Queensland Museum: Researching Living Things

YEAR 8 – 12
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: Dr Sue-Ann Watson, Senior Curator of Marine Invertebrates at the Museum of Tropical Queensland (MTQ). Dr Watson observes a sea star from MTQ's collection.

QUEENSLAND MUSEUM NETWORK

Queensland Government

EXPLAIN - ELABORATE

Queensland Museum: Researching Living Things

Teacher Resource

Queensland Museum has a responsibility to collect, research and promote Queensland's natural, cultural and technological heritage. Our collections provide evidence of changes occurring in our natural and cultural environments.

Dr Sue-Ann Watson is the Senior Curator for Marine Invertebrates at the Museum of Tropical Queensland. In this profile, students learn about life working in a museum, the organisms Sue-Ann researches and the fascinating adaptations that help these organisms survive and thrive in their environments.

Curriculum Links

Science

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)

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

YEAR 9

Science Understanding

Multi-cellular organisms rely on coordinated and interdependent internal systems to respond to changes to their environment (ACSSU175)

Science as a Human Endeavour

People use scientific knowledge to evaluate whether they accept claims, explanations or predictions, and advances in science can affect people's lives, including generating new career opportunities (ACSHE160)

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

YEAR 10

Science Understanding

Global systems, including the carbon cycle, rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere (ACSSU189)

Science as a Human Endeavour

People use scientific knowledge to evaluate whether they accept claims, explanations or predictions, and advances in science can affect people's lives, including generating new career opportunities (ACSHE194)

Values and needs of contemporary society can influence the focus of scientific research (ACSHE230)

Marine Science

SENIOR SYLLABUS

Marine Biology

Unit 2, Topic 2: Marine environmental management: Marine conservation

Unit 3, Topic 2: Changes on the reef: Implications for marine systems

Queensland Museum: Researching Living Things

Student Activity

Scientists at Queensland Museum have been studying Queensland's unique biodiversity for over 150 years. Dr Sue-Ann Watson is the Senior Curator for Marine Invertebrates at the Museum of Tropical Queensland (MTQ). Learn more about life working in a museum, the organisms Sue-Ann researches and the fascinating adaptations that help these organisms survive and thrive in their environments.

A Chat with Dr Sue-Ann Watson, Senior Curator of Marine Invertebrates, MTQ

Dr Sue-Ann Watson, observing a sea star from the Museum of Tropical Queensland's collection. .

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

  I loved being in, on or near the ocean as a kid. Growing up near London in England, we didn't live near the ocean, so going there was a real treat on summer holidays. I also loved animals, art and natural sciences, as well as learning new things. I liked going for walks in the countryside, to the zoo or aquariums, and poking in rock pools and rivers. I made ponds in the back garden with fish and frogs, kept fish, rabbits and guinea pigs as pets. I would've had a lot more animals if I'd been allowed.

  At school, I studied subjects that I liked (Biology, Chemistry, Maths). These subjects also gave me options to study science degrees at university. I chose to study a Bachelor of Science in Biology. During my degree, I looked for opportunities to do aquatic or marine research. I volunteered on a six-week conservation expedition in Indonesia between the second and third (final) year of my degree. On this expedition I helped with some terrestrial research on monkeys; I also learnt to SCUBA dive and helped with coral reef and marine mammal research. After this trip, I decided to become a marine biologist.

  I went on to gain a scholarship to study a Master of Science in Oceanography. I specialised in marine biology as much as possible, and my research project was on deep-sea sea cucumbers that live 4 km deep in the Atlantic Ocean.

Sue-Ann working in one of her offices – the ocean!

After taking one year off, where I participated in a research expedition to Antarctica on board the Royal Research Ship *Discovery*, I secured a PhD scholarship in Marine Biology. During my PhD, I studied a variety of shallow-water marine invertebrates from polar, temperate and tropical locations. This is how I became particularly interested in working with marine invertebrates. I also became interested in how climate change is affecting marine animals and how they might be able to adapt to this change.

- **What do you enjoy most about your work?**

  Going to interesting places is definitely the highlight of my work. As scientists, we tend to travel internationally for fieldwork, conferences or to collaborate with colleagues. I'm lucky to have travelled to all seven continents, including Antarctica. In the summer, Antarctica is light 24 hours a day, so it's possible to go skiing late in the evening and then get up to go SCUBA diving in the morning. It's actually hard to remember to go to bed sometimes because it doesn't get dark.

  Travel was one of the reasons I chose my PhD project, because it was an adventurous fieldwork project. During my PhD, I also conducted temperate and tropical fieldwork and research, and that work took me to Australia – first to Victoria, and then to Queensland. Fieldwork is an enjoyable part of my work, and marine biologists usually love getting in the water. I snorkel or SCUBA dive to make observations or collect animals for experiments in the aquarium or to study in the laboratory. It's great to be able to get out in the field, on a boat, and in the water.

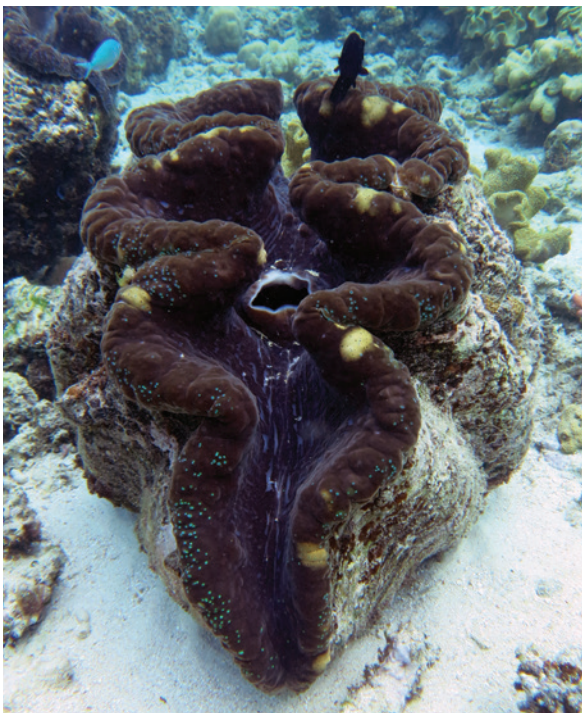
  I also come across interesting things often while working in a museum. For example, we have hundreds of specimens awaiting description in our wet collection room – each will eventually become a new species. Most of these are marine invertebrates. There are potentially tens of thousands of new species of marine invertebrates to be discovered, especially in highly diverse tropical areas and less explored areas such as the deep sea.

- **Describe some of the living things you are currently researching.**

  Marine invertebrates are incredibly diverse. I work on molluscs (e.g. snails, clams, squid), echinoderms (e.g. sea urchins, sea cucumbers, sea stars), crustaceans (e.g. hermit crabs) and brachiopods (also known as lampshells). I have also worked on projects about sharks, fish, corals, and seawater chemistry.

  One of the groups I work on are giant clams. There are 12 species of giant clam and the true giant clam is the largest shelled animal in the world, reaching 1.3 m in length and 250 kg in weight. This species may live to be 100 years old. Although giant clams are protected in Australia, in other areas of the Indo-Pacific region these organisms are harvested for their meat and shells and for the ornamental aquarium trade. This has led to giant clams becoming threatened species; some species of giant clam are now extinct in former areas of their natural range.

  I also work on pygmy squid. These are the world's smallest squid, and are only about 1 cm long. These charismatic little critters can be found in the waters around Townsville.



A giant clam, one of the groups of animals Sue-Ann is currently researching.

  There is a citizen science project called REDMAP (Range Extension Database and Mapping Project) that I work on too. Queensland is a global warming hotspot, warming at twice the global rate. REDMAP invites the Australian community to spot, log and map marine species that are uncommon along particular parts of our coast so we can track where species are moving with global warming and ocean heatwave events. You can get involved too! Visit https://www.redmap.org.au/region/qld/ to find out more.

- **Why did you decide to research these living things?**

  I thought about researching larger marine animals like birds or whales for my PhD, but there was less hands-on work with these animals and much more data analysis (e.g. from satellite tags). In contrast, shallow-water marine invertebrates are usually easy to collect, observe in the field and use for aquarium experiments. This allows me to ask scientific research questions, and find answers by directly observing and studying the animals.

- **What scientific processes are involved in the research of these living things?**

  Most scientific research is question-driven. For example, as a scientist, I wondered why animals have particular adaptations and how they might fare with climate change. I then set about to answer those questions. I conducted fieldwork (which included underwater observations, collections and experiments in a research aquarium) and analysis in a laboratory. I collected lots of data on special waterproof paper and video recorded the experiments.

Then I spent many days in the office doing computer work – recording data from the videos and then analysing the data using statistical software. After this, I spent several weeks writing up this information in a scientific paper called a journal article.

I love my job because I get to discover new things about marine animals. Being the first person to discover something is really exciting. Although big discoveries don't happen all the time, I do get to contribute to new knowledge everyday through working up data and writing scientific journal articles.

- **What adaptations do these living things have to help them survive in their environments?**

  Marine invertebrates have evolved lots of interesting ways to cope with life in the oceans.

  One of my main study groups are molluscs. Gastropod (snail) and bivalve (clam) molluscs have shells, and these shells are a structural adaptation that protects the soft body of the animal inside against biotic (i.e. predation) and abiotic (i.e. wave movement) factors.

  The humpbacked conch (or jumping snail) is another interesting animal we have on the Great Barrier Reef. These animals have a behavioural and structural adaptation that allows them to 'jump' away from cone snails, avoiding these dangerous predators. You can see the snail and their jumping adaptation in action in this story about our research: https://www.youtube.com/watch?v=VAE3rN-1i-o.

A humpbacked conch (or jumping snail), jumping away from its predator – the cone snail.

Recently, I have been researching the responses of jumping snails to climate change, specifically their responses to ocean warming and ocean acidification. I have found that ocean acidification alters the behaviour of jumping snails, making them less likely to avoid their predators. This may affect the survival of jumping snails into the future if climate change continues.

I am also working with a team of researchers to investigate how squid are responding to climate change. We have found that squid behaviour is also affected by rising carbon dioxide levels – squid become more active and display more defensive behaviours when threatened, but are worse at catching their prey. Overall, these behavioural changes at multiple levels of a complex marine food web could change predator-prey interactions in the future, and this could then affect other parts of the marine ecosystem.

- **What do you hope to achieve from this research?**

  By discovering patterns in marine animals across the globe and how they will cope with ocean warming and ocean acidification, we can start to predict how groups of marine animal will respond to climate change under different carbon dioxide emission scenarios. We can then use this information to inform other people about what is happening and influence decisions around climate change solutions.

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

  I didn't plan to be exactly where I am now, but I chose to do things that I enjoyed and that didn't feel like work to me. I think this is very important. Also, make sure you gain experience, paid or voluntary, in areas of work that you are interested in. You need to be keen on a subject to study it for three years, especially at PhD level.

  Marine biology is a competitive field; there are more people studying marine biology than there are jobs available. The pay is also relatively low for the number of years you study at university. I studied for nearly 8 years in total! I started with a Bachelor of Science (Honours) (Biology) for three years. I then went on to study a Master of Science (Oceanography) for one. Finally, I studied a PhD in Marine Biology for three and three quarter years.

  In the end, I knew I wanted to work with marine animals after studying subjects I enjoyed and taking gap years in between my degrees to gain experience in other work areas that I thought I might like. Ultimately, I didn't mind the competition, lower pay and length of study time because I was heading towards a career path that knew I would enjoy and that would give me a sense of purpose. Looking back, I'm so happy I put in the hard work and dedication throughout my school and university years so that I could achieve my dream job as a marine biology research scientist.