TEACHING RESOURCE | PROTECTING THE MARINE ENVIRONMENT – HABITAT RESTORATION AND MARINE DEBRIS

RATIONALE

This resource aims to help students and teachers in secondary schools investigate and understand more about some of the ways we can protect and restore the marine environment and reduce the impact of human activities in Tasmania. Climate change also has a significant impact on marine environments, and the effects of warmer waters around Tasmania could impact Tasmania's seafood production and alter the marine species found in Tasmania. See Teaching Resource - Understanding and Monitoring the Tasmanian Marine Environment for more information on water temperature in Tasmania.

LEARNING OUTCOMES

- Understand how humans are impacting marine environments, focusing on changes to marine habitats and marine plastic pollution.
- Understand the importance of restoring and conserving marine habitats to support marine biodiversity in Tasmania.
- Research a marine habitat restoration project; understand why it was needed; and how it supports the environment, society, and the economy.
- Understand the origin of marine debris.
- Understand the impacts (human health, environmental and economic) of marine debris.
- Research a marine debris mitigation method and evaluate the effectiveness.
- Consider some alternatives to plastics and how people could be motivated to use less plastic.

PART 1: HABITAT RESTORATION

Outline: Habitat restoration in Tasmanian marine environments

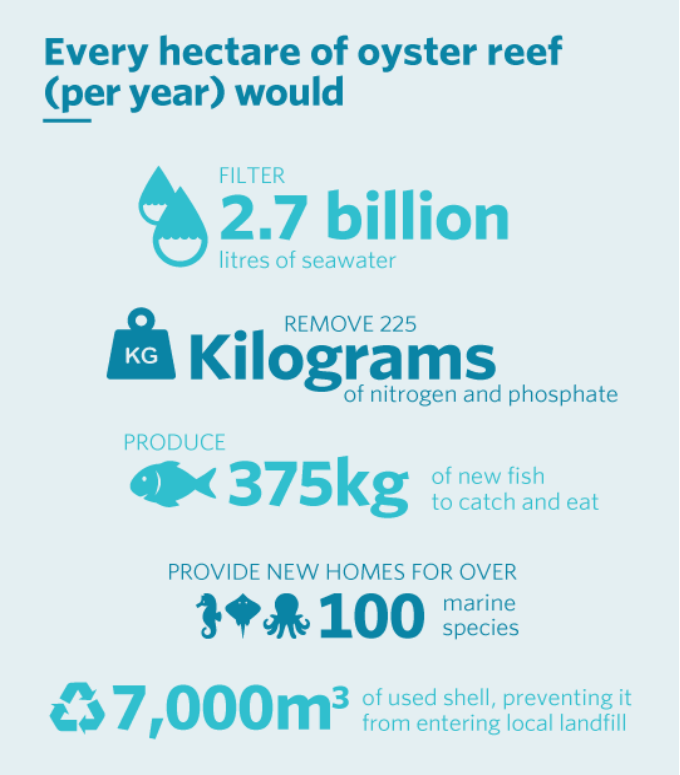
There are many diverse marine habitats in Tasmania, from coastal shallow waters, to rocky reefs and deep open ocean. Many Tasmanians enjoy beach and ocean based recreational activities. We also have thriving seafood and tourism industries that rely on healthy marine habitats. Unfortunately, some marine habitats have been negatively impacted over the last 100 years in Tasmania due to a range of different factors.

Image credit: John Turnbull

CASE STUDIES

Oyster reef/bed restoration

Over 90% of Australia's native oyster reefs were destroyed during the late 1800's and early 1900's through a combination of destructive dredging methods, changes to estuarine conditions, and overfishing. The native Angasi oyster (Ostrea angasi), also known as the Flat oyster, forms the foundation of these reefs, providing habitat for other species (shellfish, fish, crustaceans, invertebrates, and algae). Efforts are underway to restore 60 native oyster reefs by 2025, by placing suitable substrate (for example cured shellfish shells) seeded with Angasi oysters into suitable areas around southern Australia (including Tasmania). More information can be found on The Nature Conservancy website.



Source: Nature Conservancy Australia

Giant Kelp restoration

Giant Kelp *(Macrosystis pyrferia)* is a fast-growing brown alga that grows in cool and nutrient rich waters. Strands of Giant Kelp can form tall underwater kelp forests, providing habitat for many other species.

Tasmania has lost 95% of its surface canopy-forming Giant Kelp population over the past few decades due to warming waters. Climate change is increasing water temperatures globally, however the warm East Australian Current has been extending further south from northern Australia, meaning that the Tasmanian east coast is warming at a rate faster than the global average. Increasing water temperatures and low nutrient levels of the East Australian Current are contributing to a dramatic loss of Giant Kelp.

Kelp Forest. Image credit: Dr. Cayne Layton

The underwater Giant Kelp forests contribute to carbon sequestration and are a unique and integral part of Tasmania's marine ecosystems. Trials are underway to repopulate areas of Giant Kelp with kelp individuals that can withstand warmer waters, to a stage where they will self-recruit. Gametophytes from the remaining thermally tolerant kelp are being collected and grown in the IMAS lab, and the young kelp is transplanted to trial sites around southern Tasmania.

More information can be found on the IMAS website or in a case study on the TSSP page. See also Teaching Resource - Understanding and Monitoring the Tasmanian Marine Environment for more on the East Australian Current and water monitoring.

Removing the long-spined sea urchin *(Centrostephanus rodgersii)*
This urchin was first reported in Tasmanian waters in 1978, although it is likely that it arrived in the 1960s. Larvae of the species are thought to have been carried to Tasmania by the East Australian Current. This opportunistic eater consumes a wide range of organic material including seaweeds and animals. Its eating habits create underwater 'barrens' (vast areas of bare rocks which were previously covered in kelp), destroying natural habitat and significantly reducing biodiversity. Once an urchin barren is established, it is very difficult for kelp to recover as urchins can survive on a range of food sources, so the population of urchins doesn't decline once the kelp has disappeared.

Urchins threaten marine biodiversity as well as commercially and recreationally valuable species that rely on rocky reef habitats (i.e. abalone and rock lobster). One of the main predators of the long-spined sea urchin in Tasmania is Southern Rock Lobster. Historically rock lobsters have been heavily targeted by Tasmanian commercial and recreational fishers, to a point where their population on the east coast has reduced to 10% of natural levels. Management strategies were introduced in 2010 to assist with population recovery. They were complemented by relocation of rock lobsters from the south-west coast, where they are abundant, to areas impacted by the urchin.

Seafood industry workers are collaborating with scientists to remove urchins by hand and investigate habitat recovery. Efforts to create a market for these problematic intruders aids harvesting efforts. Urchin roe can be a cuisine delicacy with its rich seafood flavour, or compounded urchins can be deposited on garden beds as fertilizer. More information on the long-spined sea urchin story can be found in this UTAS news article.

Image credit: John Turnbull

PART 2: MARINE DEBRIS

Outline: Marine Debris – Sources, Impacts and Seafood Industry Mitigation

Marine debris is any abandoned item found in the marine environment that would not naturally occur there. About three quarters of the debris found is plastic, however there are many other materials that classify as marine debris.

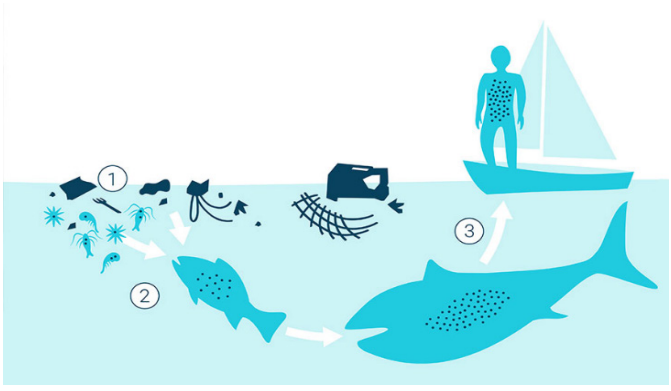
However, most marine debris comes from rubbish that has not been managed on land, including rubbish that has blown or been washed into the ocean. Research from CSIRO tracked the source of marine debris found in Australia and found that most debris was of Australian origin and debris increases around highly populated areas.

Sources

Humans create huge amounts of waste each year, and not all waste is managed correctly.
Some debris entering the ocean and foreshore areas has been accidently or deliberately discarded from human activities on the water, for example recreational activities, commercial fishing, aquaculture, oil rigs, shipping cargo, and the tourism industry.

Marine debris includes items such as nylon rope, shellfish baskets, buoys, PVC piping, cigarettes, bottles, soft plastics, hard plastic fragments, aluminium cans, textiles, rubber, wood or fishing gear.

BIOACCUMULATION



Plastics in the ocean can enter the marine food web. As one animal eats another, plastic can be passed up the food chain, and eventually accumulate in larger animals and fish, some of which might be eaten by humans.

Impacts

WILDLIFE ENTANGLEMENT
Animals may be strangled, drown or starve when trapped in floating debris. Animals can accidently swim into lost or discarded fishing nets, which can wrap around their fins, flippers and tails making it difficult for the animals to swim, catch food and escape predation.

INGESTION BY WILDLIFE
Animals can choke or suffocate from eating soft plastics and balloons. Hard plastics with sharp edges can damage an animal's internal organs. Animals can also have so much plastic in their stomach that there is no room for food, and they starve.

BOATING HAZARDS
Recreational and commercial boats can hit floating marine debris causing propeller entanglement or damage to the boat.

HAZARD TO BEACH VISITORS
Broken glass, sharp plastics and metal can be dangerous to humans and other animals.

NEGATIVELY IMPACTS TOURISM
People don't want to visit highly polluted areas.

TOXIC EFFECTS OF MARINE PLASTICS
Chemical contaminants can be toxic to humans and animals. Toxins can enter the food chain through being ingested as plastics or microplastics, and reach humans via bioaccumulation.

Seafood Industry Mitigation Methods

- Aquaculture companies regularly replace moorings, ropes and nets to avoid losing them in the event of breakage.
- Aquaculture companies use specific rope colours to aid accountability and data collection at clean ups.
- Aquaculture companies report to MAST when a large piece of gear is lost. MAST alerts waterway users of hazard.
- Aquaculture companies conduct clean-up days, where different companies target sections of the coast around southern Tasmania and remove rubbish.
- The Department of Primary Industries Parks Water and the Environment (DPIPWE) introduced a zero-tolerance policy to marine debris in July 2018.
- Tasmanian Salmon Growers Association released a debris tracking application for smart phones, which allows people to report sightings (type and location). Reports are sent to Marine and Safety Tasmania and the Marine Farming Branch of DPIPWE, for collation and any necessary action.
- The wild catch fishing sector supports coastal clean up activities by supplying use of boats and volunteer time.

LEARNING ACTIVITIES

1) RESEARCH A MARINE HABITAT RESTORATION PROJECT

Students should summarise the cause of damage to the natural resources; what are the consequential impacts (i.e. social, economic, environmental); what are the restoration activities and who is conducting them; and have they been successful? Share with class.

2) DESIGN A CLEAN-UP DAY FOR A SECTION OF BEACH OR FORESHORE

Choose a section of coast and describe why you think this area needs cleaning up. Think about who you will get to help clean up (e.g. members of the public, industry workers). Design promotional material to help people engage with your clean up (e.g. flyer, news article, social media event). Consider other impacts of your clean-up, for example nesting shorebirds, and factor this into the timing of your event.

3) ARTIFICIAL REEFS

Can artificial reefs be a solution to habitat damage and an opportunity to increase biodiversity, or is introducing artificial structures into the marine environment adding further human intervention to the ocean habitat? Share with class.

4) RESEARCH ABOUT 'GHOST GEAR'

What it is, how it occurs, why it harms marine life and what can be done about reducing it? Recreational fishes can also contribute to marine plastic pollution. Design a sign for popular fishing spots and boat ramps to inform people about the problems of lost fishing gear.

5) DESIGN CHALLENGE

Marine farmed oysters are grown in plastic baskets. Design an oyster basket that is robust and easily cleaned but is made from a biodegradable material.

6)REUSE CHALLENGE

Re-using and Recycling. Investigate a possible use for old marine farm rope; or research an alternative to plastic rope.

7) PACKAGING OF SEAFOOD

Seafood must be kept cool and free from bacteria to ensure it is safe for the consumer. Investigate the research into making plastic-like material from biological products, such as corn or rice starch, arthropod chiton, and algae; or look at re-usable options for seafood product transportation.

RESOURCES AND FURTHER READING

HABITAT RESTORATION

1. https://www.shellfishrestoration.org.au/
2. https://seagrassrestorationnetwork.com/
3. https://www.imas.utas.edu.au/research/ecology-and-biodiversity/projects/projects/assessing-the-potential-for-restoration-and-permaculture-of-tasmanias-giant-kelp-forests
4. https://ozfish.org.au/projects/

MARINE DEBRIS

1. https://www.huonaqua.com.au/identifying-our-equipment/
2. http://www.ourwaterway.com.au/wp-content/uploads/2014/09/101160+Coastline+Responsibility+Map.compressed.pdf
3. https://dpipwe.tas.gov.au/wildlife-management/marine-conservation-program/marine-mammal-incident-response
4. https://www.nationalgeographic.com/magazine/2018/06/plastic-planet-health-pollution-waste-microplastics/
5. https://www.aquaculturealliance.org/advocate/plastic-2-ocean-seafood-packaging-made-from-shellfish/