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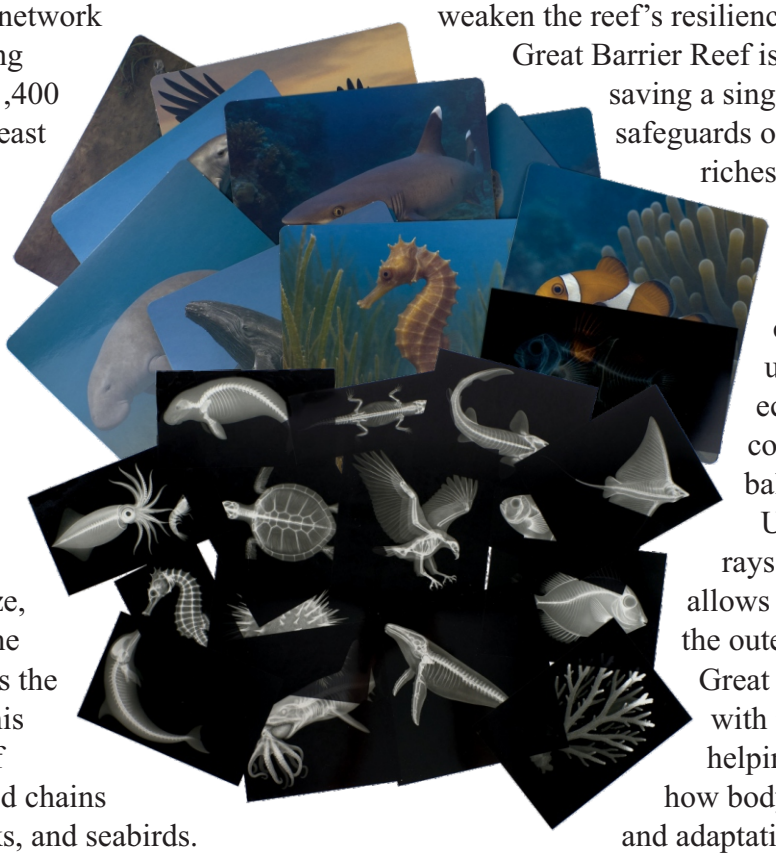
Great Barrier Reef X-rays and Picture Cards

Teacher's Guide

The Great Barrier Reef is the largest coral reef system on Earth, built over thousands of years by tiny animals called coral polyps. These polyps create hard calcium carbonate skeletons that stack and spread, forming the reef's structure. Within this living framework are lagoons, coral gardens, seagrass meadows, mangroves, sand flats, and deep-water slopes, each supporting different species. The reef is not a single place, but a huge network of connected habitats stretching more than 2,300 kilometers (1,400 miles) along Australia's northeast coast.



Coral reefs exist in relatively nutrient-poor tropical waters, yet they are bursting with life. This is possible because energy is recycled efficiently. Corals live in partnership with microscopic algae called zooxanthellae, which live inside their tissues. The algae use sunlight to photosynthesize, producing energy that feeds the coral. In return, the coral gives the algae shelter and nutrients. This symbiosis is the foundation of the ecosystem, supporting food chains that include fish, turtles, sharks, and seabirds.

Thousands of species depend on the reef, from plankton and colorful reef fish to rays, sea turtles, dolphins, and apex predators like sharks. Herbivores such as parrotfish help prevent algae from smothering corals, while filter feeders like clams and manta rays clean the water. Predators control populations of fast-breeding fish and invertebrates. Many animals use the reef as a nursery, sheltering young fish until they are strong enough to survive in the open ocean. Every role, even tiny plankton, helps maintain the balance of life.

Because the reef depends on a delicate balance of temperature, sunlight, and water quality, it is highly sensitive to change. Warmer oceans can cause coral bleaching by driving algae out of coral tissues. Pollution, overfishing, and sediment from land also weaken the reef's resilience. Protecting the Great Barrier Reef is not only about saving a single habitat — it safeguards one of the world's richest sources of marine biodiversity, a major carbon sink, and a natural classroom for understanding how ecosystems depend on cooperation and balance.

Using the cards and x-rays in the classroom allows students to compare the outer appearance of each Great Barrier Reef animal with its internal structures, helping them understand how body shape, skeletons, and adaptations support survival within the habitat. Students can layer the x-ray over the card to observe features such as fins, shells, or cartilage-based skeletons, then connect these traits to how the animal hunts, moves, or defends itself. This hands-on approach encourages curiosity, supports visual learners, and makes abstract biological concepts concrete by letting students "look inside" the organism as scientists do.

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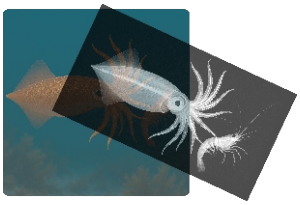
White-bellied Sea Eagle (Haliaeetus leucogaster)

The White-bellied Sea Eagle is a powerful coastal bird of prey found across the Indo-Pacific, including the Great Barrier Reef. It hunts fish, sea snakes, and small seabirds by swooping low over the water. Like other apex predators, it helps control populations of marine animals and keeps ecosystems in balance. It also scavenges, removing dead animals that could otherwise carry disease. Sea eagles rely on healthy coastlines and tall nesting trees, so their presence is an indicator of a thriving habitat. Because they feed high on the food chain, they reflect the overall health of the reef environment.

Trevally (Family Carangidae)

Trevally are fast-moving schooling fish that patrol the reef in large groups, feeding on smaller fish and crustaceans. Their speed and agility make them efficient mid-level predators that help prevent smaller species from becoming too abundant. By keeping prey numbers balanced, trevally help maintain the structure of reef communities. They also act as a food source for larger predators such as sharks and dolphins. Because they respond quickly to changes in water temperature and food supply, the movement of trevally schools often signals shifts in reef conditions, making them useful for understanding ecosystem health.

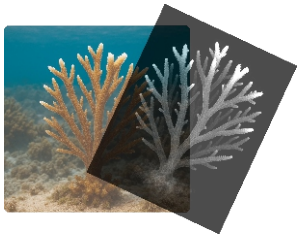


Reef Squid (Sepioteuthis australis)

Reef squid are intelligent, fast-swimming invertebrates that use jet propulsion and rapid color-changing skin for camouflage and communication. They feed on small fish and shrimp and are themselves prey for dolphins, sharks, and large fish, making them an important link in the middle of the food web. Reef squid reproduce quickly and play a role in recycling nutrients through the ecosystem. Their sensitivity to water clarity and temperature means changes in squid behavior can signal stress in reef environments. They also help keep populations of smaller reef creatures in balance through active hunting.

Peppermint Shrimp (Lysmata spp.)

Peppermint shrimp are small reef-dwelling crustaceans known for their bright stripes and helpful "cleaning" behavior. They remove parasites, dead skin, and leftover food from fish, which protects other reef animals from infection. This cleaning service makes them a form of natural healthcare for the reef. Although tiny, they play an essential role in maintaining healthy fish populations and water quality. They are also prey for larger fish, contributing to energy flow in the reef ecosystem. Their presence encourages biodiversity, because many fish prefer to live near areas where cleaner shrimp are active.



Staghorn Coral (Acropora spp.)

Staghorn coral is a branching coral that creates much of the reef's physical structure. Its many arms provide shelter and hiding spaces for fish and invertebrates. Like other reef-building corals, it lives in partnership with algae that produce food through photosynthesis. This energy helps the coral grow and expand the reef over time. Healthy staghorn colonies support high biodiversity by offering habitat for juvenile fish. However, they are very sensitive to rising ocean temperatures and bleaching. Because they grow quickly but are easily damaged, staghorn corals are considered a key indicator of reef recovery and resilience.

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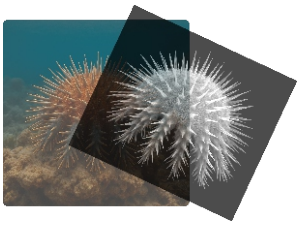
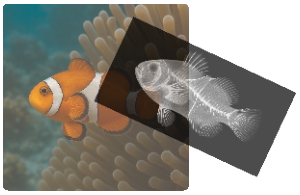


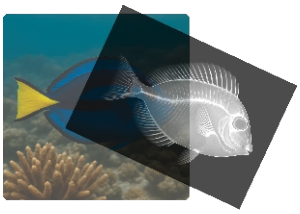
Crown-of-Thorns Starfish (Acanthaster planci)

The crown-of-thorns starfish is a large, spiny predator that feeds on coral polyps. In small numbers, it plays a natural role in the reef by preventing a single coral species from dominating. But when populations grow too large, often due to pollution or loss of predators, they can strip large areas of reef. These outbreaks reduce habitat for reef fish and slow coral growth. Because they have few natural enemies and can produce millions of eggs, population spikes can happen quickly. Scientists monitor this species closely because its behavior strongly affects coral cover and ecosystem health.



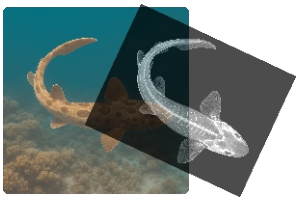
Clownfish (Amphiprion percula)

Clownfish live in a special partnership with sea anemones, gaining protection from predators by hiding among the anemone's stinging tentacles. In return, they help clean the anemone and chase away fish that might harm it. Clownfish feed on plankton and tiny invertebrates, acting as mid-level consumers in the reef food web. Their life cycle depends on healthy coral habitats, especially sheltered areas where anemones can attach. Because clownfish are highly recognizable and live in close relationship with another species, they are a good example of mutualism — a type of symbiosis where both animals benefit.



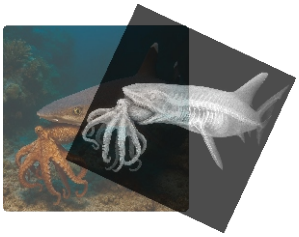
Blue Tang (Paracanthurus hepatus)

The blue tang is a brightly colored herbivorous fish that spends most of its time grazing on algae growing on coral. By removing algae, it prevents them from smothering the coral by blocking sunlight, helping the reef stay healthy. Blue tangs are important to balance plants and coral growth. They are prey for larger fish, sharks, and some marine mammals, making them part of both energy cycling and food chain. Their grazing activity plays a quiet but crucial role in coral survival, which is why herbivorous fish are often called the "gardeners" of the reef.



Epaulette Shark (Hemiscyllium ocellatum)

The epaulette shark is a small reef shark famous for its ability to "walk" across the seafloor using its fins, especially when trapped in shallow pools at low tide. It can survive in low-oxygen conditions that would harm most fish, allowing it to feed in reef flats where other predators cannot hunt. Epaulette sharks help control populations of crabs, shrimp, and small fish along the reef edges. Their unique tolerance for changing water conditions makes them an important species for studying climate resilience and adaptation in reef environments.



Whitetip Reef Shark (Triaenodon obesus)

The whitetip reef shark is a slender, slow-swimming shark that rests in caves during the day and hunts at night. Unlike many sharks that must keep moving to breathe, it can pump water over its gills while still, allowing it to live inside complex reef structures. It preys on reef fish, crustaceans, and octopus, helping regulate populations of mid-sized animals that might otherwise overgraze or outcompete other species. As a top predator, the whitetip reef shark plays a vital role in maintaining balance within reef ecosystems and signaling reef health.

Day Octopus (Octopus cyanea)

The day octopus is an active daytime hunter that moves across coral surfaces in search of crabs, shrimp, and small fish. It is a master of camouflage, able to change color and texture in an instant to blend in with its surroundings. As a predator, it helps control populations of fast-growing invertebrates on the reef. When finished feeding, it often leaves behind piles of empty shells that become micro-habitats for smaller animals. Because it uses coral crevices for shelter, the day octopus depends on healthy reef structure for survival.

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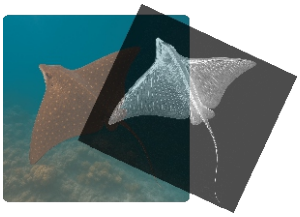
Teacher's Guide

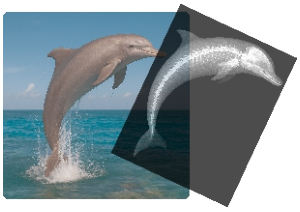
Seahorse (Hippocampus whitei)

The seahorse is a small, upright-swimming fish that clings to seagrass and coral with its tail to avoid being swept away by currents. Instead of hunting by chasing, it uses stealth to suck tiny crustaceans and plankton into its snout. Seahorses are important low-level predators that help control small invertebrate populations. They also provide food for larger fish and are an indicator of healthy seagrass and coral nurseries. One of their most unique traits is that the male carries the eggs in a brood pouch, making them a symbol of unusual reproductive strategies in the marine world.



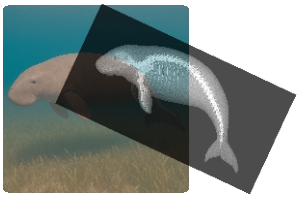
Spotted Eagle Ray (Aetobatus ocellatus)

The spotted eagle ray is a graceful swimmer with wide, wing-like fins and a long tail. It feeds on clams, snails, and crustaceans by crushing their shells with powerful jaws. By digging in the sand for food, it helps stir up sediment and release buried nutrients back into the ecosystem. Eagle rays are prey for large sharks, so they transfer energy from the seafloor to higher parts of the food web. Their movements also help shape seagrass and sandy habitats, making them important ecosystem shapers as well as predators.



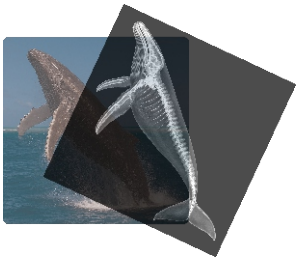
Australian Humpback Dolphin (Sousa sahulensis)

The Australian humpback dolphin lives in shallow coastal waters and often hunts cooperatively, sometimes driving fish toward shorelines to make them easier to catch. It feeds on fish and cephalopods, helping regulate prey populations near the reef. Because these dolphins rely on clean, sheltered waters, their presence signals a healthy nearshore environment. They are also social animals, passing learned behaviors between individuals. As a top marine predator, they help maintain balance in coastal reef ecosystems and play an important role in connecting shallow reef habitats with deeper ocean waters.



Dugong (Dugong dugon)

The dugong is a gentle, slow-moving marine mammal that grazes on seagrass beds, much like a manatee. By feeding, it prunes old seagrass and creates space for new growth, which keeps seagrass meadows healthy and productive. These meadows are nurseries for many reef fish and invertebrates, meaning dugongs indirectly support biodiversity. They also recycle nutrients through their feeding and movement. Because dugongs require stable seagrass habitats, their health reflects the overall well-being of the coastal marine environment. They are considered a keystone herbivore in tropical reef ecosystems.



Humpback Whale (Megaptera novaeangliae)

On the Great Barrier Reef, humpback whales use warm waters as calving and nursery grounds before migrating south to feeding areas. While they do not feed heavily here, their presence still benefits the reef. As they dive and rise, they move nutrients through the water column, creating "whale pumps" that fertilize plankton — the base of the marine food web. Their migrations link distant ecosystems together, transporting nutrients across vast distances. Because they return to the same breeding areas year after year, they also help scientists track environmental change over time.

Saltwater Crocodile (Crocodylus porosus)

The saltwater crocodile is an apex predator that lives in estuaries, mangroves, and river mouths connected to the reef. It hunts fish, turtles, and waterbirds, helping control populations of larger prey species. Young crocodiles are prey for birds and big fish, contributing to energy cycling in nursery habitats. Crocodiles also connect land and sea ecosystems by moving nutrients between freshwater and marine environments. Because they sit at the top of the food chain, their presence shows that the habitat can support large predators and a healthy prey base.

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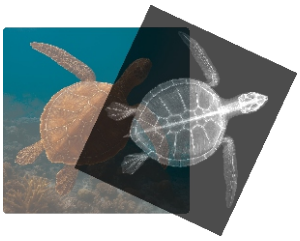

Green Sea Turtle (Chelonia mydas)

Green sea turtles are herbivores that graze on seagrass and algae, helping maintain healthy seagrass meadows that act as nursery grounds for fish and invertebrates. Their grazing prevents seagrass from growing too thick, increasing sunlight and oxygen flow. They also carry nutrients across habitats during migration. Hatchlings are prey for many species, supporting early stages of the food web, while adults act as ecosystem gardeners. Because their survival depends on clean water, stable food sources, and safe nesting beaches, they are widely used as an indicator of reef health.

Follow Up Activities:

Try these activities with your students:

1. Lay out all of the cards and x-rays. Ask students to match them up.

2. Create Ocean Art: Place x-rays on a light table or in a window. Lay a sheet of paper over top and trace the animals. Use the cards as reference when adding detail. Write the name of the animal on the back of the sheet and add some interesting details.

3. Separate the animals into different categories: Mammals, birds, fish; herbivores and carnivores.

Comparative Ecosystem Activities:

Our world is not neatly compartmentalize. Take a look at how ecosystems relate to each other. For instance, compare and contrast Arctic animals with Great Barrier Reef animals.

Create a chart showing how animals from the Arctic and Great Barrier Reef solve similar survival problems in different ways. For example, students can match pairs like polar bear to a shark (top predators). How are they similar? How are they different? Look at the Arctic fox and compare it to the reef octopus (adaptable hunters). Focus on the caribou and dugong (large herbivores).

Students can examine body coverings, movement, diet, and environmental challenges such as cold water versus tropical water.

After pairing species, students can identify which adaptations are unique and which are shared. This activity encourages pattern recognition, systems thinking, and a deeper understanding of how climate and habitat shape evolution.

Expand your exploration further by looking at other ecosystems around the world. Another powerful comparison for students is between the Sahara Desert and the Brazilian Rainforest. These ecosystems represent opposite ends of Earth's moisture cycle: the Sahara is shaped by extreme dryness and limited resources, while the rainforest holds enormous biodiversity supported by constant rainfall and rich plant life. In the desert, animals survive by saving energy and conserving water, often becoming active at night, storing moisture, or reducing body heat gain. In the rainforest, survival depends on competition, camouflage, and specialization, because so many species share the same space. By comparing these systems, students can see how climate, rainfall, and vegetation shape not only animal adaptations, but also behavior, food webs, and reproductive strategies.

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Nature's Neighbours

A Teacher's Guide to Ecosystems

At Roylco, we want teaching science to younger children to be fun and fascinating. Because younger students are fascinated to learn and understand their own bodies, we want to use their natural curiosity to introduce them to science and help them gain an appreciation of nature.

We are developing a series of x-ray and picture cards that focus on ecosystems from around the world. No ecosystem survives in isolation, so use a combination of these sets to explore the entire world.

Let's start by understanding what an ecosystem is:

An ecosystem is a place where living things, like plants and animals, and nonliving things, like water, air, and soil, all work together. Every part of an ecosystem is connected—if one thing changes, it can affect everything else.

More specifically, a living thing can be as small as a single cell bacteria, or as big as a gray whale. In between we have bugs, fungi, plants and animals like mammals, amphibians, reptiles, invertebrates, fish and birds.

Non-living parts of an ecosystem includes sunlight, water, air, rocks, and soil. And don't forget the weather! Temperatures and space contribute to every ecosystem. When it comes to something like weather, think about how rainfall/snowfall affects your environment. Seeds, pollen and some animals, like birds and insects, travel on the wind. Storms and fire can quickly change an ecosystem. Likewise, the normal flow of seasons require ecosystems to adapt to the changing climate.

There are wonderful benefits to learning about ecosystems:

Cognitive and Academic Benefits

• Build Science Foundations: By understanding how living and nonliving things interact, we are introduced to the concept of cycles, like water cycles, food chains, and the four season.

• System Thinking: Instead of focusing on isolated facts, students will start to think about how things come together: Plants need sunshine and water; animals need plants; people need both. Together these elements make up systems and by learning about the systems, we start to become aware of the importance of each part and the role it plays.

• Supports Curiosity: When we start to ask "what if" questions, we develop critical thinking and problem solving skills.

Environmental Awareness

• Fosters Stewardship: Appreciating ecosystems helps nurture respect for nature and a sense of responsibility.

• Highlight Human Impact: Students learn that their actions matter. They can help by recycling their waste, reducing the amount of water they consume, and protecting habitat.

• Connect Local to the Global: Your environment is part of an ecosystem. By protecting your home ecosystem, you are contributing to the whole planet.

Social and Emotional Benefits:

• Encourage Empathy: By learning about how living things depend on each other, children develop empathy for animals, plants, and people.

• Nurtured by Nature: Exposure to nature increases attention, lowers stress, and improves mood.

• Build Wonder and Joy: Learning about the elements of an ecosystem sparks imagination, creativity and the excitement of exploration.

Cross-Curricular Benefits:

• Literacy: Reading and writing about ecosystems builds scientific and relationship vocabulary.

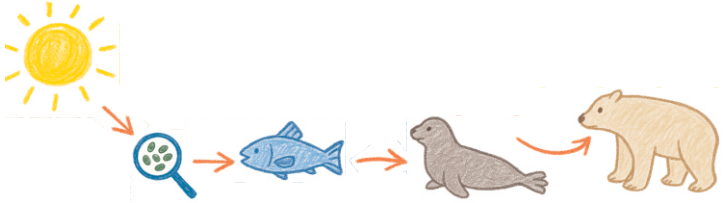
• Math: Looking at groups and individuals helps children develop a strong number sense.

• Creativity: Drawing pictures of animals or creating diagrams of food chains promotes visual literacy.

Activity Suggestions

Explore ecosystems with children through science, art and language.

• Create a diagram of a food chain. Up in the Arctic, sunlight shines down on the ocean and nourishes plankton. Fish eat the plankton. Seals eat the fish. Polar bears eat the seals.



There are other ways to understand this information.

• Show how the world is interconnected. Look at the migratory patterns of birds, whales and Monarch butterflies.

• Use Roylco's X-ray and Picture cards sets to explore the animals from the inside out. The cards are printed with detailed images of animals in their natural habitat. Match the cards to their x-rays. Group animals by characteristics. Use the x-rays on a light table and trace the details.

• Write stories about the animals. Be sure to include information about where they live, what they eat, and the threats they face.