



Queensland Museum: Where the Research Happens

YEAR 7 AND 9
BIOLOGICAL SCIENCES



QGC

FUTUREMAKERS



**QUEENSLAND
MUSEUM NETWORK**



**Queensland
Government**

Future Makers

Future Makers is an innovative partnership between Queensland Museum Network and Shell's QGC business aiming to increase awareness and understanding of the value of science, technology, engineering and maths (STEM) education and skills in Queensland.

This partnership aims to engage and inspire people with the wonder of science, and increase the participation and performance of students in STEM-related subjects and careers — creating a highly capable workforce for the future.

Cover image: This specimen of ankylosaur, Kunbarrasaurus, found near Richmond is the most complete dinosaur specimen from Australia. This specimen has rows of simple teeth to grind its food. Peter Waddington, QM.

Copyright © 2019 Queensland Museum and The University of Queensland.



The images included in this teaching resource may be used for non-commercial, educational and private study purposes. They may not be reproduced for any other purpose, in any other form, without the permission of the Queensland Museum.

This teacher resource is produced by Future Makers, a partnership between Queensland Museum Network and Shell's QGC business, with support from the Australian Research Council and other parties to ARC Linkage Project LP160101374: The University of Queensland, Australian Catholic University Limited and Queensland Department of Education.

EXPLAIN - ELABORATE

Queensland Museum: Where the Research Happens

Teacher Resource

Scientists at Queensland Museum have been studying Queensland's unique biodiversity for over 150 years. In these activities, learn about current research and be a scientist, analysing evidence from millions of years ago, and then your local environment, to make predictions.

Patrick Couper, Senior Curator of Reptiles and Amphibians

In this activity students learn about life as a curator at Queensland Museum, and the projects that Patrick Couper has worked on. Students will also learn why Patrick is so interested in plastics, and some ways he reduces his impact on the environment. Students are then encouraged to think about how they can reduce plastic consumption and litter and encourage others to do the same.

Fossil Food

In *Fossil Food*, students will analyse the diet of extinct Queensland animals and use their prior knowledge to predict the structure of the digestive systems of dinosaurs and marine reptiles. They will also construct a food chain of an extinct marine reptile.

Students can learn more about these dinosaurs and extinct marine reptiles in the [Lost Creatures](#) exhibition at Queensland Museum in Brisbane.

The Queensland Museum Discovery Guide [In Search of Ancient Queensland](#) also showcases the outstanding fossil collections and research of the Queensland Museum, including pictures of coprolites, illustrations of corkscrew intestines and the gut content of an ankylosaur.

Fascinating Faeces

Scientists are forensic investigators, always collecting evidence to better understand the world. Students explore what palaeontologists can learn from coprolites (fossilised faeces). Students are then encouraged to explore their local environment to find evidence of living things and investigate what they can learn from this evidence.

Both the [Queensland Museum Network Field Guide to Queensland Fauna App](#) and Queensland Museum's [Ask an Expert](#) service can help provide more information if students have questions about what they have found. They can also drop into the [Discovery Centre](#) on Level 4 of Queensland Museum in Brisbane where knowledgeable staff can answer questions about Queensland's animals, rocks, fossils, people and history.

Curriculum Links

Science

YEAR 5

Science as a Human Endeavour

Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE081)

Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE083)

Science Inquiry Skills

With guidance, pose clarifying questions and make predictions about scientific investigations (ACSIS231)

YEAR 6

Science as a Human Endeavour

Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE098)

Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE100)

Science Inquiry Skills

With guidance, pose clarifying questions and make predictions about scientific investigations (ACSIS232)

YEAR 7

Science Understanding

Interactions between organisms, including the effects of human activities can be represented by food chains and food webs (ACSSU112)

Science as a Human Endeavour

Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE119)

Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures (ACSHE223)

Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE120)

People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE121)

Science Inquiry Skills

Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS124)

YEAR 8

Science as a Human Endeavour

Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE134)

Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures (ACSHE226)

Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE135)

People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE136)

Science Inquiry Skills

Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS139)

YEAR 9

Science Understanding

Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems (ACSSU176)

Science as a Human Endeavour

Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE119)

Values and needs of contemporary society can influence the focus of scientific research (ACSHE228)

General Capabilities

Literacy

Comprehending texts through listening, reading and viewings

Critical and Creative Thinking

Inquiring – identifying, exploring and organising information and ideas

Generating ideas, possibilities and actions

Reflecting on thinking and processes

Ethical Understanding

Understanding ethical concepts and issues

Reasoning in decision making and actions

Queensland Museum: Where the Research Happens

Student Activity

Queensland Museum has been an authority on the investigation, documentation and conservation of Queensland's biodiversity for over 150 years. Through this research we have seen firsthand the growing problem of plastic pollution. Plastics are now commonly found in the digestive tracts of seabirds, marine turtles, fish and even whales. We have even found plastic waste in areas previously unexplored by humans, collecting samples from the abyssal zone off the eastern Australian coast, on the sea-floor, 4000 meters down.

A Chat with Patrick Couper, Senior Curator of Reptiles and Amphibians

Patrick Couper is the Senior Curator of Reptiles and Amphibians at Queensland Museum. Learn more about life working in a museum and how you can reduce your plastic consumption below.

- **How did you become interested in your field of study?**

I was always interested in natural history and as a child I had collections of shells, feathers and rocks. A pivotal experience was visiting the Dominion Museum in Wellington, New Zealand, for a behind the scenes tour and seeing shelves of whale bones, drawers of study skins and a taxidermist at work. I set my sights on a museum career, studied zoology at university and learnt how to do taxidermy. These skills equipped me for a job at the Queensland Museum and led to my current position as Senior Curator of Reptiles and Amphibians.



Patrick Couper examining turtle skulls in the Queensland Museum's reptile collection (left) and monitoring nesting Flatback Turtles, Crab Island, north Queensland (right).

- **What is your favourite part of your work?**

I enjoy all my work. Participating in a field survey assessing the status of a Tuatara population on a remote island off the east coast of New Zealand and studying marine turtles feeding in Moreton Bay stand out as career highlights. More recently, I've enjoyed my involvement in the World Science Festival's Turtle Hatchery and engaging with museum visitors.

- **Describe some of the projects that you are currently working on.**

I am currently collaborating with other scientists working on the descriptions of two new burrowing skinks and investigating field sites to assess the status of some leaf-tailed gecko populations. A large part of my work over the last four years has involved the Hatchery at the World Science Festival Brisbane. This is a public engagement exercise that focuses on turtle research and the conservation and management of Loggerhead Turtles nesting along the southeast Queensland coast. The event highlights plastic waste in the oceans as a major problem for wildlife, particularly marine turtles during the open ocean stage of their life histories. As surface feeders they ingest small, hard pieces of plastic which result in gut blockages and death.

- **Why did you decide to undertake these projects?**

The description of new species has always been a focus of my research. Although I'm particularly interested in geckos and burrowing skinks, my approach is largely opportunistic – if I suspect something is new I'll investigate it further. The Hatchery provides people with the opportunity to witness Loggerhead Turtle hatchlings emerging from their eggs. In natural circumstances it occurs 60 cm below the beach surface. It's a special event and is well received by museum visitors. It provides an opportunity to tell the story of Loggerhead Turtles nesting at Mon Repos, on the Bundaberg coast, the conservation successes and how Queensland scientists have unravelled many of their life history mysteries.

- **How did you become interested in working with plastics?**

Programs like Blue Planet 2 (BBC) and War on Waste (ABC) have brought the plastics issue to the forefront. It seems that everybody is now aware of the issues surrounding plastic waste and its terrible impacts on the environment and wildlife. Working in the World Science Festival Brisbane Hatchery gave us an opportunity to focus on plastic waste and to introduce a school program around this. I wanted to reduce my use of plastics and influence others to do the same, particularly students who, in turn, can influence their parents.

- **How have you seen plastics affect living things?**

Like everyone else, I've seen televised images of marine turtles entangled in abandoned fishing nets (ghost nets) and seabirds and turtles dying from eating plastic waste. I've watched necropsies of post-hatchling turtles that have washed up dead along the Queensland coast and seen many with small, hard pieces of plastic in their guts. For the Hatchery, I've collected samples of plastic taken from the digestive tracts of turtles and seabirds and I've displayed these to show museum visitors the consequences of plastic waste entering the environment.

- **What do you do to reduce your impact on the environment?**

I organise a walk from the museum every Thursday to remove rubbish, particularly plastic waste, from city streets. I recycle at home and work and deposit my soft plastics in the designated bins at shopping centres. I use a bamboo toothbrush, a keep-cup for my coffee and carry a reusable water bottle. I reduce the amount of plastic wrapping around products I buy and try to influence others to do the same.



Rubbish collected around Queensland Museum, Brisbane on a lunchtime litter walk.

- **What would you recommend for students who would like to work in a similar field?**

Study subjects you're interested in to a graduate or postgraduate level and be proactive in taking advantage of any opportunities that will increase your skill set. Many organisations take volunteers, and scientists and postgraduate students at universities are often looking for people to assist with field studies. I learnt taxidermy and skeletal preparation by volunteering in a small museum in the Zoology Department at the University of New England (Armidale) and this helped me to get a job at the museum. There are opportunities to volunteer in the Turtle Research Program at Bundaberg each summer and I would encourage any student interested in turtles or wildlife management to get involved. Make your face known to the people who work in these fields.

After seeing the effect of plastics on animals, particularly turtles, Patrick, Senior Curator of Reptiles and Amphibians at the Queensland Museum, is working to reduce his impact on the environment.

1. How could you reduce plastic consumption and litter in your area?



If you want to learn more about life as a curator, or see some baby Loggerhead Turtles, watch as [Patrick Couper visits Mon Repos Turtle Rookery](#). Mon Repos is the most significant Loggerhead Turtle nesting population in the South Pacific region (located 15 minutes outside Bundaberg).

Fossil Food

Patrick is not the only person at Queensland Museum who studies the gut content of turtles. In fact, palaeontologists also study the gut content of turtles, the main difference being that their turtles are from the Cretaceous Period between 145 – 66 million years ago! The gut contents from turtles from the Cretaceous Period in Queensland show that they ate the bottom-dwelling bivalve, *Inoceramus*.

While fossilised records of gut contents are rare, the information they provide makes it possible to reconstruct the food webs that existed in ancient environments. For example, analysis of gut contents from a land dwelling, armoured ankylosaur confirms that it was a herbivore, eating ferns and other plants.



This specimen of ankylosaur, [Kunbarrasaurus](#) found near Richmond is the most complete dinosaur specimen from Australia. This specimen has rows of simple teeth to grind its food. Analysis of its fossilised gut content (right) revealed that it ate soft vegetation, including flowering plants, ferns and fruit. QMF18101, QM, Peter Waddington



Plesiosaur stomach stones. These marine reptiles often ingested stones to aid buoyancy and digestion. QMF18785. QM, Peter Waddington.

The gut contents of plesiosaurs reveal that these marine reptiles fed on the squid-like belemnites that also existed at this time. More interesting still, plesiosaur vertebrae have been found in the gut contents of pliosaurs, another type of marine reptile. This suggests that pliosaurs either hunted plesiosaurs, or scavenged on their remains.

You can find more information on fossils and the work of palaeontologists in the Queensland Museum Discovery Guide [In Search of Ancient Queensland](#) and in the [Lost Creatures](#) exhibition at Queensland Museum in Brisbane.

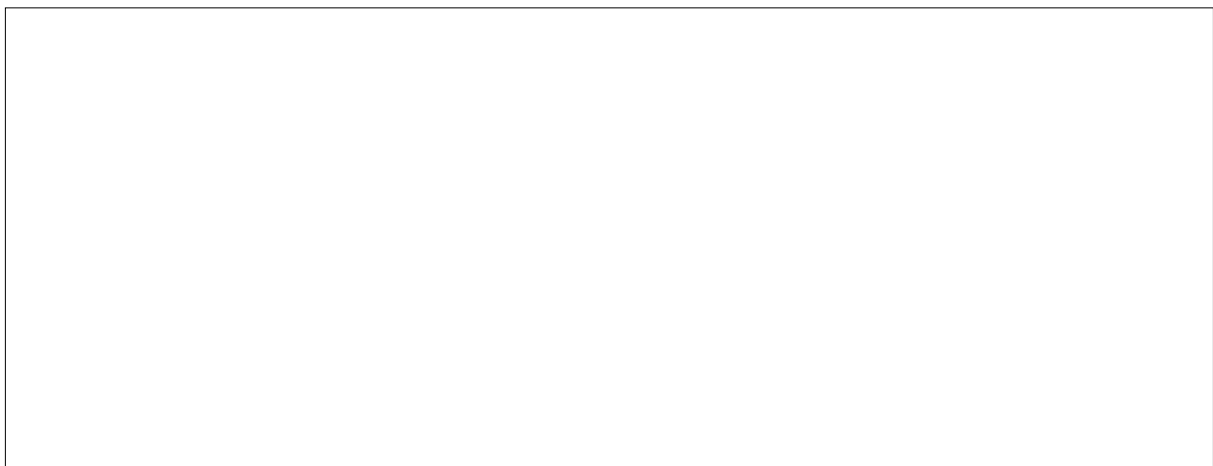
2. The animals mentioned above have been extinct for millions of years, but we can still learn about them from fossils.

Using the information provided above, and the *Pain in the Guts* activity, predict the structure of the gastrointestinal tract of the extinct animals below. Draw a labelled diagram and justify your answer.

Predicted structure of the gastrointestinal tract of extinct Queensland animals

a) Turtle from the Cretaceous	b) Armoured ankylosaur	c) A pliosaur

3. Draw a pliosaur food chain.



Fascinating Faeces

Forensic-style analysis of animal remains, hair, scats, and other traces can provide valuable evidence of where animals have lived, what they were doing, and who was eating who. Queensland Museum's carefully preserved collections of animal specimens, as well as dried scats or poo, are a vital resource for nature detectives.

Fossilised faeces, known as coprolites, can also provide information about the diet of extinct animals. Coprolites associated with fish, amphibians and reptiles are known from the Triassic Period of Queensland and there are also a number of turtle coprolites from Cretaceous-age marine rocks.

In some cases, the shape of the coprolite can reveal which animal made the droppings. For example, sharks, rays and lungfish have a corkscrew-like structure in the lower intestine, and some spirally twisted coprolites probably originated from these fishes. The size of the coprolite, alone, gives information about the size of the animal. Sections through coprolites may also provide information on the diet of the animal.



*Corkscrew-like lower intestine.
QM, Geoff Thompson*

4. Look for evidence of animals in your local area. Record any evidence of animals and living things in the table below, and explain what you can learn from this evidence.

Evidence of living things	What we can learn from this evidence

You may wish to use the [Queensland Museum Network Field Guide to Queensland Fauna App](#) to identify animals that may live in your local area.

Have a question about something you found? You can ask the helpful and knowledgeable staff at Queensland Museum questions about Queensland's animals, rocks, fossils, people, history and more! Just complete the question form on Queensland Museum's [Ask an Expert](#), or drop into the [Discovery Centre](#) on Level 4 of Queensland Museum in Brisbane. Here you can also see (and touch!) more examples of coprolites (fossilised faeces).