Seaweed Soloutions for Sustainable Futures

Teacher Guide

Coastcare Victoria School Kit

Coastcare Victoria

VICTORIA State Government | Energy, Environment and Climate Action

Acknowledgements
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Author
Coastcare Victoria and Ocean Imaging.

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Ocean Imaging.

Acknowledgment

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.

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Accessibility

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Contents

Curriculum links

Year 5 and 6 curriculum	Curriculum code	Content description	Topic covered – link to Learning Intentions
Science – Science as a Human Endeavour – Nature and development of science	VC2S6H01	Scientific knowledge changes over time, often resulting from collaboration or by building on the work of others, and leads to advances in science	There is an emerging and growing seaweed industry in Australia.
Humanities – Geography – Geographical Knowledge and Understanding – Management of places	VC2HG6K01	How places and environmental are changed and managed by people	Traditional Owners have had a long history of using seaweed for a diverse range of uses.
English – Literacy – Phonic and word knowledge	VC2E5LY03	Use phonological, morphological and vocabulary knowledge to read and spell words that share common letter patterns but have different pronunciations	Traditional Owners have had a long history of using seaweed for a diverse range of uses.
English – Literacy – Phonic and word knowledge	VC2E5LY04	Build and spell new words from knowledge of known words, prefixes and suffixes, word origins (etymology), letter patterns and spelling generalisations	Traditional Owners have had a long history of using seaweed for a diverse range of uses.
English – Literacy – Phonic and word knowledge	VC2E6LY03	Use combined phonological, morphological and vocabulary knowledge to read and write increasingly complex words	Traditional Owners have had a long history of using seaweed for a diverse range of uses.

English – Literacy – Phonic and word knowledge	VC2E6LY04	Use their knowledge of know words, base words, prefixes, letter patterns, spelling generalisations and word origins (etymology), including some Latin and Greek roots, to spell new words, including technical words	Traditional Owners have had a long history of using seaweed for a diverse range of uses.
Intercultural Capability – Culture, Identity and Belonging	VC2CI6C01	How identity can be influenced by one or more cultures	Traditional Owners have had a long history of using seaweed for a diverse range of uses. Many cultures around the world have had a long history of consuming seaweed in their cuisine.

Year 7 and 8 curriculum	Curriculum code	Content description	Topic covered – link to Learning Intentions
Science – Science as a Human Endeavour – Nature and development of science	VC2S8H02	Multidisciplinary endeavours to advance scientific knowledge make use of people's different perspectives and worldviews	There is an emerging and growing seaweed industry in Australia. Traditional Owners have had a long history of using seaweed for a diverse range of uses. Many cultures around the world have had a long history of consuming seaweed in their cuisine.
Science – Science Understanding – Biological sciences	VC2S8U01	There are similarities and differences within and between groups of organisms living on Earth; the development and use of classification tools, including dichotomous keys, help order and organise human understanding of the diversity of life	There are three main groups of seaweeds (brown, green and red). Australia has the highest diversity of seaweeds in the world.

Humanities – History – Historical Knowledge and Understanding	VC2HH8K09	Significant Aboriginal and Torres Strait Islander Peoples' beliefs and values that shaped, and continue to shape, everyday life, such as the relationships with Country and Place, land, trade, technologies and stories	Traditional Owners have had a long history of using seaweed for a diverse range of uses.
English – Literacy – Word knowledge	VC2E7LY03	Understand how to use spelling rules, base words, suffixes, prefixes, spelling patterns and word origins (etymology), including Green and Latin roots, to learn new words and how to spell them	Traditional Owners have had a long history of using seaweed for a diverse range of uses.
English – Literacy – Word knowledge	VC2E8LY03	Explore and use learnt knowledge to spell technical and academic words consistently and accurately	Traditional Owners have had a long history of using seaweed for a diverse range of uses.
Intercultural Capability – Culture, Identity and Belonging	VC2CI8C01	Change in cultures, including their own, in a range of contexts, and how this influences identity and a sense of belonging and inclusion	Traditional Owners have had a long history of using seaweed for a diverse range of uses. Many cultures around the world have had a long history of consuming seaweed in their cuisine.

Key themes

Seaweed biodiversity and classification, modern and traditional uses of seaweeds, sense of place and identity, international use of seaweed, sustainable futures.

Lessons overview

Activity	Time	Difficulty	Topic & Skills
1: Quiz	5 min video 15 min quiz	**Simple**	Wadawurrung language, Traditional Owner uses of seaweed and native species, modern uses of seaweed, community education and conservation of marine ecosystems. • Listening comprehension and understanding.
2: Seaweed biodiversity	60 min	**Moderate**: Multiple step activity.	Seaweed biodiversity, algae, local seaweed species in Port Phillip Bay, online taxonomic tools, cultural and national identify linked to marine environments, and using media to communicate scientific and cultural ideas. • Scientific research, data collection, classification, ecological literacy, critical thinking, digital literacy, teamwork and communication, presentation of scientific information and critical thinking.
3: Future job profile	60 min	**Moderate**: Using external resources. Independent learning. Multiple step activity.	Marine and coastal careers, role of experts in the marine field, pathways to future careers, sustainable thinking in professional practice, local and global environmental groups and networks. • Career awareness, inspiration and goal setting, research and comprehension, self-reflection, sustainable literacy, teamwork and communication, and critical thinking.
Investigation 1: Modern uses of seaweed	60 min+	**Complex**: Using external resources. Independent learning. Multiple step activity.	Traditional Indigenous and modern uses of seaweed in Australia, companies using seaweed in products, environmental considerations for seaweed harvesting, potential ecological impacts of seaweed use and harvesting, and critical reflection on sustainable management. • Research and digital literacy, analysis of environmental and social impacts, scientific understanding, cultural literacy, critical thinking, communication, and problem solving in real world environmental and industry contexts.
Investigation 2: International use of edible seaweeds	60 min	**Complex**: Using external resources. Independent learning. Multiple step activity.	Global cultural uses of edible seaweeds in cuisine, seaweed species used internationally, modern applications of Australian seaweeds, and comparison of traditional vs modern uses of seaweed.

		• Cultural awareness, research and digital literacy, scientific literacy, environmental understanding, and communication.

Learning intentions

Students will understand:

- There are three main groups of seaweeds (brown, green and red).
- Australia has the highest diversity of seaweeds in the world.
- Traditional Owners have had a long history of using seaweed for a diverse range of uses.
- There is an emerging and growing seaweed industry in Australia.
- Many cultures around the world have had a long history of consuming seaweed in their cuisine.

Success criteria

Students are able to:

- Use the Port Phillip Bay Taxonomy Toolkit to find similarities and differences between main seaweed groups.
- Investigate several case studies to research modern uses of seaweeds and their benefits.
- Use specific examples to demonstrate how various seaweed species are used around the world.
- Analyse and interpret job profiles to dream up future careers and career pathways.

Background

In Australia seaweed has long been overlooked. Often dismissed as just something smelly and unsightly that washes up on the beach, to this day seaweed is undervalued and underappreciated by most Australians. Historically it has been documented that Aboriginal Australians used seaweed for a wide range of purposes including food, medicine, building material, clothing and ceremonial purposes. In recent times seaweed has started to gain recognition in modern Australia for its broad range of benefits and uses for humans and the environment.

Seaweeds help to clean and de-acidify our oceans through absorbing nutrients and CO2 via photosynthesis. Seaweeds grow faster than land-based plants because the whole organism photosynthesises. It is well documented that seaweeds have enormous nutritional benefits when consumed.

Australia has the highest diversity of seaweeds in the world, most notably across the southern half of the continent (the Great Southern Reef) which also supports the highest rates of endemism of seaweeds. Seaweeds are algae and there are three main types of algae which may also be seaweeds; these are brown, red and green.

One particular species of brown seaweed, golden kelp *Ecklonia radiata* is the main habitat forming species across southern Australia, dominating 8,000km of coastline. Its presence on rocky reefs supports the growth of many other species by providing food, nutrients and shelter.

The video features four women who all share a passion for seaweed. 2021 NAIDOC award winner, **Aunty Judy Dalton Walsh** is working towards bringing Wadawurrung language back into the region through teaching those young and old. **Zoe Brittain** is an environmental anthropologist and PhD student at Deakin University, Warrnambool. Her research areas of interest include Indigenous knowledge of seaweeds in Australia and issues of equity and Indigenous rights in the developing Australasian seaweed industries. **Dr**

Prue Francis is a Senior Lecturer in Marine Science and the Course Director of the Bachelor of Marine Science at Deakin University. **Lichen Kelp** is a performance chemist, sculptor and founder of the Seaweed Appreciation Society International.

Resources

- Seaweed Solutions for Sustainable Future video
- Video transcript
- Presentation slides
- Answers
- Quiz
- Local language worksheet
- Seaweed biodiversity worksheet
- Future job profile worksheet
- Investigation: Modern uses of seaweed worksheet
- Investigation: Use of edible seaweed worksheet
- Review questions
- Glossary

Other useful external links

- Map of Indigenous Australia
- SeaForest Australia
- Phycohealth
- Notpla
- Supplementary Video: WWF - Seaweed
- Supplementary Video: Why Demand for Seaweed is about to Boom
- Great Southern Reef

Lesson plan

Activity 1: Quiz

Use this 10-question quiz to assess comprehension and understanding of the video. This could be run as a Kahoot quiz, online form or worksheet.

1. Aunty Judy explained that seaweeds were important because they
   a) Provide food for fish
   b) Feed the environment
   c) Clean the waterways
   d) All of the above

2. Zoe talks about uses of seaweeds. Which of these was not listed?
   a) Food and medicine
   b) Building houses
   c) Packaging products
   d) Clothing and ceremony

3. What animals were fed seaweeds in the video?
   a) Chickens
   b) Cows
   c) Pigs
   d) Horses

4. Aunty Judy's knowledge was passed on through her
   a) Ancestors
   b) Friends
   c) Grandpa
   d) Connection to country

5. What advantage might there be in using seaweed instead of plastic?
   a) Cheaper
   b) Biodegrades faster
   c) Faster to make
   d) All of the above

6. Finish this sentence from the video. "Each piece of land has a unique _____"

a) Smell
b) Taste
c) Culture
d) Temperature

7. What did Zoe think wasn't already a big part of the Australian identity?
   a) Being beach lovers
   b) Having lots of seaweed
   c) Surfing fans
   d) Beautiful natural clean environment

8. Why did Lichen Kelp start the portable seaweed library?
   a) To keep fit
   b) There wasn't much information on the internet
   c) She wasn't much of a reader
   d) Research as a group would be more fun

9. Lichen Kelp liked to think of her portable seaweed library as a
   a) Ocean portal
   b) Wormhole
   c) Fast ride
   d) Seafood database

10. What type of food was being made from seaweed in the video?
    a) Seaweed pasta
    b) Seaweed pizza
    c) Seaweed burger
    d) Seaweed fries

Activity 2: Seaweed biodiversity

This activity helps students build foundational knowledge of seaweed biodiversity by researching local species from the three major algal groups using the Port Phillip Bay Taxonomic Toolkit. They develop classification and digital research skills while learning how seaweeds contribute to healthy marine ecosystems.

The extension task encourages students to explore how seaweed could form part of Australia's cultural and environmental identity, drawing on ideas from the Great Southern Reef. By creating a video or flyer, students apply their learning creatively and learn to communicate environmental messages.

Australia is a global hotspot for seaweed biodiversity. Across the Great Southern Reef there are almost 1500 species. Seaweeds are algae and there are three main types of algae which may also be seaweeds; these are brown (Ochrophyta), red (Rhodophyta) and green (Chlorophyta) [presentation slides 6-7]. Watch the clip Supplementary Video: WWF - Seaweed, on slide 8.

Use presentation slides 9-11. In this activity students will use the Port Phillip Bay Taxonomic Toolkit to research local species. In the species tab, if students click Seaweed and Seagrasses they can then explore some of the local species found in Port Phillip Bay and nearby areas. Students will use the website to fill out the *Seaweed biodiversity worksheet*, finding specific information from one species from each of the three groups.

Extension: In the video Zoe said:

> *"I often think a part of Australia's natural identity, you can often see reflected in a lot of our tourism or resource marketing … is being beach lovers who have a beautiful, natural, clean environment. And I think it's quite funny in a way that we're so proud of the natural environment we have but we've never really seem[ed] to expand that to include seaweed".*

In pairs of groups, students explore the idea that seaweed could be part of Australia's identity. Use the Great Southern Reef website to explore some of the people, places and marine life of the region. Students may also use the stock imagery to create a video or flyer to promote Australia's identity as a seaweed superpower, and share these with your school community.

Activity 3: Future job profile

This activity helps students explore careers connected to the ocean and coasts by examining expert profiles and watching videos about emerging marine and seaweed jobs. Students develop career awareness, research, and collaboration skills while identifying potential mentors and pathways to future jobs. Students reflect on what they might enjoy in a career, how volunteering and sustainable thinking contribute to the role, and why a healthy environment is important. This encourages them to connect personal interests with environmental stewardship and real-world opportunities.

So far in this unit students have been introduced to a number of experts with different jobs relating to the ocean and coasts. In this activity students will look at the profile page articles to gain inspiration for their own future careers. Use the presentation slides 12-18, to explore some of the profiles. If running this lesson as part of the entire Coastcare unit you can use the full set of profiles featuring people from each of the lessons. Alternatively just use the profiles of Zoe, Prue and Lichen.

Additional resource: Use the video Why Demand for Seaweed is about to Boom (15 minutes), to generate further inspiration for students. Throughout the video there are many interesting seaweed jobs mentioned. After watching the video, generate a *popcorn* discussion. How many jobs did you hear about? Create a list of all the jobs you hear in the video, and others. Answers: Seaweed farmer, Scientists, Fisherman, biofuel maker … university researcher (in Australia), Indigenous seaweed gatherer, Anthropologist, author.

Use presentation slide 20. If this activity is being run in a class, you may like to divide the class into groups, allocate a profile to each group and then have the group share a few facts about the person. Then students will use the *Future job profile worksheet* to dream up a job for their future and answer the following questions:

1. What might you love about this job?
2. Who might be a good mentor?

3. How might you get your job?
4. How could volunteering help your career?
5. How does sustainable thinking impact what you do?
6. Why is having a healthy environment important to you?
7. What are some groups to get involved in to help the environment?

Investigation 1: Modern uses of seaweed

This activity enables students to explore traditional and modern uses of seaweed and investigate how companies use it in products. Students develop research and analytic skills by recording seaweed types, products and benefits. The extension task encourages students to consider sustainability, Traditional Owner custodianship, and potential environmental impacts, with a debate format fostering critical thinking and communication skills.

Zoe Brittain has been researching modern uses of seaweeds, including:

- Feed to cows
- Food for humans
- Pharmaceuticals
- Making plastic
- Clothing

The video also featured footage from a number of organisations including SeaForest, PhycoHealth and Notpla. Each of these companies are utilising seaweed in their unique way to create products.

In this investigation students will watch videos about each organisation [see slides 20-26 for information and the videos - click on the image to play the video on YouTube], visit the organisations' websites, gather information about seaweed types being used, what products are being made and the benefits of these products to people and/or the environment, and record the information on the *Modern uses of seaweed investigation worksheet*. There is also blank space for students to find other organisations utilising seaweed.

The best links for the companies are:

- SeaForest: https://www.seaforest.com.au/replicating-natures-solutions
- PhycoHealth: blog post https://www.phycohealth.com/blogs/news/seaweed-for-the-planet because it specifically mentions the green seaweed.
- Nopla: FAQs section for uses https://www.notpla.com/frequently-asked-questions/ and the Technology section to find the type of seaweed https://www.notpla.com/technology-2/

Modern uses of seaweed worksheet answers:

Organisation	Seaweed type	Products	Benefits
SeaForest	Red (Asparagopsis)	Feed supplement for cows	Captures carbon Reduces methane production in cows
PhycoHealth	Green (ulva 84)	Skin care Supplements	Reduce pressure on land crops

		Food	Captures carbon Health benefits
Notpla	Brown seaweed	Packaging for food, and other products Paper	Biodegradable Reduces need for plastics and plastic waste

Extension: With increasing appreciation, knowledge of and use of seaweed in Australia, emerging industries endeavouring to harvest or grow seaweed in aquaculture need to be sensitive to sustainability as well as good environmental practices. Many seaweed species that may be valuable for use are important habitat (including ecosystem engineers). Careful research needs to be undertaken to understand the potential impacts of harvest to prevent negative outcomes to ecosystems.

Traditional Owners have a custodial responsibility for caring for Country and sustainability managing resources.

1. How should Traditional Owners be involved/consulted in the emerging seaweed industries?
2. Who else should be consulted?
3. What negative impacts could occur?

This may be run as a debate between two groups. Groups should investigate counter examples when expressing their point of view.

Investigation 2: International use of edible seaweeds

This investigate enables students to explore the global culinary uses of seaweed by researching different species and dishes and recording their findings. The extension task encourages students to investigate modern uses of Australia's Golden Kelp, developing research skills and understanding the economic and cultural significance of local marine resources.

Many cultures around the world have had a long history of consuming seaweed in their cuisine [slide 27]. In this investigation, students will research the various seaweed dishes and species used from around the world and complete the *International use of edible seaweed worksheet*.

International uses of seaweed worksheet answers:

Seaweed name	Food uses	Country of origin	Seaweed type and species name
Nori	Dried edible seaweed used to wrap sushi	Japan	Red: *Palmaria yezonesis* and *P. tenera*
Wakame	Often serve in soups like Miso soup and salads	Japan	Brown kelp: *Undaria pinnatifida*
Kombu	Used to make tea	Japan	Various brown kelp
Dulse	Baking, flakes, powder, drinks	North America	Red: *Palmaria palmata*

Irish Moss	Ingredients in puddings, ice-cream and beer	Europe, North America	Red: *Chondrus crispus*
Cochayuyo	Stews and soups	Chile	Brown kelp: *Durvillaea antarctica*

Extension: Have students look into Australia's widespread Golden Kelp (*Ecklonia radiata)*. How many different modern uses (in food or otherwise) does this species have?

Review questions

1. What are the three main seaweed groups? (3 marks)

   Red, green and brown

2. What are three things that all seaweeds have in common? (3 marks)

   Gets energy from the sun, they photosynthesise, they make their own energy, they are producers, they are algae, they produce oxygen, they require nutrients to grow.

3. Which species of seaweed grows right across southern Australia and helps form the Great Southern Reef? (1 mark)

   Golden Kelp

4. Describe three ways that seaweeds are being used in emerging modern industries in Australia. (3 marks)

   Food for cows to reduce methane emissions, making seaweed plastic, food for humans, moisturiser and other pharmaceuticals.

Glossary

Algae: Simple organisms that live mainly in the water and are able to use sunlight for energy and create oxygen. All seaweeds are algae, but not all algae are seaweeds, for example some algae are phytoplankton.

Ancestors: A family member from long ago.

***Asparagopsis*:** A genus of red edible seaweed.

Biodegrade: Breaks down into very small harmless parts by the action of living things.

Chlorophyta: Green algae phylum.

Climate change: A change in the average conditions (such as temperature and rainfall) in a region over a long period of time.

Ecklonia: A genus of brown seaweed, a kelp with golden appearance.

Identity: The set of qualities and beliefs that makes one person or group different from others.

Kelp: A large brown seaweed that typically has a long, tough stalk with a broad frond divided into strips.

Ochrophyta: One of the three major divisions of algae, including brown algae and diatoms.

Phaeophyceae: The class of brown algae within the phylum Ochrophyta.

Pharmaceuticals: Any kind of drug used for medicinal purposes.

Phylum: A group of related organisms that ranks above the class and below the kingdom in scientific classification.

Photosynthesis: The process in which plants and algae use sunlight to make their own food.

Repercussion: A widespread, indirect, or unexpected effect of something said or done.

Rhodophyta: Red algae phylum.

Seaweed: Large algae growing in the sea or on rocks below the high-water mark.

Traditional Owner: A First Nations person with certain rights and responsibilities for land and sea.

Ulva: A genus of green algae collectively known as sea lettuce.