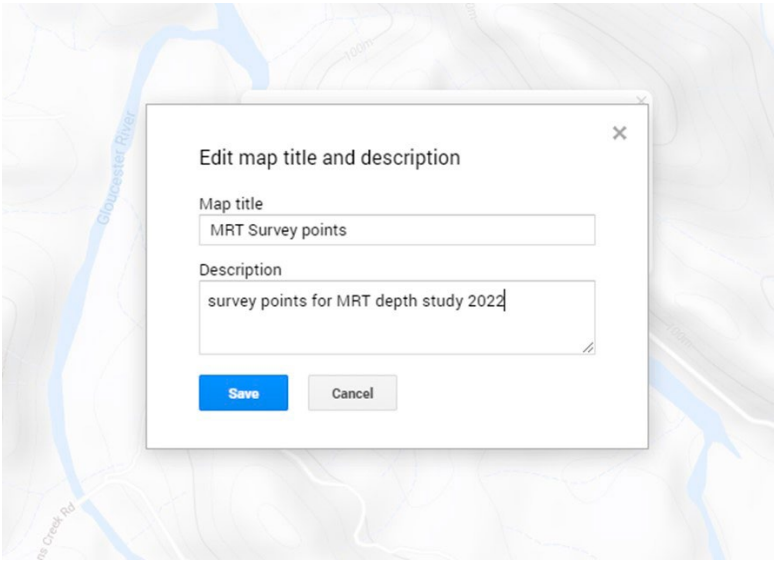


Figure 9. Screenshot of Google My Maps with map title and description

8. **Choose** a sampling site with deep, still or slow-flowing water.
   For example, an inside bend of the river on a river flat with vegetation close by.
9. To mark your sampling site use the 'Add marker' tool below the search box.
10. Give your sampling site a name (Figure 10). Add a description of the site such as access, landowner, land-use; for example, agriculture or conservation area. Add a relevant photo.

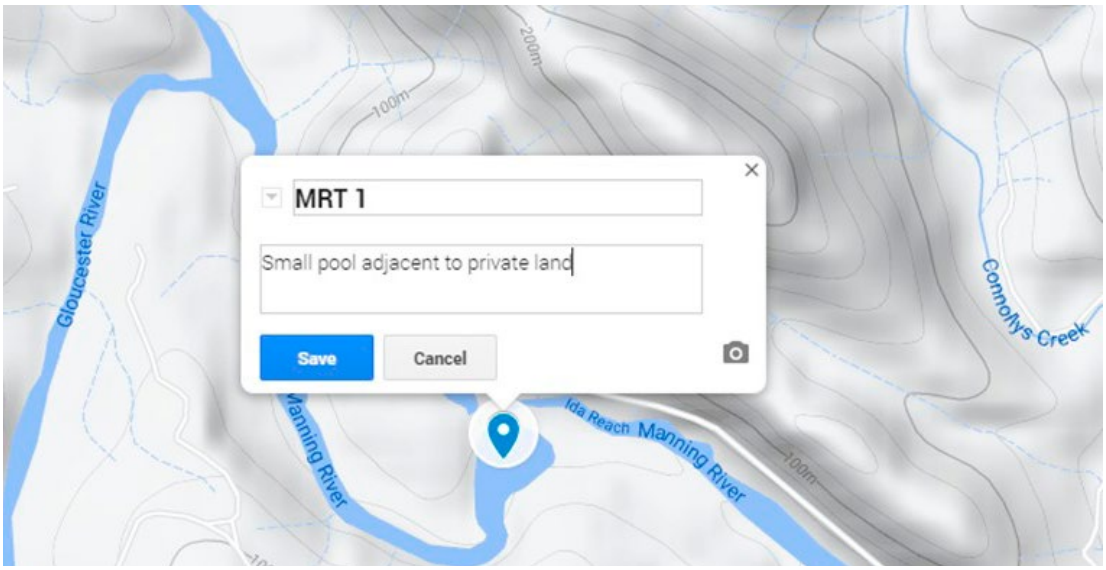


Figure 10. Screenshot of Google My Maps with marker, name and description of site

11. Click save.
12. Click on the 'Share' tab and set the map sharing rules to 'Anyone with this link can view' (Figure 11).

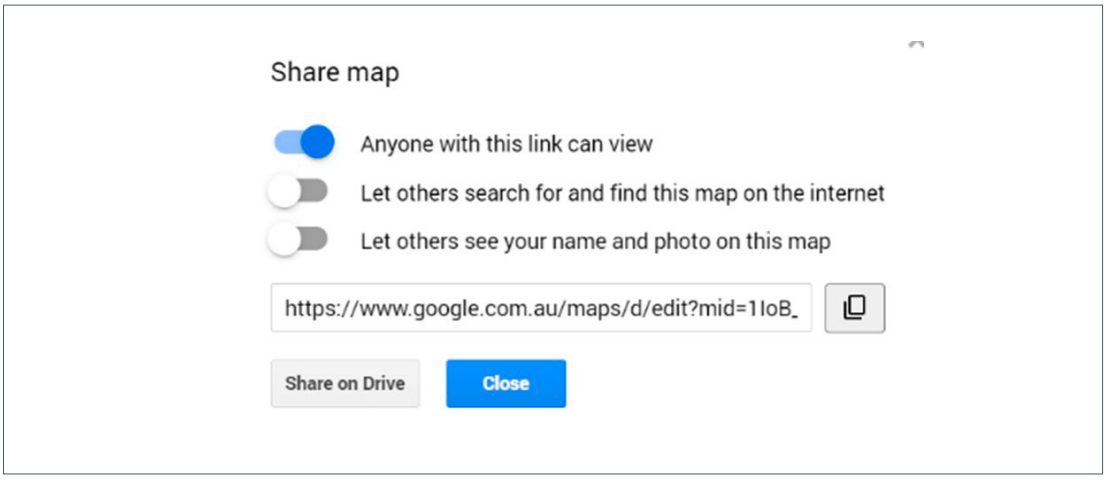


Figure 11. Screenshot of Google My Maps 'Share map' rules and link for copying

13. Share the link to your map with your teacher by copying the link and sending it to them in an email.

2.3 Ethical considerations

Researchers conducting fieldwork to collect primary data are required to follow a code of conduct to ensure minimum damage to the environment.

Researching animals and plants requires scientific licence/s and the approval of an ethics committee.

Activity 7 Prepare a scientific licence

2.3.1 Read the NSW Government requirements for a scientific licence.

What type of scientific licence do you think you will need? Why?

Ecological survey or consultancy licence, as they are conducting animal surveys.

2.3.2 The Animal Ethics wildlife research guidelines provides guidance for investigators carrying out wildlife surveys.
Use Section 3 'General ethical considerations and wildlife surveys'.
Identify strategies for minimising harm to Manning River helmeted turtles during fieldwork.

Use experienced and competent surveyors.

Select the least stressful methods available (e.g. avoid surveying on a very hot or cold day).

Complete the procedures as quickly as possible.

2.3.3 Sharing the results of wildlife research with the local community can enhance community involvement in conservation and produce better outcomes for threatened species.
Outline one strategy for sharing research reports with the community.

Write media reports, present to local community groups and schools.

2.4 Risk assessment

A risk assessment identifies hazards that have the potential to cause harm and ways to remove such hazards or control them when the risk cannot be removed.

Activity 8 Complete a sample risk assessment for fieldwork

2.4.1 Use Table 7 to **complete** a sample risk assessment for fieldwork to investigate the Manning River helmeted turtle.

Table 7 Sample risk assessment

Activity: Fieldwork to collect primary data		**Location: Manning River**
Hazard /risk areas	**Risk identification**	**Elimination or control measures**
People Special needs	Risk of: Pre-existing medical condition resulting in serious medical emergency, e.g. asthma	Teachers and students maintain school and /or personal medical action plans
Equipment Resources that may impact, e.g. footwear	Risk of: Accident with feet being cut	Students wear protective footwear
Environment Factors that impact on the activity, e.g. sunburn	Risk of: Being bitten by mosquitoes	Students bring insect repellent Wear long sleeves and long pants

Activity: Fieldwork to collect primary data		**Location:**
Hazard /risk areas	**Risk identification**	**Elimination or control measures**
People Special needs		
Equipment Resources that may impact, e.g. footwear		
Environment Factors that impact on the activity, e.g. sunburn		

2.5 Examples of qualitative survey data

Qualitative data is data that is not easily reduced to numbers. One of the advantages of qualitative data collection is that it can usually be recorded in a short timeframe.

Qualitative data tends to answer questions about 'what' (e.g. what does a species look like?), 'how' (e.g. how does soil type on riverbanks and beaches impact turtle nesting sites?) and 'why' (e.g. why does the abundance of Manning River helmeted turtles vary between sites?).

Qualitative data is used in ecological research to give a descriptive snapshot of the context of a site, species descriptions, adaptations and the niche **(G)** of species as well as abiotic **(G)** factors. Qualitative data collected for the Manning River helmeted turtle survey includes site descriptions, photos and habitat indicators.

Site descriptions

These are a record of the name of the river/creek, GPS coordinates, property owners, water flow, width of the waterway, depth of pools, presence of rocks, boulders, logs and benthic **(G)** vegetation, as well as a sketch of the site, including a North arrow, with as many of the site features labelled as possible.

Photographs

Take photos from a vantage point that frames as much of the study site as possible. Record your photos' date, site, direction, content, etc. for accurate labelling.

Habitat indicators

Indicators relevant to the habitat needs of Manning River helmeted turtles include:

- physical modifications to rivers and creeks such as access roads, causeways and dams
- changes in inundation **(G)** level, which should be noted for comparison with other records over time to understand the patterns of water flows
- soil erosion by water and wind – exposed gravel sandy loam banks and beach shorelines along river edges are ideal nesting sites
- evidence of disturbance by livestock, feral animals and native animals (e.g. hoofprints, scats, grazing) – they are a threat to Manning River helmeted turtles especially in riparian **(G)** zones, causing soil compaction and erosion
- land-use types in all directions, as well as those you can't see but know exist in the fringing zone, including houses, agriculture and conservation areas
- high levels of turbidity **(G)** caused by suspended sediment in the water, which are likely to interfere with the respiration and foraging of the Manning River helmeted turtle. This is an area requiring further research
- algal blooms, which are caused by excess nutrients in waterways from fertiliser and animal waste (called eutrophication **(G)** of the water). Algal blooms may reduce light levels, impacting the growth of macrophytes **(G)**. They can also deplete levels of dissolved oxygen in the water
- the extent of vegetation cover on riverbanks and beaches – excessive vegetation cover can reduce access to exposed gravel sandy loam sites suitable for turtles' nesting requirements

- natural cycles of flooding and drought, as well as human impacts – these factors can influence quantitative measures of water quality. Four water quality parameters easily measured are temperature, turbidity **(G)**, pH and salinity.

2.6 Examples of quantitative survey data

Quantitative data is a set of numerical values that arise from a measuring process.

Any data on which you can perform calculations such as means, differences or totals is quantitative data.

Using quantitative data in ecological research allows us to understand wider trends in our species of interest, such as how the population is changing over time.

Quantitative data collected for the Manning River helmeted turtle survey includes:

- the number of animals captured
- the weight of each individual animal
- the length of each turtle's carapace and plastron
- environmental variables such as water temperature, pH and salinity.

Survey methods – collecting valid and reliable data

Reliability and validity are concepts used to evaluate the quality of research. They indicate how well a method, technique or test measures something.

Reliability is about the consistency of a measure. A measurement is reliable if you repeat it and get the same measurement each time. An experiment is reliable if repeating it you get the same result for the entire experiment.

Validity is about the accuracy of the measure and how relevant the experiment is in addressing the purpose of the experiment; that is, is it testing what it's meant to test? It is influenced by the equipment, the experimental method, and the analysis of the results.

It is important to **check the relationship between the independent and dependent variables** and ensure all other variables (the controls) are kept the same where possible.

Survey methods and techniques used

The 3 researchers undertaking surveys of Manning River helmeted turtles during 2019 could not implement a systematic survey method. This was due to the variability of sites and because the search for Manning River helmeted turtles required the use of different techniques across sites.

For example, sites with deep holes were suited to cathedral traps (Figure 12), while more shallow areas were only suited to fyke nets (Figure 13). One of the researchers also used crab nets, while another researcher also caught turtles by snorkelling (Chessman 2019; Redleaf Environmental 2019; Spark 2019).

Figure 12. Cathedral trap used for surveys. (Photo: Darren Fielder)

Figure 13. Fyke nets set in Tuggolo Creek. (Photo: Phil Spark)

Survey methods included:

- traps set with bases on the stream bed and with floating tops, so turtles could still breathe air
- surveys carried out in late spring, early summer and early autumn
- traps baited with sheep liver, heart and sardines
- nets cleared at regular intervals
- exact locations of all nets recorded with GPS
- animals captured, processed and released at the pool of capture
- swabbing turtles around the eye and keeping samples in vials under refrigeration
- during processing, palpitating female turtles to check for eggs
- measuring turtles' carapace and plastron (chest shell) lengths using callipers
- weighing animals on electronic scales
- marking animals with notching or drilling
- holding captured turtles in covered bins out of the sun for no more than 6 hours
- recording physical abnormalities.

Note: Identification of mature females was difficult.

2.7 Fieldwork equipment

Equipment for fieldwork includes gear to enable:

- personal safety
- making observations
- taking measurements
- recording data.

The use of electronic technologies is expected when it is practical and/or improves the safety and quality of fieldwork.

Activity 9 Plan fieldwork equipment requirements

2.7.1 In Table 8, **evaluate** the pros and cons of technology that you could use to support your identification and recording of fieldwork data.

Examples include:

- TurtleSAT – a freshwater citizen science project to map turtles in your local area
- Atlas of Living Australia
- iNaturalist
- a smartphone camera.

Table 8 Pros and cons of using different apps for fieldwork

Technology app for fieldwork	Pros	Cons
TurtleSat	Data collected goes into an aggregated database Has survey forms to guide data collection App helps identify geo-location Guides on turtle identification	Dependent on reception/ internet connection and phone battery, so may be unreliable in some circumstances
Atlas of Living Australia	Data collected goes into an aggregated database Has survey forms to guide data collection App helps identify geo-location Guides on turtle identification	Dependent on reception/ internet connection and phone battery, so may be unreliable in some circumstances Does not easily provide identification guides within the platform
iNaturalist	Data collected goes into an aggregated database Has survey forms to guide data collection App helps identify geo-location Community members / school can create their own project to record, share and track sightings and data over time	Dependent on reception/ internet connection and phone battery, so may be unreliable in some circumstances
Smartphone camera	Readily available and easily accessible Can gather sufficient evidence for ID later, if you know what to look for Useful for capturing digital backups of paper records (such as datasheets)	Dependent on reception/ internet connection and phone battery, so may be unreliable in some circumstances Geo-tagging is harder to access Does not provide identification guides Quality of photo for ID purposes is dependent on technology and photographer skills/knowledge

2.7.2 Based on the pros and cons in Table 8 **choose** a fieldwork app that you would use to support your identification and recording of fieldwork data. Briefly explain the reason for your choice.

2.7.3 **Use** the information in Sections 2.5, 2.6 and 2.7 to **list** in Table 9 the equipment needed for the Manning River helmeted turtle fieldwork surveys (add extra rows if required).

Table 9 Fieldwork equipment

Fieldwork equipment requirement				
Ensuring personal safety	**Making observations**	**Taking measurements**	**Recording data**	**Recording data Ensuring safety of the turtles**
Completing a job safety analysis (JSA)	Camera	Pesola or electronic scales	Datasheet	Gloves
Enclosed shoes, gloves, long-sleeve shirt, pants, hat, sunglasses, (standard PPE)	Cathedral traps	Callipers	Apps	Water bins as shelters for protecting animals from the sun
			Pen and paper	Fit for purpose netting / traps

Extension activity: Fieldwork plan

If you have chosen to undertake an assessment of a river and/or creek in your area to determine its suitability as a freshwater turtle habitat, use this scaffold to help plan your fieldwork:

- Title
- Background information: include species and common name
- Purpose of the investigation
- Time of year
- Location map
- Research ethics
- Risk assessment
- Site selection
- Photographs
- Indicators relevant to the habitat needs of the turtle being investigated
- Survey methods
- Fieldwork equipment
- Use of app/s
- Links with existing relevant citizen science projects
- Resources and/or people assisting your work.

Module 3 Conducting investigations

BIO11/12-3 conducts investigations to collect valid and reliable primary and secondary data and information.

Students are to select appropriate equipment, employ safe work practices and ensure that risk assessments are conducted and followed. Appropriate technologies are to be used and procedures followed when disposing of waste. The selection and criteria for collecting valid and reliable data is to be methodical and, where appropriate, secondary sourced information referenced correctly (NESA 2017, p.23).

3.1 Recording fieldwork

Activity 10 Review fieldwork plan

3.1.1 **Use** the excerpt in Section 1.4, Figure 3, taken from the Manning River helmeted turtle 2019 autumn survey report (Redleaf Environmental 2019), to **describe** the objectives of the survey.

The objectives of this project are to:

- improve understanding of the distribution of *M. purvisi*
- improve understanding of the distribution of the turtle *E. macquarii* in the Manning River system
- establish the extent, prevalence and severity of threats to *M. purvisi*
- provide a basis for development of site-based management actions
- contribute to movement of this species out of the data-deficient management stream.

Activity 11 Review collected data

3.1.2 What do Table 10 and Figure 14 (following pages) illustrate about the study design? **Discuss.**

The figures depict graphically and in table format the spread of study sites across multiple streams and at multiple locations along these streams.

This helps illustrate how the project attempted to address the objective of understanding the species' distribution.

Table 10 Sites surveyed in 2018–19 (Chessman 2019, p.11)

Site no	Location	Elevation (m)	Mean trap latitude (GDA94)	Mean trap longitude (GDA94)	Dates trapped	Trap hours (cathedral nets)	Trap hours (fyke nets)	Trap hours total
1	Barnard River, Bretti	109	–31.7838	151.9107	29 Mar 2019	86	0	86
2	Barnard River, Kauthi South	111	–31.7779	151.9044	6 Apr 2019	60	0	60
3	Barrington River, Rocky Crossing	134	–32.0375	151.8707	17 Apr and 3 Dec 2018	111	0	111
4	Bobin Creek, Bobin Creek Road	139	–31.6860	152.2682	23–24 Nov 2018	72	0	72
5	Dingo Creek, Robinsons Road	58	–31.7921	152.3300	22–23 Nov 2018	191	24	215
6	Gloucester River, Doon Ayr	57	–31.8921	152.0939	19 Apr 2018 and 2–3 Dec 2018	204	11	215
7	Gloucester River, Faulkland Road	139	–32.0610	151.8800	18 Apr 2018 and 8 Apr 2019	124	0	124
8	Gloucester River, Wirradgurie	64	–31.9092	152.0605	4–5 Dec 2018	160	0	160
9	Manning River, Archinals	31	–31.9160	152.2157	18–19 Nov 2018	31	23	54
10	Manning River, Charity Creek	27	–31.9007	152.2390	19–20 Nov 2018	87	0	87
11	Manning River, Cundle Flat	88	–31.8087	151.9821	3 Apr 2019	30	0	30
12	Manning River, Deadbird	208	–31.8355	151.8142	27–28 Mar 2019	77	0	77
13	Manning River, Dewitt	240	–31.8114	151.7980	25–27 Mar 2019	261	48	309
14	Manning River, Karaak Flat Site 1	23	–31.9301	152.2933	21 Nov 2018	18	0	18
15	Manning River, Karaak Flat Site 2	23	–31.9240	152.2968	24 Nov 2018	32	0	32
16	Manning River, Kimbriki	25	–31.9338	152.2856	20–21 Nov 2018 1 and 5 Apr 2019	297	0	297
17	Manning River, Tigrah Road	96	–31.7923	151.9370	28 Mar and 7 Apr 2019	87	0	87
18	Manning River, Tiri Road	47	–31.8378	152.0927	4 Apr 2019	61	0	61
19	Nowendoc River, Rotating House	70	–31.8061	152.0551	2–3 Apr 2019	222	0	222

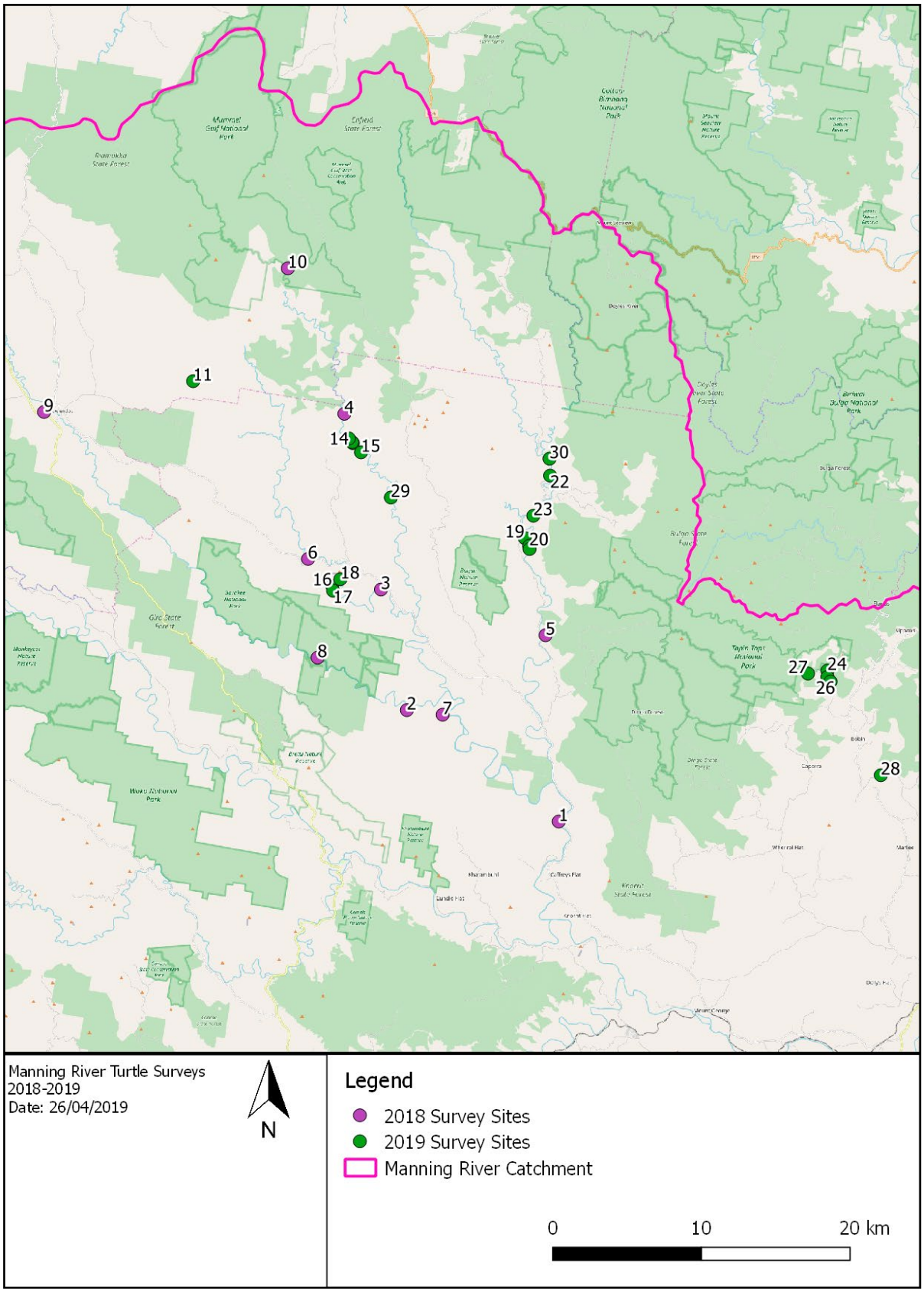


Figure 14. Map showing sites sampled in the 2018–19 survey of the Manning River helmeted turtle – reproduced from Redleaf Environmental 2019, p.4

3.1.3 **Review** the 'Materials and Methods' section of the Survey and monitoring report on turtle trapping in 2018–19 (Chessman 2019) and explain why surveys were conducted in autumn.

Because this is one of the seasons when *M. purvisi* is active and feeding.

3.2 Recording qualitative data

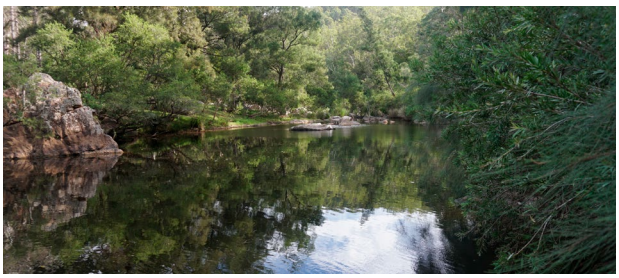
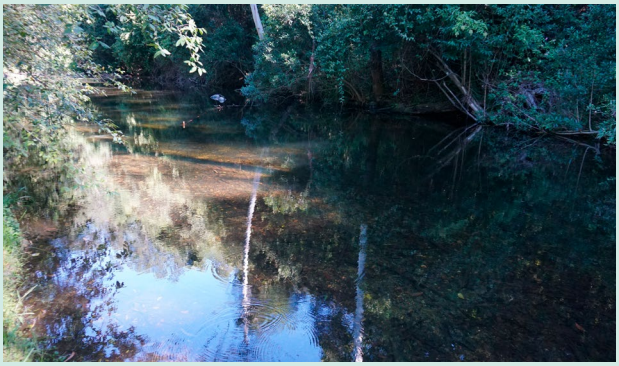
Qualitative data captures first-hand observations, is quite often descriptive and generally non-numerical. Table 11 contains the qualitative data from the Manning River helmeted turtle autumn survey.

Activity 12 Review site descriptions

3.2.1 **Review** the site descriptions in Table 11. Has all the information Section 2.5 above suggests be included in a site description been captured? How could these site descriptions be improved?

Some missing information (discussed in Section 2.5 of this resource) includes GPS locations, land tenure/property owners. A mud map with more details about site conditions could enhance the site description. Note: Quite often this data is excluded from public reports for privacy reasons.

Table 11 Examples of site descriptions (Redleaf Environmental 2019)

Sites	Photographs of sites
Cooplacurripa River, Top Station Mostly shallow with several small pools to 1.5 m. A shaded stream with riparian **(G)** vegetation present. Evidence of stock access through bank trampling. Stream had a small flow through it with high turbidity **(G)** preventing snorkelling as capture method.	
Mummel River, Cooplacurripa Station Trapping site with several deeper pools to 1.8 m. Water clarity was good with intact riparian zone vegetation.	
Rowleys River, Strike-A-Light at its northern boundary Near pristine river reach with large deep waterholes. Water clarity was excellent here. Caught 16 ***M. purvisi*** in this stretch. Two pairs were observed mating underwater at a depth of about 2 m, and subsequently caught (in the act) by the snorkellers.	
Bobin Creek, Les McKensie place Pristine stream environment except for infestation of small and large leaved privet in riparian vegetation. Crystal clear water (cold ~15°C) with leaf litter areas covering the creek bed providing habitat for ***M. purvisi***. Mostly long shallow stream reaches interspersed with small deeper waterholes (to about 1.5 m). Three large waterholes to 3.5 m occur 1 km from each other.	
Dingo Creek, Dingo Bend Thin riparian strip along each side of the banks. Adjacent land use is improved pasture paddocks and cattle grazing. There wasn't a waterhole deeper than 1.5 m. Mostly wide shallow stretches. The water clarity was moderate. Very cold water (~15°C).	

3.3 Recording quantitative data

Quantitative data captures measurements that can be counted and are usually numerical.

Table 12, Table 13, Table 14 and Figure 15 are examples of quantitative data from the Manning River helmeted turtle 2019 autumn survey report (Redleaf Environmental 2019).

Table 12 Survey effort and capture results 2018–19 (Redleaf Environmental 2019, p.9)

Site no	Year	Survey effort (hours)			Turtles		
		Cathedral nets	Fyke nets	Snorkel	*M. purvisi*	*C. longicollis*	*E. macquarii*
1	2018	120		1			
2	2018	100	12.5	1	1		
3	2018	144	18	2	1	11	
4	2018	128		2.5	11		
5	2018	112	24	2	4	1	
6	2018	152	19	1	2	9	
7	2018	128		1		1	1
8	2018	116	14.5	1	1		
9	2018	120					
10	2018			2	1		
11	2019	108.5	17		1		
12	2019	104	15		1		
13	2019			1.5		1	
14	2019			1.5	1		
15	2019			4	2	2	
16	2019	120	17		1	4	
17	2019			3	5	10	
18	2019			4		1	
19	2019	56	48	2			
20	2019			2	1		
21	2019			2	2		
22	2019			2	4		
23	2019			4	16		
24	2019			5	1		
25	2019		52		1		
26	2019			2			
27	2019			4			
28	2019			4			
29	2019	104			3	1	
30	2019			4	1	1	
Totals							

Table 13 Capture results by tributary (Redleaf Environmental 2019, p.10)

Tributary	*M. purvisi*	*C. longicollis*	*E. macquarii*
Bobin Creek	2		
Dingo Creek			
Cooplacurripa River	10	35	
Mummel River	19	4	
Nowendoc River	2	1	1
Rowleys River	28	8	
Totals			

Table 14 Age class and sex of *M. purvisi* (Redleaf Environmental 2019, p.10)

Species	Mature female	Mature male	Immature female	Immature male	Unsexed	% immature	F/M ratio
M. purvisi	28	15	6	2	10	29.5%	

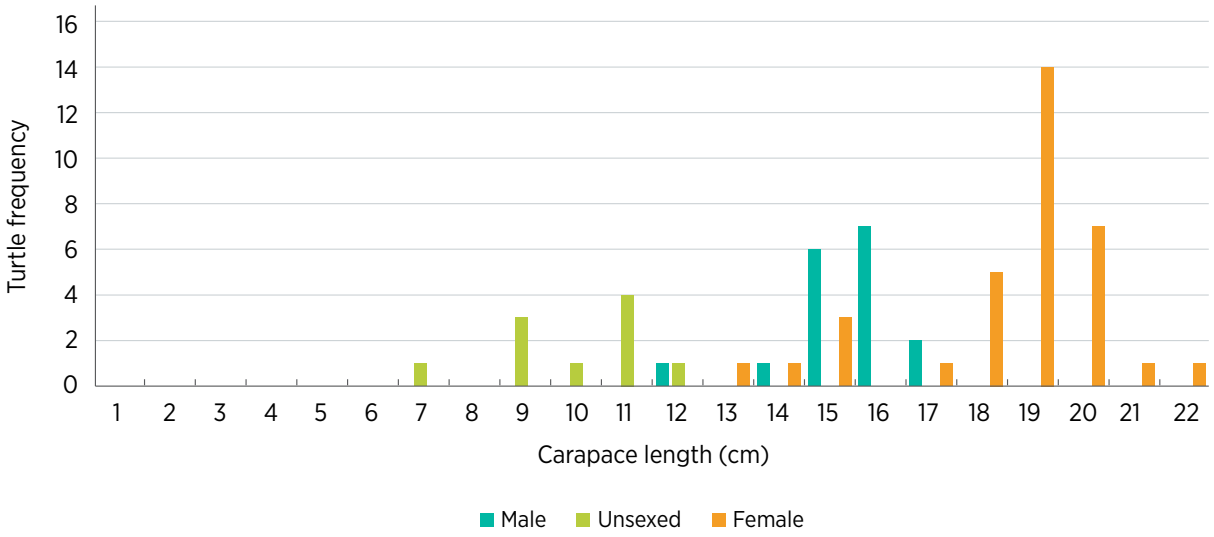


Figure 15. Population demographics for the combined survey sites for female, male and unsexed individuals (Redleaf Environmental 2019, p.11)

Table 15 Survey effort and capture results including incidental recordings (Redleaf Environmental 2019, p.10)

Method	*M. purvisi*	*C. longicollis*	*E. macquarii*	Effort (hours)	Total	Capture rate
Cathedral trap	7	12	1	1,612	20	0.012
Fyke net	3	4		237	7	0.029
Snorkelling	51	31		58	82	1.41
Hand capture		1			1	
Totals	**61**	**48**	**1**		**110**	

Survey summary

The survey captured turtles across most size classes. There were 6 immature females, 2 immature males and 10 unsexed immature turtles caught. There were 28 adult females and 15 adult males captured.

The largest female was 22.47 cm straight carapace with a mass of 1,554 g. The largest male caught was 17.18 cm long with a mass of 616 g. The smallest immature turtle caught was 8.07 cm long and had a mass of 71 g.

Activity 13 Investigate the data

3.3.1 Use Tables 12–14 to complete Table 16.

Table 16 Total number of each species of turtle captured (student response)

Species	Number captured
M. purvisi	61
C. longicollis	48
E. macquarii	1

3.3.2 **Calculate** the number of sites at which *M. purvisi* were captured.

21 out of 30 sites

3.3.3 **Identify** the site (1–30) where ***M. purvisi*** was most abundant and the number of *M. purvisi* captured?

Site 23 with 16 turtles

3.3.4 Which sex had the largest carapace?

Females

3.3.5 **Identify** which method of capturing turtles was most successful (Table 15).

Snorkelling

Extension activity: Fieldwork journal

You are undertaking an assessment of waterways in your area to determine their suitability as a freshwater habitat for ***M. purvisi***.

Review Sections 1.2 and 1.3 in Module 1 about key criteria for assessing habitat suitability.

Use the following questions to help prepare a fieldwork journal. Conduct your own research.

Safe work practices and protecting the natural environment

3.3.6 **Describe** one action to avoid venomous snakes during fieldwork.

- Wear sturdy work boots
- Avoid heavy underbrush where you can't see what's in front of you
- Use existing trails
- Inspect the area where you intend to sit

3.3.7 **Describe** how being bitten or stung by ants, wasps or spiders is best avoided during fieldwork.

- Wear protective clothing
- Use insect repellent
- Avoid places where they are active

3.3.8 **Describe** an action you have taken to ensure your sun safety during fieldwork.

- Wear a hat and protective clothing
- Use sunscreen SPF 30 or higher
- Seek shade
- Wear sunglasses

3.3.9 **Describe** how disturbance of the riparian **(G)** area habitats can be reduced during fieldwork?

- Avoid repeated vehicle use and equipment access
- Develop a biosecurity plan – ensure vehicles are weed free
- Do not move wood or rocks
- Leave the site waste free

Location

3.3.10 **Create** a location map using Google My Maps (see Section 2.2).

3.3.11 On the map **label** north, the map title, an estimate of the scale, site locations, and a key.

Title	
Scale	
Site 1 name	
Site 2 name	
Key	
Google My Maps URL	

Descriptions

3.3.12 **Record** the qualitative details for site 1 in Table 17.

Table 17 Details for survey site 1 (student response)

Species	
Site name	
GPS coordinates	
Property owners	

3.3.13 **Draw** a sketch of site 1, include a north arrow and label features of the site.

3.3.14 **Record** the qualitative details for site 2 in Table 18.

Table 18 Details for survey site 2 (student response)

Species	
Site name	
GPS coordinates	
Property owners	

3.3.15 **Draw** a sketch of Site 2, include a north arrow and label features of the site.

Photographs

3.3.16 **Take** photos into or along the habitat. **Record** details of your photos in Table 19.

Table 19 Sample table for recording photo details (student response)

Image name *e.g. xxx.jpg*	Date taken	Description *Features highlighted in the image*	Image thumbnail

Hydrology and soils

3.3.17 **Identify** factors influencing the hydrology of the wetland at your chosen sites by ticking boxes and enter (fill in) water source types in Table 20.

Table 20 Hydrology (student response)

Type of wetland	Site 1	Site 2	Water sources into wetland	Site 1	Site 2
Dam	☐	☐		☐	☐
Lake	☐	☐		☐	☐
Floodplain	☐	☐		☐	☐
Billabong	☐	☐		☐	☐
Channel	☐	☐	**Current local climate**		
Marsh/swamp/bog	☐	☐	Dry period	☐	☐
Other	☐	☐	Average period	☐	☐
Water level			Wet period	☐	☐
High	☐	☐	Very wet period	☐	☐
Medium	☐	☐	**Modifications**		
Low	☐	☐	Bridges	☐	☐
Mostly small pebbles	☐	☐	Dams	☐	☐
Dry	☐	☐	Roads	☐	☐

3.3.18 Tick boxes in Table 21 to **record** soil disturbance.

Table 21 Soil and river disturbance (student response)

Soil disturbance through bank erosion	Site 1	Site 2	Soil disturbance by animals	Site 1	Site 2
Stable (no visible erosion)	☐	☐	Pugging **(G)**	☐	☐
Good (very little visible erosion)	☐	☐	Estimated mean pugs per m^2	_____	_____
Moderate (a moderate area of bank is eroding)	☐	☐	Signs of native animals	☐	☐
Unstable (most of the bank is eroding)	☐	☐	Signs of feral animals	☐	☐

Abiotic and biotic factors impacting freshwater turtles

3.3.19 **Identify** factors impacting turtles at your chosen sites using Table 22.

Table 22 Abiotic and biotic factors (student response)

Abiotic factors	Site 1	Site 2	Biotic factors	Site 1	Site 2
Water clarity and turbidity **(G)**	☐	☐	Macrophytes **(G)**	☐	☐
Water temperature	☐	☐	Food sources of small aquatic invertebrates such as shrimps and insects and plants	☐	☐
Deep pools	☐	☐	Structural complexity provided by submerged logs, roots and plants	☐	☐
Still or flowing water	☐	☐	Evidence of introduced predators, e.g. foxes	☐	☐
Shallow water	☐	☐			
Ephemeral water flow	☐	☐			

Land-use activities

3.3.20 **Identify** land-use activities within or near sites 1 and 2 by ticking boxes in Table 23.

Table 23 Land-use activities (student response)

Land use	Site 1	Site 2	Urban	Site 1	Site 2
Piggery	☐	☐	Houses	☐	☐
Dairy	☐	☐	Commercial	☐	☐
Poultry	☐	☐	Industrial	☐	☐
Grazing	☐	☐	Roads	☐	☐
Animal kennels	☐	☐	Railway	☐	☐
Aquaculture	☐	☐	Bridge	☐	☐
Market gardens	☐	☐	Fences	☐	☐
Orchard	☐	☐	Garden and lawn clippings dumping	☐	☐
Plant nursery	☐	☐	Rubbish dumping	☐	☐
Crop production	☐	☐	Building construction	☐	☐
Irrigation	☐	☐	**Utilities**		
Other	☐	☐	Airport	☐	☐
Recreational			Hospital	☐	☐
Golf course	☐	☐	School	☐	☐
Playing fields	☐	☐	Landfill site	☐	☐
Picnic grounds	☐	☐	Electricity line corridor	☐	☐
Caravan park	☐	☐	Sewer pipeline corridor	☐	☐
National park	☐	☐	Water supply	☐	☐
Horse riding	☐	☐	**Other**		
Wood for BBQs	☐	☐	Evidence of past fire	☐	☐
Carpark	☐	☐	Natural bushland	☐	☐
Walking trails	☐	☐	Logging	☐	☐
Boardwalk	☐	☐	Clearing	☐	☐
Boating	☐	☐	Firebreak clearing	☐	☐
Swimming	☐	☐	Bush regeneration	☐	☐
Fishing	☐	☐	Weed clearing	☐	☐

Module 4 Processing and analysing data and information

BIO11/12-4 selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media.

Students use the most appropriate and meaningful methods and media to organise and analyse data and information sources, including digital technologies and the use of a variety of visual representations as appropriate.

They process data from primary and secondary sources, including both qualitative and quantitative data and information (NESA 2017, p.23).

BIO11/12-5 analyses and evaluates primary and secondary data and information.

Students identify trends, patterns and relationships; recognise error, uncertainty and limitations in data; and interpret scientific and media texts. They evaluate the relevance, accuracy, validity and reliability of the primary or secondary-sourced data in relation to investigations. They evaluate processes, claims and conclusions by considering the quality of available evidence, and use reasoning to construct scientific arguments.

Where appropriate, mathematical models are to be applied, to demonstrate the trends and relationships that occur in data (NESA 2017, p.23).

4.1 Interpreting qualitative data

Activity 14 Describe habitat quality at survey sites

Table 24 River reach descriptions from the 2019 autumn survey of Manning River helmeted turtles (Redleaf Environmental 2019, pp.6–8)

Sites	Qualitative description
Cooplacurripa River	Thin strip of riparian **(G)** vegetation occurs here. Heavily impacted river reach from unfettered stock access. Long, wide and shallow stretches with extensive algal and macrophyte **(G)** growth present choking the waterway. Several deeper sections with clear water. Water clarity was good.
Mummel River	Water clarity was good with some minor turbidity **(G)** from recent rainfall further upstream. Intact riparian zone vegetation. There were several deeper sections to 2–3 m. Spotted 3 pairs of turtles mating over 2 days, 28 and 29 March 2019. Each pair were underwater at a depth of about 2 m.
Rowleys River	Near pristine river reach. Excellent water clarity. Very large waterholes to >6 m depth present. However, most deeper waterholes to 3.5 m. Shaded stream from adjacent riparian vegetation.
Bobin Creek	Small stream, near 100% shaded by rainforest riparian vegetation. There were 3 large pools to 3 m depth. They were isolated from each other by most of the stream being 0.2–0.4 m depth. Water clarity was excellent. Very cold water estimated at 15°C.
Dingo Creek	Thin riparian strip along each side of the banks. Adjacent land use is improved pasture and cattle grazing. Water clarity was limited because of elevated turbidity. The water temperature was cold (estimated ~15°C). Very shallow stream (0.4 m) with a few deeper areas to 1.5 m.

4.1.1 Using the river reach descriptions in Table 24 **analyse** the researcher's qualitative data to identify one or 2 limiting factors that may influence the presence or absence of Manning River helmeted turtles, and complete Table 25.

Table 25 Limiting factors on Manning River helmeted turtle presence (student response)

Sites	Possible limiting factors on the presence of Manning River helmeted turtles
Cooplacurripa River	
Mummel River	
Rowleys River	
Bobin Creek	
Dingo Creek	

4.2 Interpreting quantitative data

Activity 15 Interpret and assess quantitative data

4.2.1 Look at Figure 16. **Describe** patterns of relative abundance **(G)** and distribution of the 3 turtles surveyed across the sites.

No turtles found in Dingo creek.

Nowendoc has greatest diversity (all 3 species found) but low abundance.

M. purvisi found in greatest numbers in Rowleys and Mummel rivers.

E. macquarii found in Nowendoc River, but very low numbers.

4.2.2 **Identify** possible limitations of the data shown in Figure 16.

It can change with time – temporal differences. Also river depth.

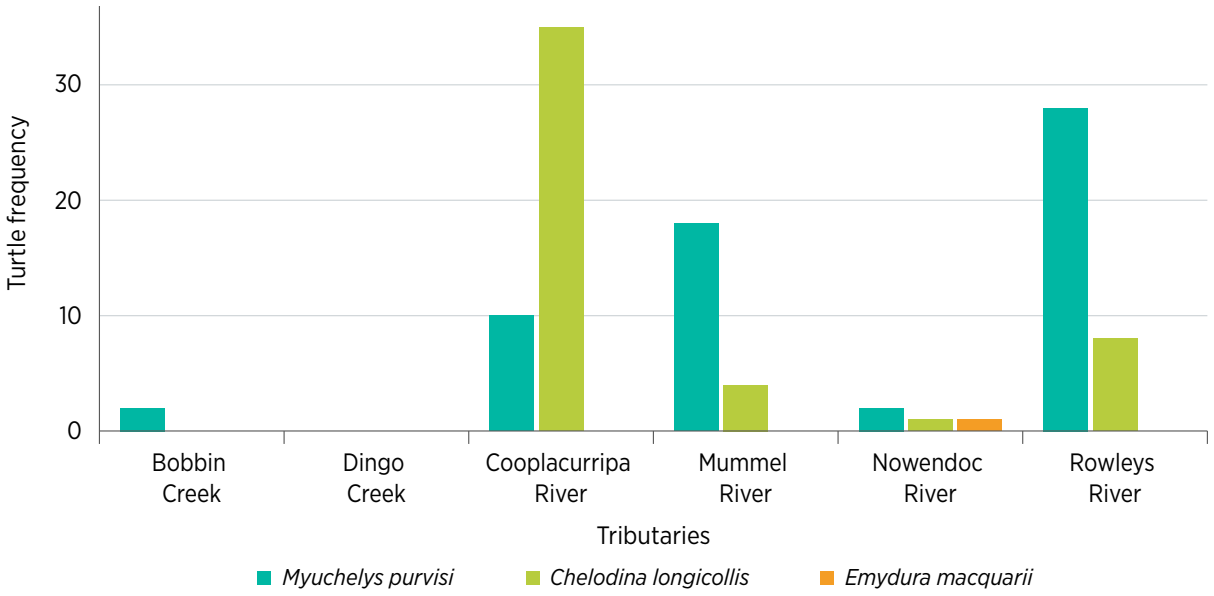


Figure 16. Tributaries surveyed, and turtle captures (Redleaf Environmental 2019, p.10)

Table 26 Age classes and sex of Manning River helmeted turtles (Redleaf Environmental 2019, p.10)

Species	Mature female	Mature male	Immature female	Immature male	Unsexed	% immature	F/M ratio
M. purvisi	28	15	6	2	10	29.5%	2:1

4.2.3 Look at Table 26. **Describe** the age classes and sex of the Manning River helmeted turtles captured.

The majority were mature females and mature males (twice as many females).

4.2.4 **Identify and explain** an aspect of uncertainty in the dataset presented in Table 26.

The unsexed turtles present uncertainty. The trend from Table 26 could be less or more prominent.

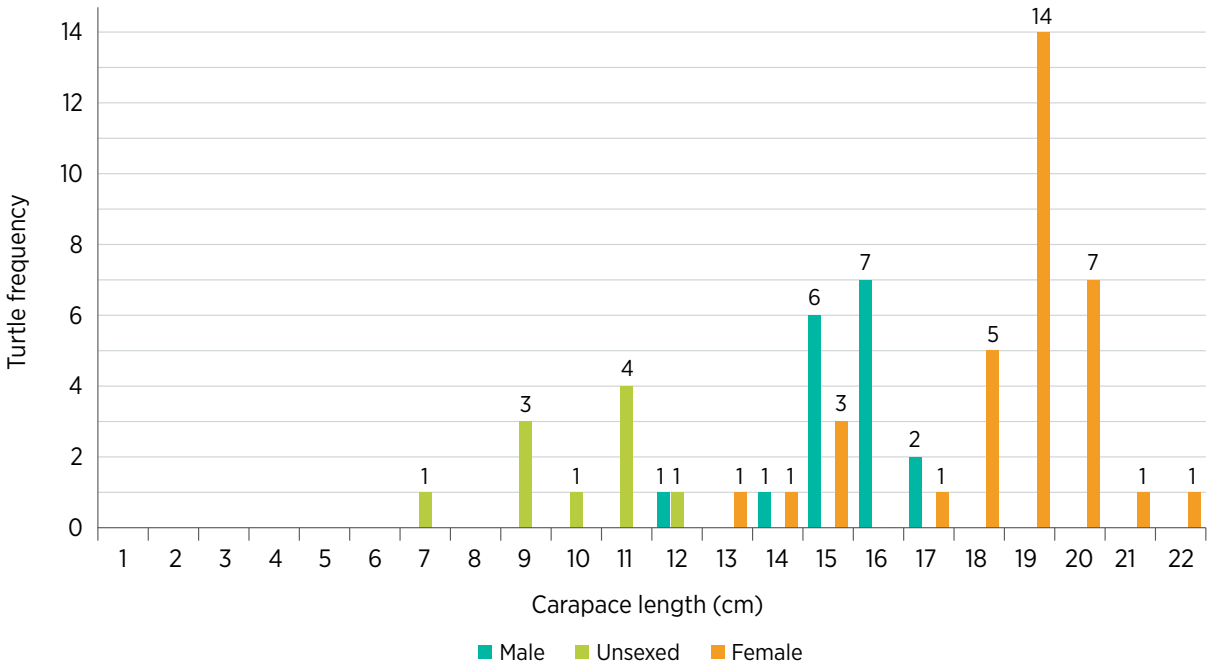


Figure 17. Carapace length and sex of Manning River helmeted turtles (Redleaf Environmental 2019, p.11)

4.2.5 Look at Figure 17. **Explain** the relationship between carapace length and how helpful it is in determining the sex of a turtle.

Mature females appear to have the greater carapace length – this is an easy ID feature.

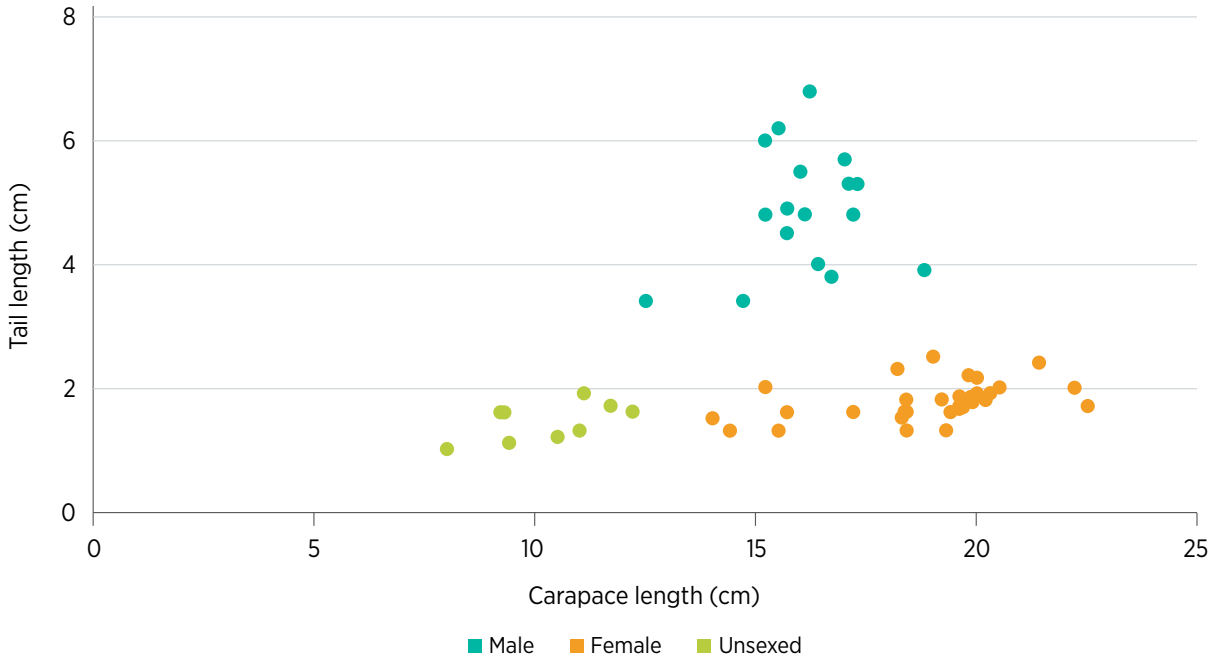


Figure 18. Tail length, carapace length and sex of Manning River helmeted turtles (Redleaf Environmental 2019, p.11)

4.2.6 Look at Figure 18. **Describe** the trend in data relating to size and sex of male and female turtles.

Males have longer tails and females have longer carapaces.

4.3 Experimental validity

Activity 16 Evaluate experimental validity

Experimental validity is determined by how well the investigation design addresses the aims.

4.3.1 Revisit the aims of the NSW Government researcher in Section 1.4. Evaluate the validity of the methods and data presented.

1. Improve understanding of the distribution of *M. purvisi*.

   The surveys found *M purvisi* to be relatively common and widely distributed in the Manning River system.

2. Improve understanding of the distribution of the turtle *E. macquarii* in the Manning River system.

   The surveys indicated that there was little presence of *E. macquarii* across the Manning River system.

3. Establish the extent, prevalence and severity of threats to *M. purvisi*.

   This is not clear from the data presented.

4. Provide a basis for development of site-based management actions.

   Further research into nest predation by pests, impacts of climate change (flooding and drought), introduction of pathogens and diseases.

5. Contribute to movement of this species out of the data-deficient management stream.

   It is reported that the species has been moved from the data-deficient Saving our Species stream into the site-managed stream.

4.4 Reproduction and population demographics

Activity 17 Construct a conclusion

Review the 'Discussion' section, **specifically size distribution of turtle species** from the Manning River helmeted turtle 2019 autumn survey report, Redleaf Environmental, pp.12–14 and respond to the following.

4.4.1 Recruitment is when a juvenile of a species is added to a population. **Construct** a scientific conclusion including data as evidence about recruitment of Manning River helmeted turtles into the population over the past 2 years.

Hint: Refer back to Table 14 in Module 3.

There is a broad size distribution, which indicates ongoing juveniles and recruitment. In fact, 30% of the *M. purvisi* population are juveniles.

4.4.2 **Describe** the sex ratio of females to males.

There are almost twice as many females (mature and immature) as males.

4.4.3 **Evaluate** the reliability of your conclusion and description of the sex ratio.

The researchers note that the sex ratio of 2:1 warrants further attention.

4.5 Threatening processes

Activity 18 Research threats and threatening processes

Continue reviewing the 'Discussion' section from the Manning River helmeted turtle 2019 autumn survey report (Redleaf Environmental 2019, pp.12–14) and respond to the following.

Nest predation

Feral animals such as pigs and foxes can devastate turtle populations. Research on nest predation of another species of turtle found foxes can cause losses of >90% of all nests for a season. Native predators of Manning River helmeted turtles include dingos and goannas, both of which were identified by the researcher as being present at some sampling sites.

4.5.1 **Describe** indicators of nest predation that may be apparent in population demographics **(G)**. Hint: Use Figure 17.

There are no small carapace sizes since they've been predated upon.

Habitat modification

The researcher reported most sites in moderate to good condition within national parks and undisturbed sites. However, some sites adjacent to human activities showed reduced water quality through eutrophication **(G)** and turbidity **(G)**, while disturbance to riparian **(G)** vegetation had led to weed infestation and excessive shading of waterways and embankments.

4.5.2 **List** the causes and effects of cattle grazing and pasture improvement on the habitat of the Manning River helmeted turtle.

Changes in land use from native vegetation to agricultural purposes increases the effects of cattle grazing and pasture improvement.

Cattle grazing can lead to destruction of the habitat around the rivers.

Pasture improvement can increase the amount of fertiliser in the rivers.

Competition and hybridisation with the Murray River turtle *(Emydura macquarii)*

Only one Murray River turtle was captured during the Manning River helmeted turtle 2019 autumn survey (Redleaf Environmental 2019) (Table 13); however, the researchers from Chessman Ecology that compiled the Survey and monitoring report on turtle trapping in 2018–19, captured 68 Murray River turtles (Chessman 2019).

4.5.3 **Explain** how competition and hybridisation **(G)** threatens Manning River helmeted turtle populations.

The hybridisation of the Manning River helmeted turtle can lead to a genetic swamping of the gene pool.

Photo: Mummel River Cooplacurripa (Darren Fielder)

Module 5 Problem solving

BIO11/12-6 solves scientific problems using primary and secondary data, critical thinking skills and scientific processes.

Students use critical thinking skills and creativity to demonstrate an understanding of scientific principles underlying the solutions to inquiry questions and problems posed in investigations.

Appropriate and varied strategies are employed, including the use of models, to qualitatively and quantitatively explain and predict cause-and-effect relationships.

In Working Scientifically, students synthesise and use evidence to construct and justify conclusions.

To solve problems, students: interpret scientific and media texts; evaluate processes, claims and conclusions; and consider the quality of available evidence (NESA 2017, p.23).

5.1 Conceptual models

Conceptual models inform questions and predictions about species' populations.

The model in Figure 19 is a conceptual model designed to show causes and effects of population dynamics of the Manning River helmeted turtle.

The model helps identify existing knowledge and aspects of the species' ecology in need of further research as well as opportunities for conservation actions.

Activity 19 Using a conceptual model

5.1.1 Use the model in Figure 19 to:

- **identify** the stressors affecting Manning River helmeted turtles
- **suggest** conservation actions
- tick boxes in Table 27 to **identify** who might be involved in delivering the actions.

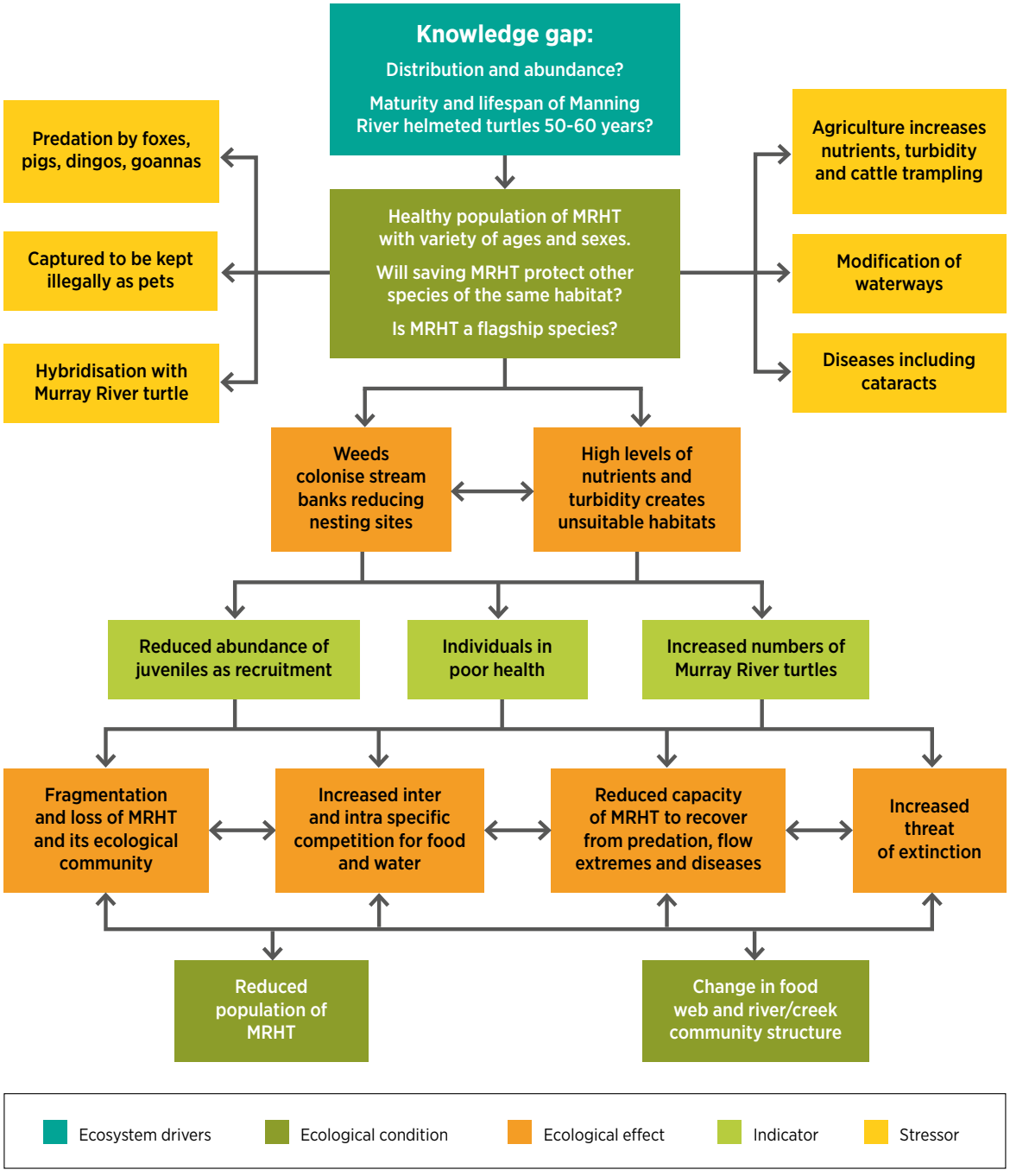


Figure 19. Conceptual population model for the Manning River helmeted turtle and its habitat

Table 27 Stressors and conservation actions (student response)

Stressors on Manning River helmeted turtle	Conservation actions	State govt	Local govt	Land owners	Community environment group	Schools, universities, citizen scientists	Other
	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐

5.1.2 **View** the Aussie Ark videos below (Figure 20 and Figure 21) by Tim Faulkner seeking crowdfunding to establish a breeding program for Manning River helmeted turtles (links below). **Include** a description of Aussie Ark's Tim Faulkner's Manning River helmeted turtle project as an action in Table 27.

Figure 20. Screenshot, Meet Manny our first Manning River turtle YouTube video

Figure 21. Screenshot, Help us save the Manning River turtle YouTube video

5.1.3 **Research** and describe the concept of flagship species.

Flagship species are highly threatened species near extinction. They are ambassadors for conservation, used to generate community interest for a cause. They often act as an icon or symbol for a habitat or threatening process and are usually charismatic species.

5.1.4 **Create** an argument using scientific evidence either for or against giving the Manning River helmeted turtle flagship species status.

The species is unique and iconic to the local area, it's a cute, charismatic species, it's highly threatened and faces significant threats such as stream degradation and disease. Therefore it qualifies as a flagship species.

5.1.5 **Evaluate** the quality of the evidence you have used in making your argument and conclusions.

Unique and iconic:

- endemic to the Manning River catchment, located in place
- carries the name Manning.

Cute and charismatic:

- subjective, but already has community interest groups.

Significant threats:

- as indicated by recent research (predation, climate change – flooding and drought, pathogens, riparian zone damage).

Photo: Manning River helmeted turtle (Darren Fielder)

Module 6 Communicating

BIO11/12-7 communicates scientific understanding using suitable language and terminology for a specific audience or purpose.

Communicating all components of the Working Scientifically processes with clarity and accuracy is essential.

Students use qualitative and quantitative information gained from investigations using primary and secondary sources, including digital, visual, written and/or verbal forms of communication as appropriate. They apply appropriate scientific notations and nomenclature. They also appropriately apply and use scientific language that is suitable for specific audiences and contexts (NESA 2017, p.23).

Activity 20 Prepare a report

Prepare a report to inform a specific audience about your research. The report can be in the form of a brochure, PowerPoint, video, newspaper article or another format that suits the audience and purpose. The report needs to ensure a scientific reporting format is followed. The following guide sets out scientific reporting requirements.

6.1 Title

Give your investigation a title that describes what it is about.

6.2 Abstract

An abstract is a complete summary of your project and has the following characteristics:

- uses the third person; that is, from the point of view of an outsider
- is written for the target audience
- uses present tense for the existing body of facts
- defines specialised terms and abbreviations
- 100–250 words long
- is written last by summarising the report according to the scientific method format; that is, it summarises the introduction, aim, method, results and discussion in one paragraph.

6.3 Introduction

The ‘Introduction’ should outline why you are interested in this area of wildlife conservation, what is already known about freshwater turtles in the NSW environment, what you will be investigating, and your research question (hypothesis). The introduction should include:

- your inquiry question
- what you already know about the Manning River helmeted turtle from secondary sources, including its conservation status, a physical description, its known distribution, diet, breeding cycle, seasonal behaviour, its habitat requirements and known threats
- important variables to consider
- what new information you will learn from your experiment
- the aim of yours and/or the researchers’ investigation
- the possible hypothesis of the investigation.

6.4 Method – planning and conducting investigations

The ‘Method’ contains the steps followed in your investigation in enough detail so that the procedure could be replicated by somebody else. It also states the variables controlled.

6.5 Results – processing data and information

The ‘Results’ should include a written explanation of the major findings in paragraph form, and the data is presented as graphs, charts, tables and pictures using the most appropriate and meaningful methods to organise and analyse data. The data presentation should include digital technologies and the use of a variety of visual representations.

Each table and graph should have a caption with enough detail so that it can be understood even if it is separated from the text. Also, describe any major findings or unexpected errors.

Photo: Manning River helmeted turtle (Phil Spark)

6.6 Results – analysing data and information

The 'Results' should also include a written explanation of the major findings in paragraph form identifying trends, patterns and relationships. Discussion is also required about sources of error, uncertainty and limitations of data.

Include critical evaluation of the relevance, reliability, accuracy and validity of both primary and secondary sources. Construct informed conclusions from the data and where possible cite mathematical models to support patterns and trends about cause and effect relationships.

6.7 Discussion – problem solving and limitations

The 'Discussion' is the place to apply critical thinking skills and creativity to evaluate what has been learnt, generate questions for further inquiry, and/or propose solution/s to ensuring the future of Manning River helmeted turtles in the wild. It should cover the following:

- Explain major findings.
- Write 1–2 sentences to summarise your results.
- Are there any anomalies in the results (i.e. things that don't seem to fit)? Can you explain these?
- Can you explain the trends or patterns in your results? Try to use some scientific ideas to help you explain what happened.
- Did your results support your hypothesis?
- How do your results relate to what was known in this area?
- Do your results agree with what you learnt from your references? How are they the same? How are they different?
- How do your results contribute new knowledge to the body of knowledge in this area? They could support previous knowledge, extend previous knowledge or even challenge previous knowledge.
- Could the research procedures and data be used to establish baseline procedures and data to support replication of the process in the future?
- Outline specific issues placing the Manning River helmeted turtle at threat of extinction.
- Describe conservation actions to protect populations of Manning River helmeted turtles in the wild.
- What do your results mean for other people?
- What interesting questions did your project lead to? What more could you do in this area?
- What would you do to improve the project if you were to do it again?
- Were you satisfied with the method? Most scientists can think of a couple of changes they would make next time.
- How could you improve the fairness, accuracy, sample size, etc.?

6.8 Conclusion

The concluding paragraph should let the reader know what the investigation was about and what results were obtained. The student should then be able to state why the results are significant in a wider world context. Include the following:

- Restate the purpose or the original question.
- Restate the hypothesis.
- Did your results support the hypothesis?
- What is the importance of this experiment?
- Prepare an overview of issues facing the community, your suggested strategies and prioritised actions to work toward conserving and/or improving ecological stability.

6.9 References

This is a list of all text and source material used and should be presented alphabetically. Referencing is important as you need to acknowledge where you obtained your information. There are accepted ways to present references so your readers can identify and follow up the sources you have used if they wish. The online ***Australian Government Style Manual*** provides useful guidance on Referencing and attribution.

Photo: Manning River helmeted turtles Rowleys River Long Creek (Darren Fielder)

Glossary

Abiotic – relating or resulting from nonliving parts of an ecosystem

Benthic – relating to the bottom of a sea or lake or to the organisms that live there

Biotic – relating to life or resulting from living organisms

Diurnal – of or during the day

Ecological community – naturally occurring group of plants, animals and other organisms that are interacting in a unique space or area

Elevation – height above sea level

Eutrophication – excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life

Hybridisation – the process of an animal or plant breeding with an individual of another species or variety

Inundation – an overwhelming abundance of something; inundation of water is flooding

Lotic – running water habitats such as river or streams, characterised by higher oxygen levels due to continually running water

Macrophyte – an aquatic plant large enough to be seen by the naked eye

Niche – the role a species plays in an ecological community or the range of resources and conditions the species needs to maintain a viable population there

Population demographics – statistical data relating to a population and particular groups within it

Pugging (in agriculture) – when the top 4–8 cm of the soil acts as a seal and prevents further rain from dispersing through the soil; generally a consequence of hooves on wet soil

Relative abundance – used when talking about biodiversity and refers to how common or rare a species is relative to other species in a defined space or community

Riparian – relating to or living or located on the bank of a natural watercourse (such as a river) or sometimes of a lake or estuary

Symbiotic – involving interaction between 2 different organisms living in close physical association; a mutually beneficial relationship

Turbidity – the quality of being cloudy, opaque, or thick with suspended matter

References

Chessman B (2019) *Conservation program for the Manning River helmeted turtle – survey and monitoring: Report on turtle trapping in 2018–19*, prepared for the NSW Office of Environment and Heritage, Chessman Ecology, Pymble NSW, https://datasets.seed.nsw.gov.au/dataset/manning-river-turtle-survey-report-middle-reaches-may-2019/resource/9a78ab5c-7eef-451c-bd44-3d033622a6f5 [PDF 21.4MB]

Chessman BC, Fielder DP, Spark PH and Steed AC (2023) 'Distribution , habitat and population structure of the threatened Manning River helmeted turtle, ***Myuchelys purvisi***', *Austral Ecology*, 29 May 2023,
doi: 10.1111/aec.13366

Driscoll J (16 December 2017) 'Manning River Turtle researchers seeking locations', ***Gloucester Advocate***, https://www.gloucesteradvocate.com.au/story/5120707/have-you-seen-this-turtle-we-want-to-know-where/ (article updated 30 January 2019, reproduced in Appendix A).

Hunter Local Land Services (2021) ***Threatened Fauna of the Hunter and Mid Coast – Manning River helmeted turtle***, Hunter Local Land Services, NSW Government, published March 2021, https://www.lls.nsw.gov.au/__data/assets/pdf_file/0006/1343814/Manning-River-Turtle-Information-Sheet_2021.pdf [PDF 1.0MB]

Lowrey T (2015) 'Bellinger River snapping turtles face extinction from mystery virus on NSW mid north coast', *ABC News*, posted Wed. 18 March 2015 at 6:51pm, https://www.abc.net.au/news/2015-03-18/rare-snapping-turtles-face-extinction-from-virus/6330262

NESA (NSW Education Standards Authority) (2017) ***Biology: Stage 6 Syllabus***, NSW Education Standards Authority, Sydney NSW, https://educationstandards.nsw.edu.au/wps/wcm/connect/657d2611-c201-49ce-a18e-ef0f786a5de0/biology-stage-6-syllabus-2017.pdf?MOD=AJPERESandCVID= [PDF 1.5MB]

Redleaf Environmental (2019) ***Manning River Helmeted Turtle: 2019 Autumn Survey Report***, prepared for the NSW Office of Environment and Heritage, Redleaf Environmental, Toowoomba, https://datasets.seed.nsw.gov.au/dataset/manning-river-turtle-survey-report-northern-catchments-may-2019

Spark P (2019) ***Survey for the Manning River Helmeted Turtle Conservation Program March 2019***, prepared for the NSW Office of Environment and Heritage, North West Ecological Services, Tamworth, https://datasets.seed.nsw.gov.au/dataset/66503b40-d1e9-4013-88d7-1f8cf8bbab99/resource/39159712-7d4f-4254-ac39-f4ff92e08b27/download/manning-river-turtle-survey-report-western-catchments-may-2019.pdf [PDF 9.4MB]

Online resources

Department of Climate Change, Energy, the Environment and Water

www.environment.nsw.gov.au/

The Department of Climate Change, Energy, the Environment and Water (the department) is part of the NSW Government. The department is responsible for protecting the environment in New South Wales. This responsibility includes the regulation of threatened species, ecosystems and populations under the *Biodiversity Conservation Act 2016*, and the implementation of NSW Government policy and programs including the Saving our Species program.

BioNet

www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx

NSW BioNet is the entry point to a range of biodiversity data products managed by the NSW Government including site records for threatened species. It is the trusted source of biodiversity data for the state of New South Wales.

You can search BioNet via species type, threatened status, or create a list for a geographic area or for a specific timeframe.

NSW Government threatened species profile database

www.environment.nsw.gov.au/threatenedspeciesapp/

The database holds information on every listed threatened species, ecosystem or population in New South Wales.

You can search the database via species name (scientific and common), keywords, region, habitat, species type and threatened status.

Each profile contains a description and information on the threatened status, broad distribution, habitat and ecology of the species. There is also detailed distribution, habitat and vegetation information. There are sections on threats, broad actions to assist the species, a reference section and links to related information. There are also links to the Saving our Species database and targeted strategies developed to assist the species. Where available the page will have images of the species and many birds have call recordings available.

Atlas of Living Australia

www.ala.org.au/

The Atlas of Living Australia (ALA) is Australia's national biodiversity database. It provides free, online access to millions of occurrence records for species. The ALA species pages display text descriptions, images, location information, taxonomic details and links to academic literature for every species in the database. The ALA also enables you to explore the biodiversity in your own area or region.

TurtleSAT

www.turtlesat.org.au/turtlesat/default.aspx

TurtleSAT is an online resource where citizen scientists can map the location of freshwater turtles in waterways and wetlands across Australia. Sightings will help to track the movement and behaviour of turtles, to protect them and their offspring in your local area.

Freshwater turtles

www.environment.nsw.gov.au/topics/animals-and-plants/native-animals/native-animal-facts/freshwater-turtles

This is a NSW Government webpage with information on the ecology, species and threats to freshwater turtles in New South Wales.

Saving our Species database

www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/saving-our-species-program/saving-our-species-database

The Saving our Species database contains information on conservation status, management objectives, species sightings and management sites across New South Wales, critical actions for the species, and how the species it to be managed under the Saving our Species program.

SEED: Sharing and enabling environmental data portal

www.seed.nsw.gov.au/

SEED is a free NSW Government online resource that allows anyone to access environmental data for research or academic purposes. SEED includes over 2,400 environmental datasets currently held by NSW Government entities related to water, land, air, vegetation and threatened species. SEED provides a medium to visualise data without requiring scientific expertise or specialist mapping software. You can search and view environmental information and data. Where the data is in spatial form, you can overlay different types of data and then export and print maps.

This is the portal that facilitates access to Manning River helmeted turtle survey documents.

International Union for the Conservation of Nature

www.iucnredlist.org/

https://iucnrle.org/

The IUCN Red List of Threatened Species and the IUCN Red List of Ecosystems are inventories of the global conservation status of plant and animal species and ecosystems. They use quantitative criteria and rule sets to evaluate the extinction risk of thousands of species and scientific assessments of the risk of ecosystem collapse, as measured by reductions in geographical distribution or degradation of the key processes and components of ecosystems.

Other links in this document

Table 28 Hyperlink addresses

Text	URL
Australian Government Style Manual – 'Referencing and attribution'	https://www.stylemanual.gov.au/referencing-and-attribution
'Bellinger River snapping turtles face extinction from mystery virus on NSW mid north coast', Lowrey (2015)	https://www.abc.net.au/news/2015-03-18/rare-snapping-turtles-face-extinction-from-virus/6330262
Conservation program for the Manning River helmeted turtle – survey and monitoring: Report on turtle trapping in 2018–19, Chessman (2019)	https://datasets.seed.nsw.gov.au/dataset/manning-river-turtle-survey-report-middle-reaches-may-2019
'Data-deficient species'	https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/saving-our-species-program/threatened-species-conservation/data-deficient-species
'Environmental and zoo education centres'	https://education.nsw.gov.au/teaching-and-learning/curriculum/sustainability/environmental-zoo-centres
'Final Determination' – Manning River helmeted turtle, NSW Scientific Committee (2017)	https://drive.google.com/file/d/15VAGqevd7TGv3YJ-3cQtasfdlfyQMUrf/view
Google My Maps	https://www.google.com/maps/d/
Help us save the Manning River turtle YouTube video, Part 2, Tim Faulkner from Aussie Ark (2018)	https://www.youtube.com/watch?v=ZX_fYmJrJ44
iNaturalist	https://www.inaturalist.org
'Key threatening processes'	https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/about-threatened-species/key-threatening-processes
Manning River Helmeted Turtle: 2019 Autumn Survey Report, Redleaf Environmental (2019)	https://datasets.seed.nsw.gov.au/dataset/manning-river-turtle-survey-report-northern-catchments-may-2019
'Manning River helmeted turtle *(Myuchelys purvisi)* – endangered species listing'	https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2017-2018/manning-river-helmeted-turtle-myuchelys-purvisi-endangered-species-listing
Manning River Turtle 2017 YouTube video, WILD Conservation (2017)	https://www.youtube.com/watch?v=hYUld_9APHU
'Manning River Turtle researchers seeking locations' – *Gloucester Advocate* article, Driscoll (2017)	https://www.gloucesteradvocate.com.au/story/5120707/have-you-seen-this-turtle-we-want-to-know-where/
Meet Manny our first Manning River turtle YouTube video, Part 1, Tim Faulkner from Aussie Ark (2018)	https://www.youtube.com/watch?v=wAHYZRM-ZrY

Text	URL
'NSW Threatened Species Scientific Committee'	https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee
Saving Our Species NSW Australia YouTube video, NSW Environment and Heritage Group (2018)	https://www.youtube.com/watch?v=gJdaenelPRs
'Saving our Species program' – overview	https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/saving-our-species-program
'Scientific licences' – NSW Government requirements	https://www.environment.nsw.gov.au/licences-and-permits/scientific-licences
Searching for the Manning River Turtle YouTube video, Dr Bruce Chessman (2013)	https://www.youtube.com/watch?v=v4cEs1-q-Rs
'Site-managed species' – Saving our Species program	https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/saving-our-species-program/threatened-species-conservation/site-managed-species
'Species listing categories' for NSW threatened species	https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/programs-legislation-and-framework/species-listing/species-listing-categories
Survey for the Manning River Helmeted Turtle Conservation Program March 2019, Spark (2019)	https://datasets.seed.nsw.gov.au/dataset/66503b40-d1e9-4013-88d7- 1f8cf8bbab99/resource/39159712-7d4f-4254-ac39-f4ff92e08b27/download/manning-river-turtle-survey-report-western-catchments-may-2019.pdf [PDF 9.4MB]
Threatened Fauna of the Hunter and Mid Coast – Manning River helmeted turtle, Hunter Local Land Services (2021)	https://www.lls.nsw.gov.au/__data/assets/pdf_file/0006/1343814/Manning-River-Turtle-Information-Sheet_2021.pdf [PDF 1.0MB]
'Working Scientifically' – outcomes	https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-learning-areas/stage-6-science/biology-2017/working-scientifically

Appendix A: *Gloucester Advocate* article

‘Manning River Turtle researchers seeking locations’

By Julia Driscoll, *Gloucester Advocate*, published 16 December 2017, updated 30 January 2019 (reproduced here with permission)

Elusive: The Manning River Helmeted Turtle is considered perhaps the most beautiful turtle in Australia and is very distinctive. Picture: Gary Stephenson

The Manning Valley’s own 55 million-year-old turtle, found only in our river and its catchments, has advocates both locally and outside the valley cheering on its survival.

The Manning River Helmeted Turtle (also known as the Manning River Snapping Turtle and Purvis’ Turtle) was officially declared an endangered species in April 2017.

Following the announcement a small group of concerned citizens formed the Manning River Turtle Conservation Group, the group responsible for the Wingham Winter Solstice Lantern Walk and the school colouring/art competition in June 2017.

Watch what we think is the first underwater footage of the Manning River Turtle *(Thank you to Kane Durrant for use of the video)*:

https://www.youtube.com/watch?v=hYUId_9APHU

The group has since been auspiced by Manning Valley Neighbourhood Services in Wingham and plans are underway for another awareness raising lantern walk and art competition in 2018, at the request of locals who enjoyed the first one.

The MRTCG has also been in regular contact with the NSW Office of Environment and Heritage (OEH) and professionals interested in researching the turtle.

Little is known about the population of the turtle as not a lot of research has been done, but since being declared endangered work is in progress to learn more about them.

NSW Office of Environment and Heritage data support officer, Andrew Steed, with Kerrie Guppy and Jennifer Granger of the Manning River Turtle Conservation Group, and Mia Granger

OEH in Coffs Harbour have been studying the very similar Bellinger River Turtle and will now be seeking funding to begin research and establish regular monitoring of the Manning River Turtle.

Once funding is approved, OEH data support officer, Andrew Steed anticipates three researchers, including Dr Bruce Chessman who has previously done some research on the turtle, will get to work finding, tagging, taking swabs and studying the turtles. They are also particularly interested in how vulnerable the Manning River Turtle would be to a virus similar to one that nearly decimated the Bellinger River Turtle population.

However, to undertake this research, they need to find spots where the turtle is located and how to get access to those spots.

“I don’t know what our chances of success are. It’s always a bit of a lottery,” Andrew Steed said.

So we’re asking you, the community. Have you seen the Manning River Turtle? If so, where have you seen it?

If you have sighted a Manning River Turtle please email Andrew Steed on Andrew.Steed@environment.nsw.gov.au.

How to identify the Manning River Turtle

- Short-necked turtle.
- Brown shell above, but is usually quite bright yellow below, except in large older individuals.
- Usually a distinct yellow stripe from the angle of the jaws, especially in the young, while the underside of the tail has distinctive yellow markings: a bright yellow stripe from median plastron notch to anus.
- Another stripe on each side of the tail slopes down to also reach the anus; and there is a bright yellow patch under the tip of the tail.
- Shell above broadly oval with a smooth hind edge.
- Two 'barbel's' under the chin.
- A horny 'helmet' on its head.
- Habitat preference is for relatively shallow, clear, continuously fast-flowing rivers.

The turtles are not found in dams, and most likely will not be seen crossing roads.

If you do find what you think might be a Manning River Turtle, please DO NOT handle the turtle.

Keep up to date at the Manning River Turtle Conservation Group's Facebook page.

Julia Driscoll – Journalist

Julia Driscoll has worked as a journalist for the Wingham Chronicle and Manning River Times for seven years. She values the deep connection with community that being a rural and regional journalist brings. Career highlights have involved environmental stories - bringing the plight of the little known endangered Manning River helmeted turtle to the attention of the public, resulting in wide-spread knowledge in the community and conservation action; and breaking the news of the Manning River ceasing to run for the first time in recorded history