TASMANIA'S GIANT KELP FORESTS

One of the last remaining patches of giant kelp forest on the NE Tasmanian coast
Photo: Cayne Layton Quote: Zoe Kean for ABC Science

The largest and the most colourful Weedy Sea Dragon are found in Tasmania.

Source: Behind the News – https://www.youtube.com/watch?v=BJU64Vm0T-U

Interesting facts

⚓The giant kelp forests along Tasmania's East coast were once so dense they featured as obstacles on shipping maps.

🌿Giant kelp forests are the most productive ecosystems on Earth in terms of total amount of **carbon fixed** per square meter per year.

Source: Great Southern Reef website – https://greatsouthernreef.com/giant-kelp

SUPER KELP

Giant kelp (*Macrocystis pyrifera*)

- Giant kelp is a large brown alga growing on rocky reefs in water depths of 8 metres or more. The fronds grow vertically toward the surface, in the cold temperate waters of southeast Australia where mean sea surface temperature range between 5 °C and 20 °C with moderate wave exposure.
- The largest areas of Giant Kelp in Australia are in Tasmania, South Australia, and Victoria.
- In the past Giant Kelp was harvested as a natural resource in Tasmania.

The Giant Kelp Forest Ecosystem

Giant Kelp

- are identified by long string-like stalks with multiple leafy blades and gas filled flotation bladders that allow the kelp to reach the surface where they to form **a floating canopy.**
- **have very high primary productivity** under ideal conditions of cool, nutrient rich water. The kelp can:
  - grow over **35 metres long**
  - grow up to **half a metre each day**
- do not store Nitrogen well so rely on **nutrients** taken directly from ocean water.
- is the **foundation species** forming 3D forest habitats extending beneath a closed or semi closed canopy to the sea floor.
- provide **habitat** for mobile and stationary organisms including fish, molluscs (sea snails), bryozoans (lace corals), polychaetes (worms), crustaceans (crabs, isopods, amphipods), echinoderms (sea urchins, sea stars) and sponges.
- slows water movement and catches the drifting spores and larvae of a variety of species, helping them to settle on the seabed to grow e.g., rock lobster and kelp.

ILLUSTRATIVE EXAMPLE 3: FUTURE PROOF?

Giant kelp forest loss

Tasmania's Giant Kelp Forests have been in slow decline since the 1940's. In the last 15 years however, research has revealed that 95 % of giant kelp forests on the east coast of Tasmania have disappeared. These forests are now listed by the Australian Government as the first **endangered marine community** in Australia.

"Sixty years ago, Tasmania's coastline was cushioned by a velvety forest of kelp so dense it would ensnare local fishers as they headed out in their boats."

Cayne Layton, Institute for Marine and Antarctic Studies, UTAS
Source:https://www.yesmagazine.org/environment/2020/07/01/climate-carbon-oceans-kelp

In Tasmania we have seen a rapid and catastrophic loss of the kelp forests that dominated the State's eastern and south-eastern coastlines until very recently.

Professor Craig Johnson, IMAS. Source: https://www.imas.utas.edu.au/news/news-items/first-global-study-of-kelp-forest-change-gives-mixed-news-on-key-marine-ecosystem

The decline of giant kelp forests in eastern Tasmania is associated with increased influence of warm and nutrient-poor East Australian Current water.

Where Giant Kelp is lost it is replaced by the naturally occurring Golden Kelp (Ecklonia Radiata) or common kelp. Common kelp can tolerate warmer, nutrient poor water and is better able to store Nitrogen so can survive without a continuous supply of nutrient-rich water. The composition of the rocky reef community is almost completely changed with large, three-dimensional giant kelp ecosystems replaced by this shorter, stubbier species.

'It's like comparing heathland to a forest of 30-metre trees: the verticality of giant kelp, and the space it takes up, creates a home for a huge range of organisms.

Source: https://www.smh.com.au/environment/climate-change/inside-the-battle-to-save-tasmania-s-giant-kelp-forests-20210506-p57pls.html

Causes and impacts

The three contributing causes of giant kelp forest loss are:

a. The **East Australian Current** (EAC) current flowing up to 350 km further south and displacing cool nutrient rich water with warm nutrient poor water. Ocean temperatures have increased by an average of 2.5°C since the 1940's. This is the main cause of Giant Kelp loss.

'When water temperatures increase the kelp becomes impaired and becomes susceptible to disease and breaks down.'

https://greatsouthernreef.com/giant-kelp

'In December of 2015 the temperatures along here were about 14.5° C. Within two weeks – it's hard to believe – it jumped to over 17 degrees'

'In the ocean that's a massive change. It was a shock to the system'.

'By April there was nothing left. Nothing. Not a single strand of kelp was left.'

Mick Baron, Eaglehawk Dive Centre . Source: https://thenewdaily.com.au/life/science/environment/2020/02/09/tasmania-ocean-hotspots-giant-kelp/

For **heat maps** and **graphs** on ocean temperatures see 'The Dead Sea' from The Guardian. – https://www.theguardian.com/environment/ng-interactive/2020/feb/24/the-dead-sea-tasmanias-underwater-forests-disappearing-in-our-lifetime.

b. **Invasive species** have increased since the first long-spined sea urchin was detected in 1978. In the 15 years prior to 2016 scientists found an increase in urchin numbers in rocky reef habitats of ≈ 50% (= 200,000 additional urchins a year). Species of kingfish, snapper, and octopus from NSW now live in Tasmanian coastal waters while once populous rocky reef species numbers have fallen. Up to 40 invasive species have been identified including a Port Jackson Shark, changing the biodiversity, and functioning of the kelp forests. Sea urchins are having a significant impact on Golden Kelp and creating urchin barrens.

'Longspine urchins are common along the east coast of mainland Australia, but the cold waters in Tasmania have always hindered their extension southwards. As climate change has warmed the waters in Tasmania, the urchins have taken up residence in Tasmania, extending their range southwards by 640 kilometres over the past 40 years. They prevent young kelp from becoming established and create "urchin barrens" where they eat every living thing down to the rock.'

https://www.uw360.asia/tasmania-and-its-vanishing-forests/

Australian Museum specimen of the Long-spined Sea Urchin, Diadema savignyi. Image: Stuart Humphrey.

Source: https://australian.museum/learn/animals/sea-stars/invertebrates-collection-long-spined-sea-urchin/

ILLUSTRATIVE EXAMPLE 3: FUTURE PROOF?

c. **Overfishing** of the Southern Rock Lobsters (crayfish) has disrupted the natural food chain by removing the natural predators of sea urchins. The abalone industry has been forced to reduce its catch by about 40% since 2016 due to the impact of higher temperatures and over-fishing. The food web disruption has endangered many species.
   - **See** the Red Handfish Story under Dynamic Equilibrium.
   - For management to conserve the Critically Endangered Red Handfish **visit** https://www.nespmarine.edu.au/project/project-a10-conservation-handfish-and-their-habitat

WATCH this animation to identify the causes of giant kelp forest loss.

Forests of the Sea animation – https://www.youtube.com/watch?v=UhM6QKGZd_s. Tasmanian Giant Kelp Forests, the changing distribution of species due to warming water and changes to the EAC.

Can Super Kelp rescue Tasmania's Giant Kelp forests?

The project

A joint **research project** between the University of Tasmania's Institute of Marine and Antarctic Studies (IMAS) and the Climate Foundation to develop super kelp for the potential restoration of Tasmania's giant kelp forests. The project is based on the idea that thermally tolerant kelp is bred in a lab and replanted into the ocean to rehabilitate areas where kelp was lost. Over time restored kelp patches would become self-sustaining and spread to more areas.

The Process

Samples from the remnant 5% of giant kelp forests are collected from the ocean. These are tested in a lab to find genetic groups of kelp that are resilient to warmer water temperatures with the aim of breeding 'super kelp'. Field trials follow using plates attached to the sea floor and more recently with spores embedded in twine, wound around ropes attached to the sea floor. The spores develop into 'saplings' that will release their own spores to drift in water currents and establish new mini-forests nearby.

Super cell cultures in the lab at IMAS, Salamanca. Photo: Cayne Layton

'The real tipping point will be if they can self-expand.'

The vision is to:

- create self-expanding and self-sustaining seed patches
- 'future-proof' restored kelp by using heat tolerant varieties
- 'scale-up' to restore large areas of lost kelp forest
- involve community, including local indigenous peoples, in restoration activities
- apply successful techniques to commercial aquaculture and as a 'carbon capture' strategy to address climate change

WATCH this introductory video about the giant kelp forest restoration project. https://www.youtube.com/watch?v=vOQ3hd0dzX8

Restoring Australia's Giant Kelp forests (3.46 m) https://www.youtube.com/watch?v=vOQ3hd0dzX8. Source: Great Southern Reef YouTube

ILLUSTRATIVE EXAMPLE 3: FUTURE PROOF?

WATCH this webinar by Dr Cayne Layton from UTAS for a full explanation of the issues facing the Great Southern Reef and full details about the giant kelp restoration project.

Webinar (59 min): The feasibility and future of restoring Tasmania's disappearing giant kelp forests – Dr Cayne Layton
Source: https://youtu.be/JKPV6Dn5efw

Progress

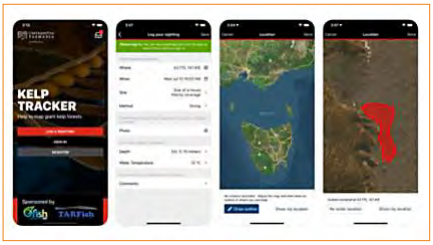
Six project sites are monitored regularly, and progress is promising. For example, in 2020 it was reported that:

- five best performing families of Super Kelp and two crosses (mixed families) were installed at Storm Bay using more than 45 m of kelp-seeded twine installed at three restoration sites.
- giant kelp planted in Storm Bay continue to grow healthily without bleaching and fouling (being overgrown by animals or other algae). Over 100 juvenile giant kelp are growing with an average of about 25 cm and largest individuals over 65 cm.

For details, project updates and photographs visit the IMAS UTAS site here – https://www.imas.utas.edu.au/research/ecology-and-biodiversity/projects/projects/assessing-the-potential-for-restoration-and-permaculture-of-tasmanias-giant-kelp-forests

Kelp Tracker – Citizen Science

Scientists have called on community members, particularly recreational fishers, to record sightings of Giant Kelp using a smartphone Kelp Tracker App. Sightings are verified by scientists and mapped identify potential sources of genetic material and restoration sites. In early 2020 over 100 sightings from 22 fishers had been recorded.



Read more HERE – https://ozfish.org.au/projects/giant-kelp-restoration-project-tasmania/

Source: Ozfish

Sharing knowledge and restoring Sea Country

The site at Trumpeter Bay, off Bruny Island, is being restored in partnership with the **Weetapoona Aboriginal Corporation** after the community approached the university and explained they had extensive knowledge of the site and had seen the giant kelp decline. The collaboration recognises the value of kelp forests culturally and as a food source and has the potential to expand and contribute to the upscaling of the project.

Future proofing

Successfully restoring giant kelp forest ecosystems to Tasmania requires a shift in thinking:

- FROM replacing / restoring what was there with kelp that has the same traits as the original forest species
- TO restoring forests with kelp possessing traits that allow it to thrive in new and future environmental conditions.

This is being called *'future proofing'.*

Challenges

Funding

Compared to the money invested in projects for the Great Barrier Reef and mainland national parks, projects to restore kelp forests remain underfunded.

Sea Urchins

Currently a commercial urchin harvesting project is one avenue used to address the large populations of urchins that decimate kelp and hinder kelp restoration.

Education

People will fight for what they love. The challenge is to increase education about the value giant kelp forests and the entire Great Southern Reef and provide opportunities to be involved in projects.

'Warming waters can have various different influences on the native organisms that live there. Some species move towards the poles or into the deep, where waters are cooler; some already exist in such a narrow window of biological tolerance that their numbers dwindle. Warmer waters can also change the timing of an organism's life cycle as well as impacting their growth. Tasmania has seen many of these influences on its marine ecosystems'.

Source" https://www.uw360.asia/tasmania-and-its-vanishing-forests/

ILLUSTRATIVE EXAMPLE 3: FUTURE PROOF?

Restoring Lobster and Sea Urchin Equilibrium

The presence of sea urchins in Tasmania is a result of warming waters along the East Coast and a range extension of the species from mainland Australia (tropicalisation). The urchins overgraze kelp and create urchin barrens. This has negative impacts on kelp beds and reef dependent species such as abalone, rock lobster and fish. Large rock lobsters are one of the few predators of long-spined sea urchin, but numbers have declined due to overfishing.

There are TWO solutions:

- increasing predator numbers (rock lobsters)
- reducing sea urchins

Two programs are being used to build lobster stocks:

- the East Coast Stock Rebuilding Strategy that limits harvesting via bag limits, seasons and catch triggers.
- the East Coast Rock Lobster Translocation Program transferring lobsters from the southern waters.

Incentives have been provided to successfully increase the harvesting of urchins to over 400,000 tonnes annually.

WATCH

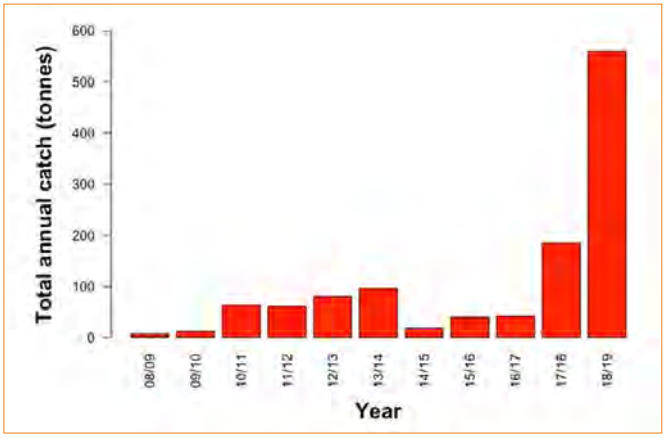
Who's been eating all the kelp (Animated explanation) https://www.youtube.com/watch?v=FF_4URQ1MrI\

Invasive Sea Urchin population growth off Tasmania's East Coast (1.50 min) https://www.youtube.com/watch?v=SSHwDY4Uuvs&t=106s

LISTEN

Tasmanian Country Hour Recording (6 min) https://www.abc.net.au/radio/programs/tas-country-hour/sea-urchins/12340542

Annual Catch of Longspined Sea Urchins



Source: https://www.imas.utas.edu.au/__data/assets/pdf_file/0006/1337604/Centro_assessment_FINAL-004.pdf

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Public call to find giant kelp in Tasmania – https://thewest.com.au/news/environment/public-call-to-find-giant-kelp-in-tasmania-ng-s-1982877

Listing of Giant Kelp Marine Forests of South East Australia PDF – http://www.environment.gov.au/biodiversity/threatened/communities/pubs/107-listing-advice.pdf

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