Lesson Introduction

Welcome to this lesson series on giant kelp! This booklet is designed to help you work through the resources at your own pace. There are clear instructions for each section, and you'll watch several videos, including the 10-minute film Reviving Giants. You can choose to work individually or in groups for the activities, but remember to always record your answers in your workbook or a Word document.

You'll see this icon when there is a section that you need to record your answers. Let's go! and explore the world of giant kelp.

You'll see this icon when there is a link.

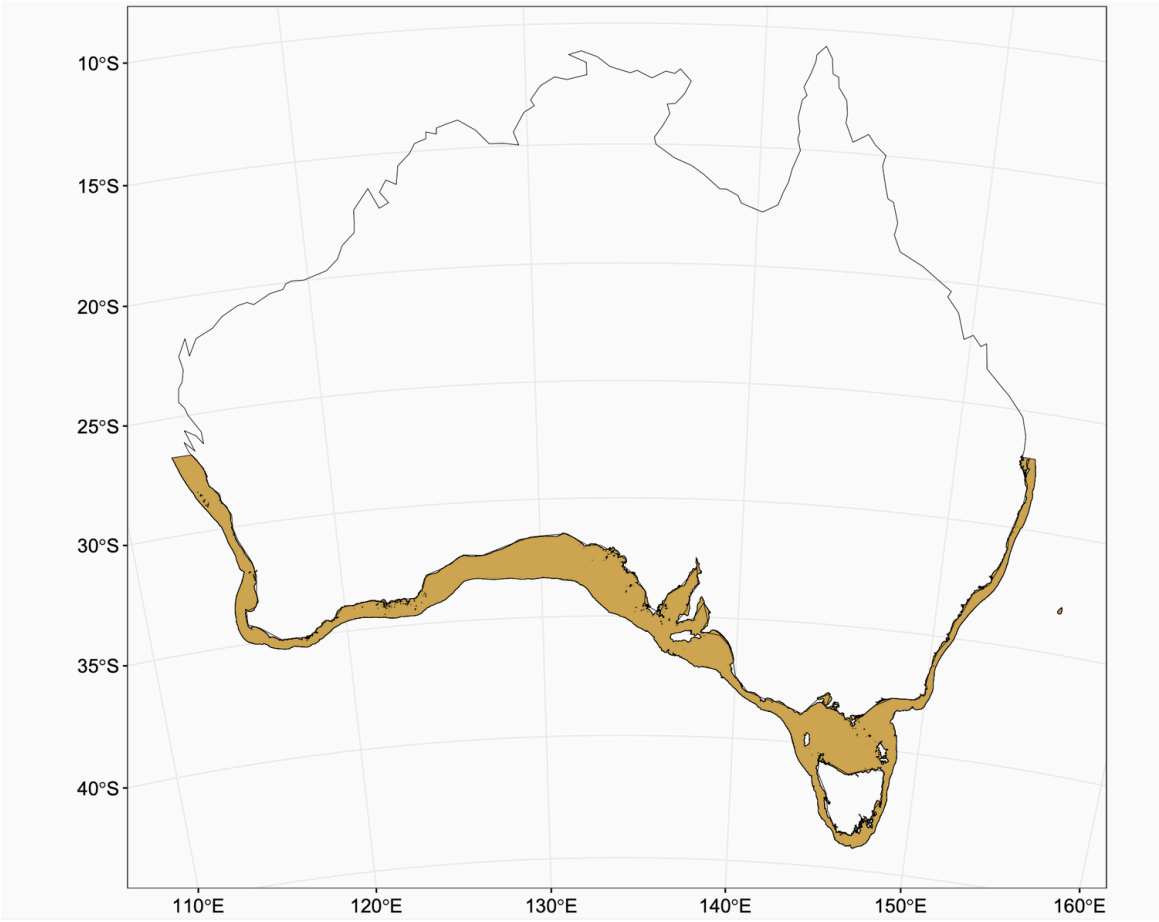
You'll see this icon if there is a QR code.

You can scan the code above to see all activities and links as part of an online course, or visit: https://greatsouthernreef.com/reviving-giants-lesson

Background

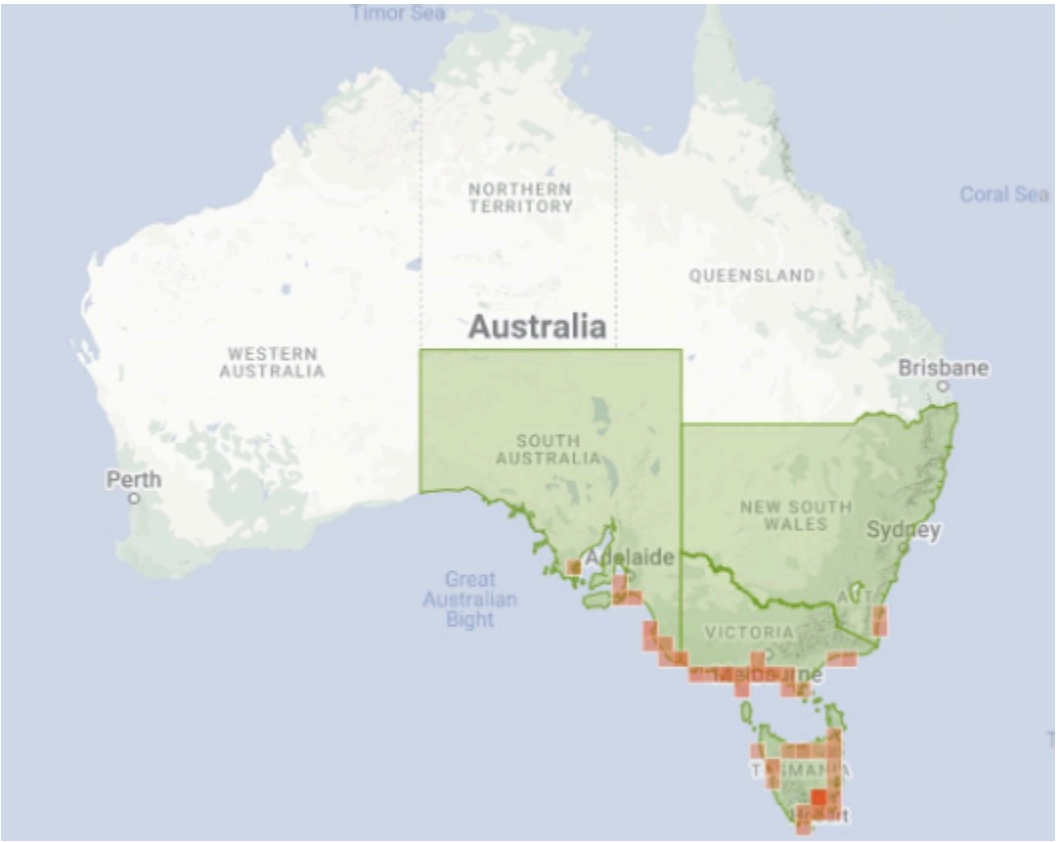
Know Your Seaweeds

Welcome to the Great Southern Reef (GSR), an interconnected system of temperate reefs. Unlike tropical reefs, which are primarily built by corals, the Great Southern Reef is formed by rocky reefs which support kelp forests. Below is a map of the distribution of the GSR which is 8,000km long from Karri in Western Australia to Coolangatta in Queensland.



The distribution of the Great Southern Reef is characterised by the presence of Golden Kelp (above). However today's lesson takes us to the waters of Tasmania, known for it's Giant Kelp forests (below).

Below are observations of Giant Kelp in Australia



Visit the giant kelp page on the iNaturalist website and zoom out on the interactive map.

🔗 https://www.inaturalist.org/taxa/124748-Macrocystis-pyrifera

1. How many Australian states is giant kelp found in?

2. Is giant kelp found elsewhere in the world? Which other countries?

Exploring the Ocean with SCUBA Diving

In this activity, you will take the lead in exploring how scuba diving is used in marine science and related careers. You'll research and present your findings, gaining insights into the importance of scuba diving in studying and protecting underwater environments.

1. What does SCUBA stand for?

2. Explore the following questions

a) How old do you have to be to get a diving licence?

b) How deep can you go with a diving licence?

c) How long can SCUBA divers stay underwater?

d) Which careers involve scuba diving?

There are many jobs that utilise scuba diving certification and skills. Some of these professions include marine scientist, underwater photographer, dive instructor, rescue diver, commercial diver, cave diver.

3. Choose one profession that interests you the most. Research the profession, focusing on key aspects such as:

a) Job Responsibilities The specific duties and tasks that a person in this profession is expected to perform as part of their job. This includes day-to-day activities and any special roles related to the profession.

b) Education/Training Required: The level of education, certifications, or specialised training needed to qualify for and succeed in the profession. This may include degrees, certifications, on-the-job training, or specialised courses.

c) Necessary Equipment: The tools, gear, and technology that are essential for performing the job effectively. For scuba diving-related professions, this might include diving gear, scientific instruments, or photography equipment.

d) Potential Challenges: The difficulties, risks, or obstacles that professionals in this field might encounter. This could involve environmental conditions, physical demands, or other job-specific challenges that make the work more complex or risky.

Component	**Details**
Profession	
Job Overview	
Education / Training Required	
Key Responsibilities	
Equipment Needed	
Potential Challenges	

Now it's time to watch Reviving Giants!

🔗 Scan the QR code or go to the following link: https://youtu.be/rCRncbD1X7g

✍🏾 **6. As you watch** the film record the following notes:

a) Who are they key characters in the film?

b) What marine species did you see?

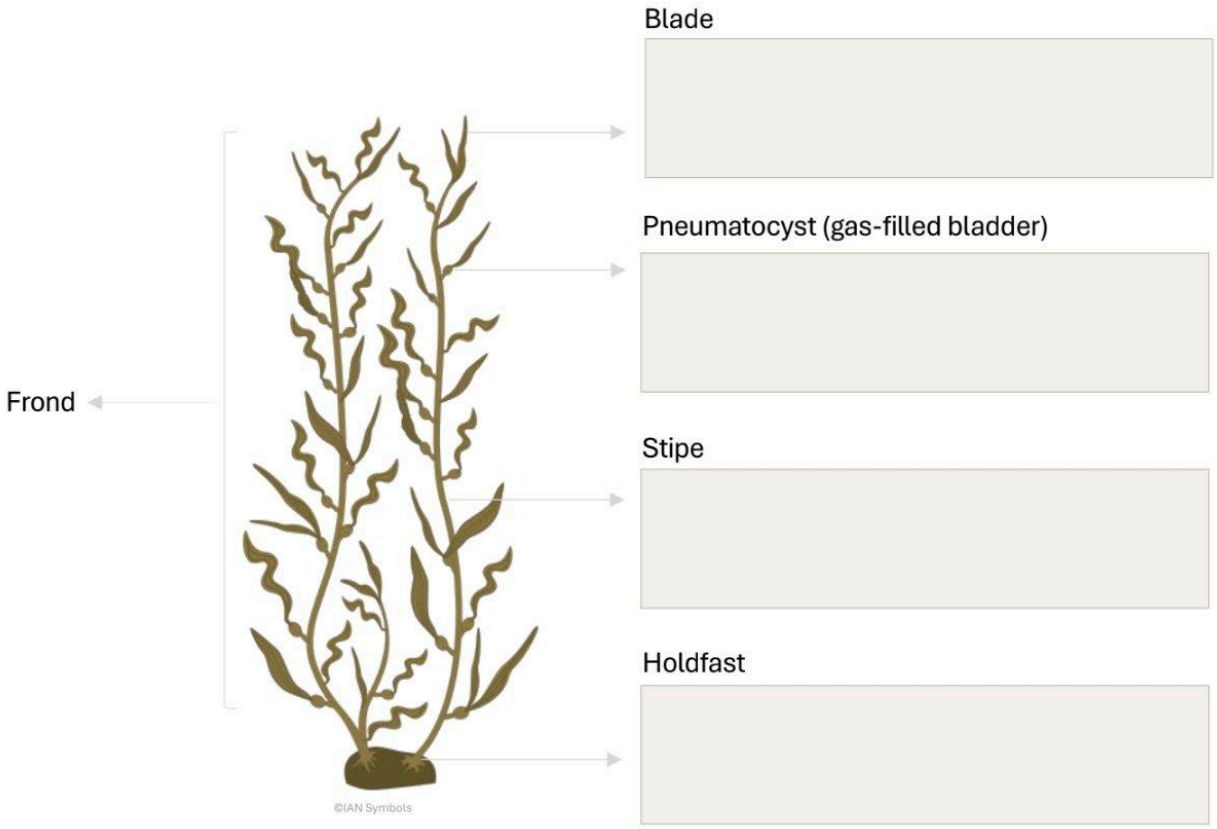
c) What role does SCUBA diving play in the film?

✍🏾 **7. After watching** the film record the following notes:

a) What was the most interesting thing you learnt from watching the film?

b) What else do you want to know now that you have watched it?

Kelp Form and Function



Function: it helps the kelp to stay afloat in the water column, increasing its exposure to sunlight.

Function: primary site for photosynthesis, carbon fixation and nutrient absorption, essential for kelp's growth.

Function: anchors the kelp to the rocky substrate, providing stability to withstand strong wave action and currents.

Function: provides structural support to the blades.

Each part of the kelp (Pneumatocyst, Blade, Stipe, Holdfast, and Frond) has a specific function.

8. For each labelled part of the kelp, write a brief explanation describing its function,

9. Describe how the challenges kelp face to grow in the dynamic conditions of the ocean.

Rainforest Comparison

In this section, you'll explore the similarities and differences between two of Earth's most vital ecosystems: kelp forests and rainforests. You'll learn how these environments function, the biodiversity they support, and the unique challenges they face.

Review the key components:

Ecosystem Type: The kind of natural environment where plants, animals, and other organisms live and interact with each other.
Location: The specific area or region where an ecosystem is found.
Biodiversity: The variety of different species of plants, animals, and other organisms that live in an ecosystem.
Ecosystem Services: The benefits that humans get from ecosystems, such as clean water, food, and climate regulation.
Threats: The dangers or challenges that can harm an ecosystem, such as pollution, climate change, or habitat destruction.

This table is designed to help you compare the key features of rainforests and kelp forests.

 10. Use the table to provide details for both rainforests and kelp forests.

Factor	**Rainforest**	**Kelp Forest**
Ecosystem Type		
Location		
Biodiversity		
Ecosystem Services		
Threats		

11. As you complete the worksheet, think about how these two ecosystems compare. Are there more similarities or differences?

11b Extension: Choose another ecosystem to compare with rainforests or kelp forests.

Hidden Value of Kelp

In this activity, you will investigate the various ecosystem services provided by kelp forests and understand their importance to both the environment and human well-being.

What are ecosystem services? Ecosystem services are the benefits that humans receive from nature. In the video you will learn about the four different main categories of ecosystem services.

Scan the QR code or go to the following link: https://youtu.be/bwLP0wrXUWU

Provisioning Services: Goods that humans directly obtain from ecosystems, such as food and raw materials.

Regulating Services: Benefits obtained from the regulation of ecosystem processes, like climate regulation and water purification.

Cultural Services: Non-material benefits that people obtain from ecosystems, including recreational, aesthetic, and spiritual values.

Habitat Services: The role ecosystems play in providing habitats for species, which maintain biodiversity.

 12. Write a few ways that kelp forests benefit you and your community.

 13. Record which ecosystem service category each of these benefits fall under.

13b Extension: Explore how ecosystem services provided by kelp forests compare to those of other marine ecosystems, such as coral reefs or mangroves. Consider how these ecosystems might complement each other in maintaining a healthy ocean environment.

Giant Kelp Threats

In Reviving Giants we learnt about the disappearance of giant kelp forests in Tasmania. Scientists estimate that 95% of the dense giant kelp forests along Tasmania's east coast have disappeared. In the film we learnt this decline was cause by climate change which had led to a) lack of nutrients, b) marine heatwaves and c) tropicalisation.

 14. Match the definitions below with the correct term.

Definition	Term
Prolonged periods of unusually elevated seawater temperatures that can make kelp more susceptible to disease.	
Tropical herbivores expanding their distribution range to temperate regions, due to ocean warming	
Changes in ocean conditions that can suppress upwelling, a process that brings cold, nutrients right waters to the ocean surface.	

In this next video we will learn more about what has caused the decline.

In the video at 01:11, Dr. Scott Bennett explained the combination of impacts that has led to the giant kelp decline.

 15 In your own words describe how these factors may impact kelp

a) climate change

b) lack of nutrients

c) sea urchins

Restoration

In Reviving Giants, baby kelp were grown in a lab and seeded onto twine that was planted at different sites around Tasmania. Six months later, the kelp had already grown to over 5m tall! But this methodology took a lot of trial and error to get right. Scientists are still learning and improving the process, in order to upscale their restoration efforts.

But it's important to note that restoration is expensive and used as a last resort for areas where vital habitats have been lost or are in decline and natural recovery is not occurring.

 16. Why do you think choosing the right location is so important? What factors need to be considered?

Giant kelp restoration is not the only type of restoration happening on the Great Southern Reef. In this next short video, you will learn about restoration of Golden Kelp using a similar but different technique, called Green Gravel.

 Scan the QR code or go to the following link: https://youtu.be/6plPl3RZJxs

17. Your task is to now record information about this restoration activity, including:

a) Location: The geographical area where the restoration project is being conducted.
b) Focus Species: The specific species that the restoration project aims to support or revive.
c) Project Size/Scale: The extent or scope of the restoration project, including how large the area is and the number of species or habitats involved.
d) Community Engagement: The ways in which local communities and volunteers are involved in the restoration project, such as through education, participation, or awareness campaigns.
e) Results to Date: The outcomes or achievements of the restoration project so far, including any measurable improvements or successes.
f) Future Work: The planned next steps or ongoing efforts needed to continue the restoration project and ensure its long-term success.

 18. Now it's time to learn about other restoration efforts happening across the Great Southern Reef. Use the restoration page on the Great Southern Reef website as well as the link page below to complete the following table.

www.greatsouthernreef.com/restoration https://linkpages.pro/LwKMka

Location	Focus Species	Project Size/Scale	Community Engagement	Results to Date	Future Work
Green Gravel					
Razorfish Reefs					
Giant Kelp					
Golden Kelp in Port Phillip Bay					
Operation Crayweed					
Oyster Reef Builder					
Seeds for Snapper					

Social Research Project

Social research is the process of gathering information about people's thoughts, behaviours, and beliefs. It helps us understand how individuals and communities perceive certain topics and issues. By asking questions and analysing the answers, we can learn more about how people think and what influences their opinions.

In this activity, you will conduct a social research project. Your task is to interview at least three people from your family, friends, or school community on how they understand and perceive the importance of kelp forests. After gathering all your responses, you will combine everyone's data to get a broader understanding of how people perceive kelp forests and visualise the results to share your findings with others.

Survey Tips

- Make sure to ask each participant all the questions and record their responses carefully.
- Ensure that all responses are anonymous when you share them in class.

- Use the provided survey questions to guide your interviews.

Q1: Kelp forests are the defining feature of the Great Southern Reef (GSR), a reef system that spans more than 8000 kilometres of the Australian Southern coastline. Have you heard about this reef before? ☐ Yes ☐ No

Q2: The GSR has the highest number of endemic seaweed species and the highest diversity of seaweed in the world, with more than 1,400 species already known. ☐ True ☐ False

Q3: Giant Kelp are a type of large brown seaweed that form vast underwater forests in the GSR. In which Australian states can we find Giant Kelp Forests? ☐ VIC, TAS, NSW ☐ SA, VIC, TAS ☐ WA, SA, TAS ☐ WA, VIC, NSW

Q4: Giant Kelp Forests are home to a wide range of marine organisms. Which of these animals does not live in giant kelp forests in Tasmania? ☐ Rock lobsters ☐ Abalone ☐ Conger eels ☐ Sea Otters

Q5: A significant percentage of the giant kelp forests in Tasmania has disappeared due to exploitation, degradation, and climate change. How much do you think remains today? ☐ 5% ☐ 15% ☐ 45% ☐ 85%

Q6: In 2012, the remaining communities of Giant Kelp in South East Australia were listed as a threatened ecological community and protected under the Environment Protection and Biodiversity Conservation Act 1999. ☐ True ☐ False

19. Now it's time to conduct your survey. See the steps below:

a) Gather all your responses: record the answers from three surveys.
b) Use an Excel spreadsheet to enter and organise the data. Combine everyone's data to get a broader understanding of how people perceive kelp forests.
c) Create graphs and tables to visualise the results. These visual aids will help us see patterns and trends in the data.
d) After visualising the data, conduct further research to find the correct answers to the survey questions. This will allow you to compare what people think with what is actually true.
e) Present your findings. Create the infographic using online tools like Canva or Piktochart. If you prefer, you can also use paper and create a large poster.

Reflection: After sharing your infographic, discuss the results in class.

 20. Record answers to the following questions:

a) How do people's perceptions compare to the correct information?

b) What surprised you about the results?

c) How can you help raise awareness about the importance of kelp forests in your community?

 21. Write a short reflection on what you learned from this activity and how it has influenced your understanding of kelp forests.

Class Debate

In this activity, you will participate in a classroom debate to explore different perspectives on the importance of restoring and conserving giant kelp forests. You'll work in groups, representing different stakeholders, to present arguments and propose solutions.

What's a stakeholder? A stakeholder is a person or group that has an interest in or is affected by a decision or project.

kelp forest stakeholders

Marine Scientist - Marine scientists study the ocean and the organisms that live in it. They are concerned with understanding the impact of environmental changes on marine ecosystems like kelp forests. Their goal is to provide scientific evidence that supports the need for conservation and restoration efforts. In the debate, they might argue that restoring kelp forests is crucial for maintaining biodiversity and the health of marine ecosystems.

Coastal Management Officer - Coastal management officers are responsible for planning and overseeing the use and protection of coastal areas. They balance environmental conservation with the needs of local communities and industries. In the debate, they might focus on the long-term benefits of protecting kelp forests for coastal stability, tourism, and sustainable fisheries.

Local Community Representative - The local community representative speaks for the people living near the kelp forests. These communities may rely on the forests for their livelihoods, recreation, or cultural practices. In the debate, they might highlight how the loss of kelp forests affects their daily lives, local economy, and cultural heritage, advocating for restoration to preserve their way of life.

Commercial Fisher - Commercial fishers depend on healthy marine environments to catch fish and other seafood. They might be concerned about how changes in the ecosystem affect their catch and income. In the debate, they could argue for balanced approaches that protect kelp forests while also ensuring their ability to fish in these areas, potentially supporting restoration as a way to enhance fish populations.

Environmental Organisation Representative - Representatives from environmental organisations are focused on protecting and conserving natural ecosystems. They are likely to advocate strongly for the restoration of kelp forests to prevent further environmental degradation. In the debate, they might push for stricter conservation measures and raise awareness about the global importance of kelp forests for climate regulation and biodiversity.

Business Owner - Business owners who rely on the ocean, such as tourist operators or seafood restaurant owners, have a direct economic interest in the health of kelp forests. They might argue that restoring kelp forests will benefit their businesses by attracting tourists or ensuring a steady supply of seafood. In the debate, they could discuss how a thriving kelp forest supports local economies and jobs.

 22. You (or your group) will choose or be allocated a stakeholder. It's now time to research the perspective of your stakeholder. Consider the following questions:

a) How does the decline of kelp forests affect your stakeholder?

b) What benefits does your stakeholder gain from healthy kelp forests?

c) What are some potential solutions to restore and conserve kelp forests that would benefit your stakeholder?

 23. Prepare at least two arguments that support the restoration and conservation of kelp forests from your stakeholder's perspective.

 24. Now it's time to present your argument to the class.

a) Present the Impact: Explain how the decline of kelp forests has negatively impacted your stakeholder.

b) Propose Solutions: Suggest restoration ideas that would help mitigate these impacts and benefit your stakeholder.

After each group presents, there will be time for questions and rebuttals. Be ready to defend your arguments and respond to opposing views.

Discussion question: How can different stakeholders work together to achieve the best outcome for kelp forest restoration?

Ocean Optimism

In this activity you will work with your classmates to create a classroom action plan aimed at addressing environmental challenges, particularly the preservation of kelp forests. Think creatively about how you can minimise impacts on our Great Southern Reef and protecting these vital ecosystems.

 25. Work together in a group and record the following points for your plan:

a) Step 1: Identify actions that can help, such as adopting sustainable practices or raising awareness.

b) Step 2: Break down each action into specific, manageable steps

c) Step 3: Consider the resources you'll need, such as materials, information, or expert advice.

d) Step 4: Anticipate challenges you might face and brainstorm solutions to overcome them.

Glossary. Here is a list of important words for this lesson:

Algae: Simple, plant-like organisms that live in water and perform photosynthesis. Kelp is a type of large brown algae.
Biodiversity: The variety of life in a particular habitat or ecosystem, including different species of plants, animals, and microorganisms.
Climate change: long-term shifts in weather patterns (e.g. temperature and rainfall).
Ecosystem: A community of living organisms interacting with each other and their physical environment.
Foundation species: species that play a crucial role in creating and sustaining a habitat for other species.
Habitat: The natural environment in which a species lives and grows.
Invasive Species: Non-native organisms that spread rapidly in a new environment, often causing harm to native species and ecosystems.
Marine Protected Area (MPA): A region of the ocean designated for conservation and protection of natural resources, where human activities are regulated to preserve marine life.
Native: originating and naturally occurring in a specific area or environment.
Nutrient: a substance that an organism must obtain from its surroundings essential for maintenance of life and growth.
Overexploitation: refers to the excessive extraction and use of natural resources at a rate faster than their ability to regenerate, resulting in resource depletion.
Photosynthesis: process in which plants, algae and some types of bacteria use sunlight to convert the carbon dioxide and water into organic matter and oxygen.
Resilience: in an environmental context, it refers to the ability of an ecosystem to withstand and recover from disturbances and adapt to change, while preserving its essential functions and structure.
Saturation chambers: enclosed environments used to expose materials or organisms to specific pressure conditions often used to simulate deep-sea environments.
Species: a group of organisms that share common characteristics and can breed with each other
Stakeholder: refers to individuals, organisations, or groups that have a particular interest in or are affected by a decision or project.
Transplantation: The process of moving organisms from one location to another to aid in the restoration of an ecosystem, such as relocating kelp plants to restore a degraded kelp forest.
Trophic Levels: The different levels in a food chain, based on the position an organism occupies, from producers (like plants) to consumers (like herbivores and predators).
Upwelling: a process in which cold, nutrient-rich water rises to the surface. This process is vital for enhancing marine productivity and supporting marine ecosystems.