An introduction to the Sydney Harbour Estuary

- Sydney Harbour is one of the most biodiverse harbours in the world. More than 580 different species of fish and 2473 species of polychaetes, crustaceans, echinoderms and molluscs have been recorded in the waters of Sydney Harbour. And that's what we currently know! As much of the harbour's vast environments remain unexplored by scientists, it is expected that the true species richness is far greater than current records suggest.

- Sydney Harbour is one of the largest estuaries in the world, extending 30 kilometres (km) in length and covering an area of approximately 55 km^2. Sydney Harbour is classified as a drowned valley estuary with a narrow, winding channel and irregular bathymetry (seafloor shape). Depth within the Sydney Harbour Estuary is highly variable, ranging from 1 - 46 metres deep, being deepest at the estuary mouth and in areas of the central basin near the Harbour Bridge.

- Along its extensive shoreline and within nearshore environments, a diverse array of habitats contributes to the high levels of biodiversity and productivity of the harbour. Mangroves, marshes, mud and sand flats, and estuarine beaches populate the intertidal zone, submerged aquatic vegetation occurs within the photic zone of shallow water, and oyster reefs and kelp forests occur within subtidal waters. In combination, these habitats serve as critical nursery grounds providing protection and feeding grounds for both resident and coastal species.

Dive below the surface of Chowder Bay in our virtual biodiversity session and have a go at tackling the questions below.

Marine Explorer: what's in a habitat

The ocean is not uniform, there are many different habitats where marine plants and animals can live. Here at Clifton Gardens:

Activity: Define the following terms. Google can help you if you miss them in the video.

Habitat:
Ecosystem:
Biodiversity:
Intertidal environment:
Subtidal environment:
Abiotic factor:
Biotic factor:
Phylum:

Below is a sketch of Chowder Bay, the home of the Sydney Institute of Marine Science. Chowder Bay is located several kilometres west of the Sydney Heads (North and South Head), which mark the entrance to Sydney Harbour from the Tasman Sea. With both marine and riverine influences, Sydney Harbour is classified as an estuarine environment. Estuaries are important biologically diverse ecosystems that have significant ecological, social and economic value.

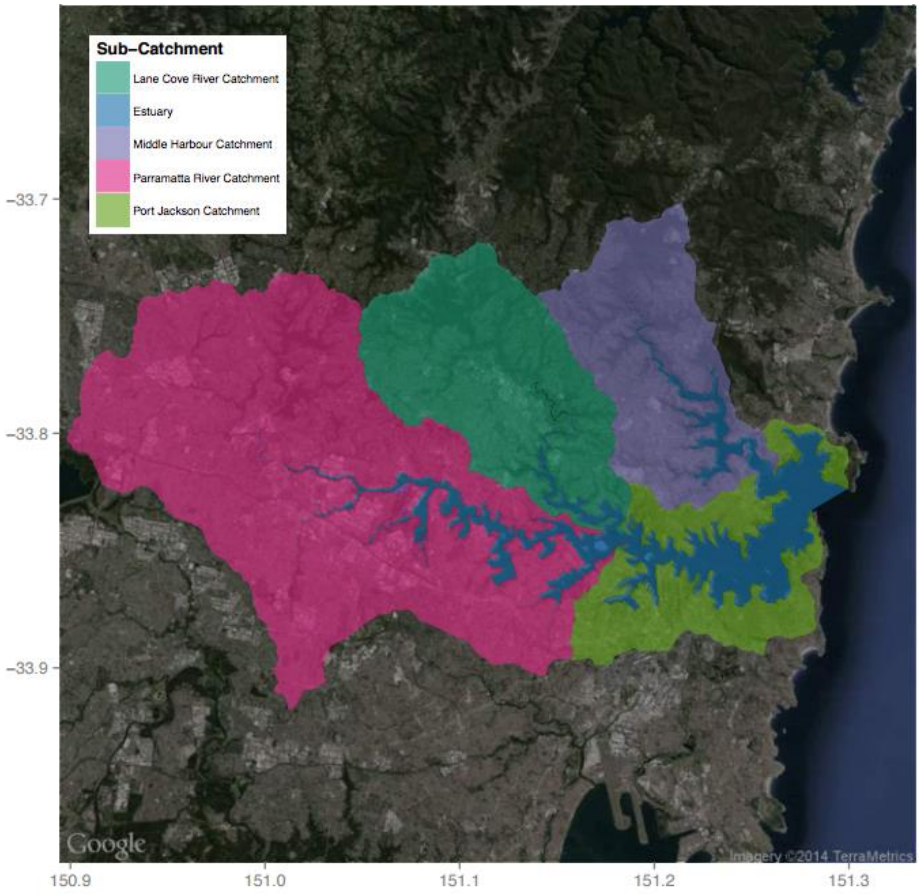
Using the information provided in the video and resources available online, have a go at answering the following questions

- Define the term estuary and provide two examples of different types of estuaries in NSW.

- How many estuaries is there in NSW? _____

- What is the average salinity level (the concentration of dissolved salts) within Chowder Bay?

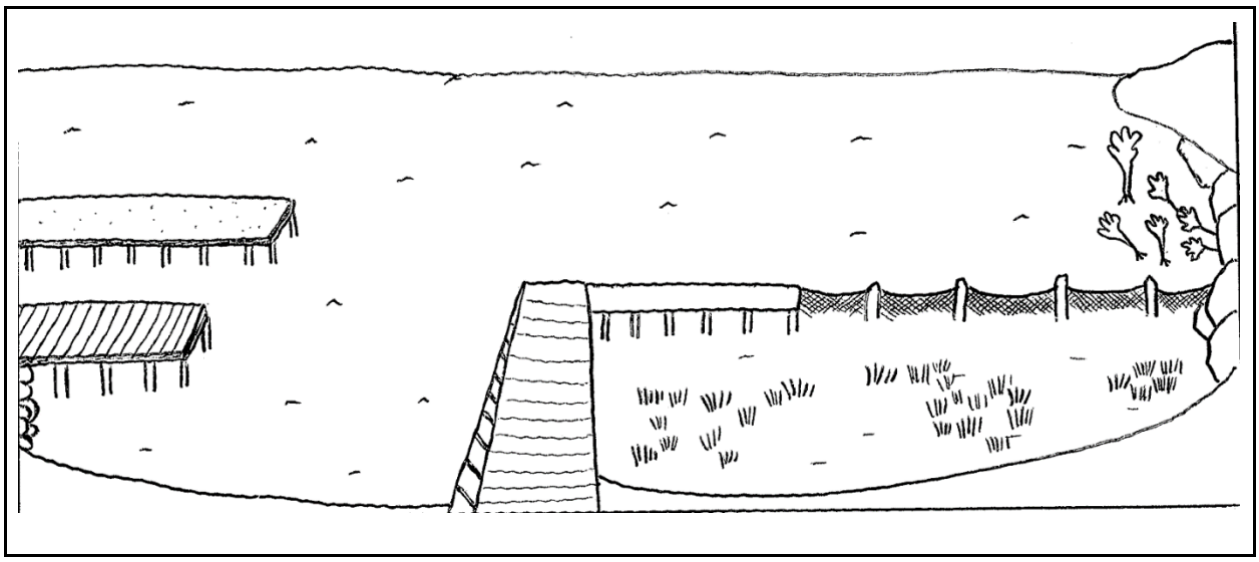
  _____ unit of measurement _____



- Sydney Harbour catchment covers an area of 484 km2 and is broadly divided into 4 catchment areas represented by different colours on the above map. If you were to measure environmental conditions at two locations along the Sydney Harbour estuary, one in the Port Jackson Catchment (lime green) and in the Parramatta River Catchment (pink) what changes would you expect to find?

Below is a site map of Clifton Gardens Beach or ‘Chowder Bay’. How many different habitats can you spot?

- Circle and label the habitats of Chowder Bay on the image below:



Are all habitats within Chowder Bay naturally occurring? Yes No

Today we will focus on two habitats and will observe the different plants and animals that live in each one.

1. Intertidal rock platform
2. Subtidal rocky reef

The Intertidal: Where land meets sea.

The ancient Greek philosopher Heraclitus originated the principle of constant change and the famous proverb ‘the only constant is change’, this is true also for the natural world which an organism inhabits. Organisms, from microbes to plants and large mammals, inhabit environments that can change to become drier, hotter, colder, more acidic, darker and sunnier – with almost an infinite number of variables, often over short time periods. The intertidal zone is a great example of a habitat that is subject to immense environmental change over a short period of time. It is for this reason that the rocky intertidal is considered among the most physically harsh environments on earth.

Shore platforms lie at the boundary between three different worlds. Below the lowest tides we have oceanic conditions where fish reign, above the tide are terrestrial systems where plants reign, and above both are the aerial environments of the birds. Plants and animals living in the intertidal must cope with harsh environmental extremes, including vast shifts in temperature, UV exposure, the risk of desiccation (drying out), influxes of rain and stormwater pollution. Animals and plants inhabiting this habitat have evolved specific adaptations and strategies to survive under these challenging conditions.

Activity: Using our Biodiversity video and google, describe some of the unique adaptations of these common intertidal animals.

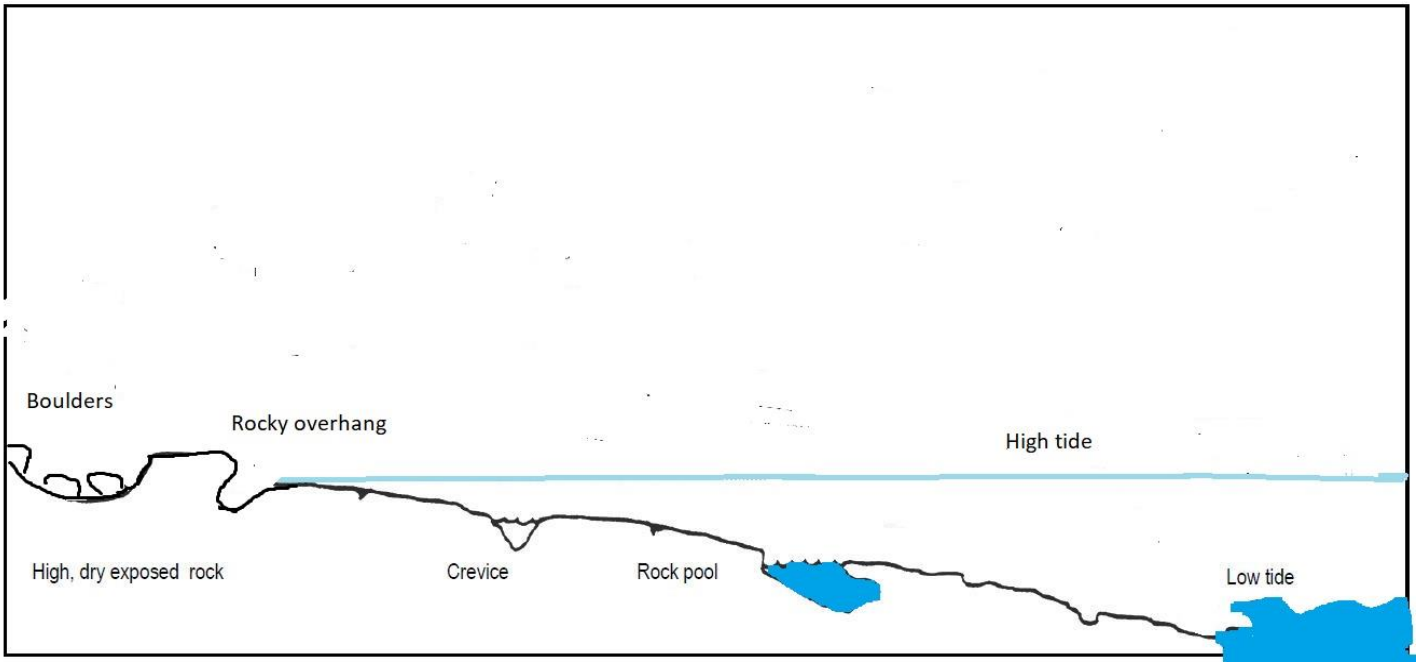
Organism Name	Adaptations or Strategies for Survival
Black Nerite Nerita atramentosa  Slate Pencil Urchin Phyllacanthus parvispinus  Mulberry Whelk Morula marginalba 	

Sea Squirt Pyura stolonifera 	

Based on what you have now learned about common animal adaptations in the intertidal zone, where do you think these animals and plants would live in the intertidal? Draw an arrow from each organism to its preferred habitat.







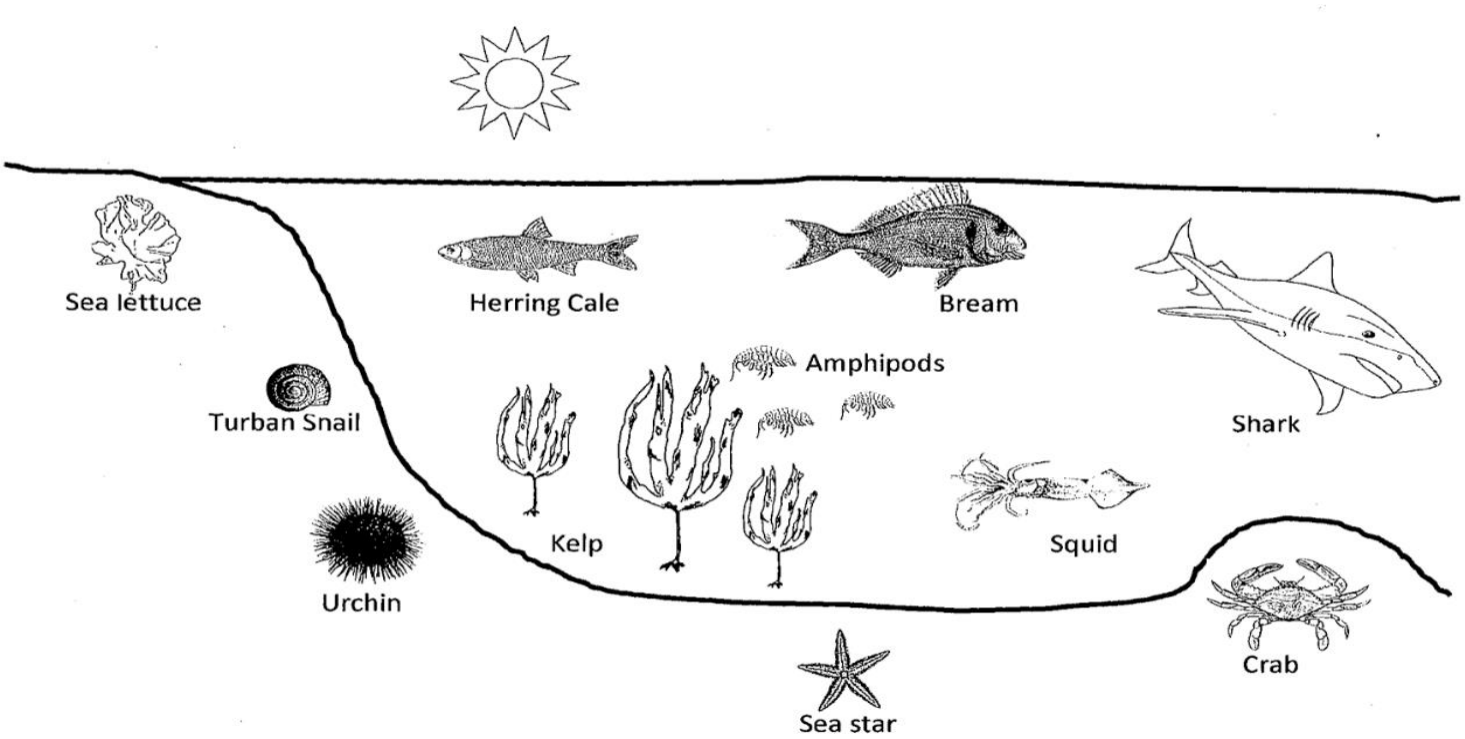
Subtidal Habitats

Macroalgae (seaweeds) are one of the main habitat forming organisms in the subtidal rocky reef habitats of temperate Australia. Ecklonia radiata, a large kelp species dominates rocky reefs within Sydney Harbour, forming dense underwater forests. These underwater forests are centres of productivity, providing food, essential chemicals and protection to many animals in the ecosystem.

Seaweeds are among the fastest growing plants on earth and provide many of the same ecological functions underwater, as trees do on land. They are autotrophs, or producers, producing their own food through the process of photosynthesis. Photosynthesis is the process of converting light energy from the sun into chemical energy and food. Consumers, also referred to as heterotrophs, are organisms that must obtain their energy by eating other organisms

Below you have an example of a food web which comprises all the food chains in an ecosystem. Each living thing in an ecosystem is part of multiple food chains. The sun provides the energy for plants to produce food. This is the beginning of every food chain.

Start with an arrow beginning at the sun, then show the flow of energy through the producers and consumers to the top predators. Can you draw a possible subtidal food web?



Extension Activity:

As scientists, nature is best explored outdoors!

Backyards and local reserves are phenomenal spaces to explore natural habitats and observe the complex relationships occurring in your local environment. In this activity you are an ecologist tasked with mapping the distribution of biodiversity (animal and plants) occurring within your chosen space.

Action: Take a photograph or draw a site sketch showcasing your chosen environment.

Steps to complete this task:

1. Complete a field sketch of your chosen environment in the space above.
   Hint: sketch the horizon and background first, then add detail.
2. Annotate your diagram. Label/identify the abiotic factors within your chosen environment
3. Identify the physical environmental factors occurring within your chosen environment.

Abiotic refers to all the living components of your ecosystem. This includes animals, bacteria, fungi and other organic matter

Biotic refers to all the non-living parts physical and chemical elements in the ecosystem. This might include air, rocks, sunlight and waterways

4. In a paragraph, explain the functioning of your ecosystem; what organisms can you identify and how are they interacting with the non-living components of the environment? Does this change at different times of the day?

We would love to learn more about the biodiversity and habitats occurring within your local environment, so don't forget to share your annotated field sketch or photograph with the team at SIMS on education@sims.org.au

We look forward to hearing from you!

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