

THE TASMANIAN SMART
SEAFOOD PARTNERSHIP

GIANT KELP MARINE FOREST RESTORATION EDUCATION RESOURCE



Image Credit: Cayne Layton

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Image Credit: Cayne Layton

ACKNOWLEDGEMENT OF COUNTRY

We pay respect to the Traditional Owners of Iutruwita (Tasmania), the Tasmanian Aboriginal people, and acknowledge their continued survival and connection with their land, sea and sky Country that spans millennia. We acknowledge the many Nations of Tasmanian Aboriginal people, past and present, as the traditional and ongoing owners of their respective countries within Iutruwita and the islands. We pay respect to those who have passed and acknowledge today's Aboriginal communities who are the custodians of this land and sea. We acknowledge that all land, sea, and sky Country holds cultural values that provide strong and continuing significance to the Tasmanian Aboriginal communities. We acknowledge that Tasmanian Aboriginal people are part of a continuous culture that holds traditional knowledge about the ecosystems we all depend on.

THE TASMANIAN SMART SEAFOOD PARTNERSHIP

The Tasmanian Smart Seafood Partnership project aims to improve the sustainability of processes and practices in the seafood industry to achieve positive outcomes for marine biodiversity in Tasmanian waters. To achieve this, the project creates links between education, training, research, and restoration within the seafood industry. The Tasmanian Smart Seafood Partnership is a partnership program between NRM South and the Tasmanian Seafood Council. This project is supported by funding from the Australian Government's National Landcare Program.

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Writing: Mountain Ash Insights



Image Credit: Cayne Layton

INTRODUCTION

This education resource aims to introduce teachers to some of the challenges associated with ecological restoration projects, with a focus on Giant Kelp Marine Forests. The resource provides a fact sheet about Giant Kelp Marine Forests, information about restoration, and questions to help teachers hold classroom conversations about restoration challenges. The resource could be used by teachers to develop learning exercises for any age group but is generally aimed at high school level enquiry. This resource is particularly focused on ecological restoration in the Tasmanian context but has applicability for learning opportunities around broader marine and land-based restoration challenges across Australia and the world.

LINKS TO THE AUSTRALIAN CURRICULUM

The resource primarily aligns with the Australian curriculum learning areas of science, and humanities and social sciences. Teachers are encouraged to integrate this resource across learning areas relevant to their classroom activities.

Learning Area	Relevant strands/subjects
Science	Science understanding
	Science as a human endeavour
	Science inquiry
Humanities and social sciences	Geography
	Economics and business
	Civics and citizenship

This resource is likely to be relevant for the following content areas of the curriculum: The cross-curriculum priorities are included in the resource by bringing attention to links that Tasmanian Aboriginal Peoples have with kelp, Australia’s connection and engagement with Asia through the potential introduction of Wakame seaweed, and the priority of sustainability in relation to ecological restoration.

The resource includes potential for further learning in general capabilities in a number of categories. Critical and creative thinking capability is supported by giving students the opportunity to generate ideas, explore alternatives and construct and evaluate arguments. The resource encourages teachers to lead students to explore contested territories, discuss ideas and learn how to manage conflict and uncertainty thereby building ethical understanding. Such discussions will assist students to develop personal and social capability through working together, collaborating and regulating their emotions and behaviours during debates.

GIANT KELP MARINE FORESTS FACT SHEET

The coastal waters around Tasmania are home to many species of seaweed (all technically algae) including Tasmanian Kombu (*Lessonia corrugata*), Golden Kelp (*Ecklonia radiata*), Bull Kelp (*Durvillaea* spp.), and several varieties of edible green seaweeds¹. Giant Kelp (*Macrocystis pyrifera*), also known as String Kelp² is the largest and fastest growing of these species. It grows on rocky reefs eight metres or more below sea level and can grow up to 60cm in a single day³. Giant Kelp plants have a strong root-like system called a holdfast which attaches them to the rock⁴. The distinguishing features of Giant Kelp are a large string-like central stalk, called a stipe, with many leafy blades which grow out of it. At the base of each blade is a gas-filled flotation bladder (called a pneumatocyst) which allows the Giant Kelp plants to float and form a canopy in the ocean, similar to the canopy of a land-based forest⁵. Giant Kelp is a cold-water species that prefers sea water surface temperatures to be between 5°C and 20°C⁴.

Marine kelp forests are found in the waters surrounding 25% of the planet's coastlines⁶. In Australia, Giant Kelp Marine Forests extend 8000km (about twice the width of Australia) from Kalbarri, Western Australia to the New South Wales/Queensland border and around Tasmania's coastline⁶. This area is far larger than the well-known Great Barrier Reef in Queensland which is only 2000km long⁷. However, the Giant Kelp Marine Forests of South East Australia are listed as a threatened ecological community under the Environment Protection and Biodiversity Conservation Act 1999. This community can be found from the southeast corner of South Australia, through Victoria and around Tasmania and extending north to the southeast corner of New South Wales⁸.

Giant Kelp Marine Forests provide benefits for many animals and people. Giant Kelp Marine Forests of South East Australia are home

to a multitude of endemic species which occur nowhere else on earth⁹. Animals which shelter within the canopy of a Giant Kelp Marine Forest include weedy sea dragon, feather star, brittle star, urchins, anemone, sponge, biscuit stars, lace coral and cup coral⁵. Seals and sea birds will also feed on the fish that inhabit the Giant Kelp Marine Forests and will use the giant blades to hide from predators such as sharks¹⁰. The kelp forests are also used by commercially fished species including abalone and southern rock lobster as nurseries and grazing grounds⁵.

In addition to providing habitat for commercial and non-commercial species, Giant Kelp Marine Forests can provide coastal erosion protection, tourism benefits, biomass production, carbon sequestration services, and are preferred locations for recreational divers¹¹. Giant Kelp is also grown under cultivation to be processed into products such as alginate³ which is used for thickening and gelling of food products and cosmetics¹². Currently, only Wakame (*Undaria pinnatifida*), an introduced seaweed from Japan, is permitted to be wild harvested¹, although seaweed which has washed up on the shore is often collected and used in private gardens. Kelp also holds cultural significance for the traditional owners of lutruwita who make "rikawa" - a water carrier made from Bull Kelp¹³. Our understanding of the benefits of seaweed species is rapidly growing which is driving an emerging seaweed farming industry in Tasmania¹. Wakame is being explored for culinary purposes, and *Asparagopsis* seaweed, is beginning to be farmed to feed to livestock to reduce their methane emissions¹⁴.

KELP FOREST RESTORATION

Ecosystem restoration

Ecosystems are the web of living organisms and the physical environment that they inhabit. They are essential for global environmental function and human well-being. Within each ecosystem is a huge and complex range of interdependencies, with each individual part of the system influencing all the other parts. Human impacts on one element, can have cascading impacts across the ecosystem¹⁵.

Human impacts on ecosystems can include exploitation, degradation, and climate change. Ecosystem restoration is the process of aiding degraded or destroyed ecosystems to improve their health and function and can extend to all sorts of ecosystems including forests, farmlands, cities, wetlands, and oceans¹⁵. The international community has recognized the importance of this work to achieving the United Nations Sustainable Development Goals and has allocated a Decade of Ecosystem Restoration (2021-2030) to encourage governments, business, communities, and individuals to play their part in restoring the world's degraded ecosystems¹⁶. Ecosystem restoration activities can include removing herbivores, replanting endemic species, reintroducing key stone species, and rehabilitating the environment¹⁵.

Giant Kelp Marine Forest degradation in Tasmania

Giant Kelp Marine Forests around Tasmania have been declining for several decades, with loss of these ecosystems thought to be at around 95% since the 1970s¹⁷. Long-term decline has meant that the Giant Kelp Marine Forests of South East Australia are now listed as an endangered marine community¹⁸.

A large driver of this wide-spread ecosystem collapse is the southward shift of the East Australian Current over the last 50 years which has been caused by human-induced climate change¹⁹. In eastern Tasmania, coastal waters are now warming at approximately four times the global ocean warming average, the fastest rate in the Southern Hemisphere. These warmer, more acidic, and less nutrient-rich waters reduce photosynthesis and growth rates of Giant Kelp plants²⁰. The warmer waters have also increased the range of the Long-spined Sea Urchin (*Centrostephanus rodgersii*)²¹ which feeds on a variety of kelp and seaweeds, including Giant Kelp, further reducing their biomass²². A major predator of sea urchins is the Rock Lobster. Historic changes in Rock Lobster populations on the east coast of Tasmania due to recreational and commercial fishing mean that these predators are less effective in balancing Long-spined Sea Urchin numbers which do not make up their traditional diet. Once the Sea Urchins reach very high population levels, and grazing pressure reaches catastrophic levels, seaweed including Giant Kelp are unable to recover, resulting in what is known as "sea urchin barrens"⁹.



Image Credit: John Turnbull

Giant Kelp Marine Forest restoration in Tasmania

Climate change mitigation and remediation may support efforts to restore Giant Kelp Marine Forests, but this is dependent on global efforts, and changes to sea surface temperatures may be irreversible. To support the return of the Giant Kelp Marine Forests to Tasmanian waters, scientists have been undertaking research and have found out that it is possible to breed warm temperature tolerant kelp cultivar to help Giant Kelp Marine Forests better adapt to climate change⁹. Tasmania's sea surface temperature differs around the state²³, with some areas likely to be more suitable for Giant Kelp Marine Forest restoration than others. Scientists, the seafood industry, and conservation groups are also exploring methods for Giant Kelp Marine Forest restoration which include herbivore management (by divers), seeding and transplanting kelp plants²⁴. Unlike land-based systems, where much of landscape is privately owned, marine environments are managed by governments on behalf

of the public. The Tasmanian government is responsible for the coastal waters surrounding (within three nautical miles) the State, with waters further offshore being managed by the Commonwealth²⁵. To give Giant Kelp Marine Forest restoration the best chance of success, strong collaboration and communication between stakeholders is critical. Potential stakeholders for such restoration projects include: the Tasmanian Aboriginal community; conservation groups; government; recreational fishers and divers; commercial fishing industries; researchers; tourism industry; local residents; seaweed industries involved in growing Giant Kelp plants¹⁷; and the general public. Furthermore, it is important to monitor and evaluate the success of any projects to inform future restoration efforts²⁶.

QUESTIONS FOR THE CLASSROOM



What role can individuals, organisations and governments play in Giant Kelp Marine Forest restoration?



Encourage students to consider societal responsibility for climate change remediation and managing the marine environment as a global common.



Who might be the stakeholders of a Giant Kelp Marine Forest restoration project?



Encourage students to consider a marine environment that is familiar to them (this might be a local beach or holiday location). Given the information provided in this resource, ask students to consider who might be interested in a hypothetical Giant Kelp Marine Forest restoration project near their chosen location. Ask students to consider different stakeholder perspectives and how these stakeholder groups could work together on ecosystem restoration – consider opportunities for role playing and mock debate. Encourage students to learn that there are many views and interests in ecological restoration and many different ways that such successful outcomes can be achieved.



Why is communication important in the restoration of Giant Kelp Marine Forests?



Encourage students to imagine they are the proponent of a reef restoration project. Who might you need to talk to? What information would you need to share to convince others that your work is important?



How could herbivores be managed in restored Tasmanian Giant Kelp Marine Forests?



Encourage the class to consider urchin harvesting as a method of restoring ecosystem function and consider the benefits for fishers and communities in this approach. Think about potential uses for harvested urchins – food, fertiliser, etc. Encourage students to be creative and innovative in their thinking.



How can the success of Giant Kelp restoration projects be future proofed, given the changing climate?



Options could include warm-tolerate breeding of Giant Kelp plants, utilising cooler areas of Tasmania, and aquaculture for Giant Kelp. Where might be the best location to restore Giant Kelp Marine Forests in Tasmania. Explore sea surface temperatures and think about the type of facilities needed to cultivate Giant Kelp plants.



How can we monitor the success of Giant Kelp Marine Forest restoration projects?



Encourage students to consider ways that Giant Kelp Marine Forests could be monitored including citizen science using Kelp Tracker. Encourage students to consider how they would know if ecosystem function has been restored? Think about what is required to coordinate working at sea to monitor healthy Giant Kelp Marine Forests and compare this to land-based ecosystem restoration.

RESOURCES AND FURTHER READING

Local

- <https://macroalgae.imas.utas.edu.au/>
Kelp Tracker – a free phone app allows recreational fishers and community members to report their sightings of Giant Kelp
- <https://greatsouthernreef.com/resources> includes student and teacher resources
- <https://www.youtube.com/watch?v=BLgmQoMQ3K8>
video of Giant Kelp Marine Forest restoration – short one minute review by IMAS of juvenile kelp being secured to the reef
- <http://www.bom.gov.au/oceanography/forecasts/idyoc300.shtml?region=VICTAS&forecast=SST>
the Bureau of Meteorology provides information about sea surface temperature
- <https://www.imas.utas.edu.au/research/ecology-and-biodiversity/temperate-reefs>
- <https://ozfish.org.au/projects/giant-kelp-restoration-project-tasmania/>
- <https://nre.tas.gov.au/>
- <https://www.nespmarine.edu.au/>

Global

- <https://www.reefcheck.org/kelp-forest-program/>
- <https://kelpforestalliance.com/>
- <https://sanctuaries.noaa.gov/education/teachers/kelp-forest/>

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