

ALL THE WAY DOWN OCEAN



THE SUNLIGHT ZONE

THE
TWILIGHT ZONE

THE
MIDNIGHT ZONE

THE ABYSS

THE TRENCHES

ALEX WOOLF & ISOBEL LUNDIE

INTERTIDAL ZONE

LIFE

Due to its warm temperatures, low pressure and abundance of food, the sunlight zone is teeming with life. In fact, 90% of all ocean life is found here, even though it's the smallest zone in terms of volume. Life here is incredibly diverse, from microscopic phytoplankton to enormous whales, but it's not distributed evenly. It's far more concentrated in food-rich coral reefs, for example, than in the open ocean.

CARBON DIOXIDE

OXYGEN

OPEN OCEAN

WHAT IS PHOTOSYNTHESIS AND WHY IS IT IMPORTANT IN OUR OCEANS?

Photosynthesis is a chemical process that takes place inside a plant. The plant takes light from the Sun and carbon dioxide from the atmosphere and converts them into food (to grow and reproduce), and oxygen. For photosynthesis to take place, plants need carbon dioxide, water and light – all of which are available in the sunlight zone.

PHYTOPLANKTON

At the base of the ocean's food chain are creatures too small for us to see: phytoplankton. Countless billions of these one-celled organisms live in the sunlight zone. They are eaten by animals that are, in turn, eaten by other animals. Phytoplankton thereby support all other marine life.

SEAGRASS MEADOW

CORAL REEF

CHAPTER 1: THE SUNLIGHT ZONE

WHAT IS THE SUNLIGHT ZONE?

The sunlight zone – also known as the photic zone – is the uppermost layer of the ocean. It covers the region from the surface to 200 metres (656 feet) down. There is plenty of light and warmth in this zone and the pressure is very low. This is the only zone that has enough light for photosynthesis and is therefore the only zone where plants can live.

HABITATS

There are many different habitats within the sunlight zone, each varying in terms of temperature, depth and closeness to land. The habitat affects the kinds of creatures that live there. In this section, we'll be looking at the intertidal zone, estuaries, kelp forests, seagrass meadows, coral reefs and the open ocean.



THE INTERTIDAL ZONE



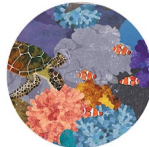
ESTUARIES



KELP FORESTS



SEAGRASS MEADOWS



CORAL REEFS



THE OPEN OCEAN



CORAL REEFS

CORAL REEFS COVER LESS THAN 1% OF THE OCEAN BUT ARE HOME TO AROUND A QUARTER OF ALL MARINE SPECIES! THEY ARE MADE OF LAYERS OF A HARD MATERIAL, CALCIUM CARBONATE, SECRETED BY TINY ANIMALS CALLED CORAL POLYPS. CORAL REEFS HOST AN INCREDIBLY DIVERSE RANGE OF ANIMALS, INCLUDING SPONGES, CRUSTACEANS, MOLLUSCS, FISH, TURTLES, SHARKS, DOLPHINS AND MANY MORE.

- 1 PICASSO TRIGGER FISH** These fish live in the sandy areas of coral reefs and eat squid, krill, clams and small fish. They constantly swim around and will vigorously defend their territory against intruders. At night, they sleep on their side, wedging themselves between corals or rocks.
- 2 WHITETIP REEF SHARK** Whitetip reef sharks lurk hungrily around coral reefs, hunting eels, fish, octopuses and crabs. Their slim, agile bodies can wriggle into narrow crevices in the reef to extract prey. They feed mainly at night, sometimes teaming up to block a prey's exit route from the reef.
- 3 NAPOLEON WRASSE** The Napoleon wrasse is one of the largest fish in the coral reef. It swims in the outer reef during the day, feeding on molluscs, reef fish, sea urchins and crustaceans. At night it sleeps in reef caves or below coral ledges.
- 4 HAWKSBILL SEA TURTLE** Adult hawksbills are found mainly in tropical coral reefs. They feed on sponges, using their narrow, pointed beaks to extract them from crevices. By removing sponges from the coral, they give better access to reef fish to feed.
- 5 CLOWNFISH** Clownfish make their home amid the stinging tentacles of the sea anemone. The clownfish is immune to the stingers, and the anemone offers protection against predators. In return, the clownfish keeps the anemone healthy and clean.
- 6 LIONFISH** Lionfish are aggressive predators of smaller fish, and can harm coral reefs if their numbers get too large. Their prey eat algae from the coral, and if the lionfish eat too many of them, the algae grows unchecked, which can damage the health of the reef.

1 PICASSO TRIGGER FISH
Length: 25–30 cm (10–12 inches)
Depth range: 0–50 m (0–164 feet)



2 WHITETIP REEF SHARK
Length: up to 1.5 m (5 feet)
Depth range: 0–330 m (0–1,082 feet)



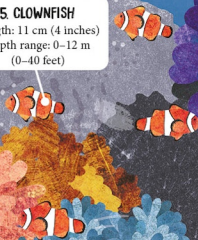
3 NAPOLEON WRASSE
Length: up to 2 m (6.5 feet)
Depth range: 0–61 m (0–200 feet)



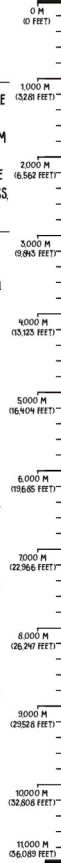
4 HAWKSBILL SEA TURTLE
Length: 71–89 cm (2.5–3 feet)
Depth range: 0–175 m (0–574 feet)



5 CLOWNFISH
Length: 11 cm (4 inches)
Depth range: 0–12 m (0–40 feet)



6 LIONFISH
Length: up to 33 cm (1 foot)
Depth range: 0–300 m (0–984 feet)



1. HUMPBACK ANGLERFISH

Length: up to 18 cm (7 inches) (female)
Depth range: 100–1,500 m (328–4,921 feet)



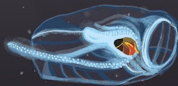
2. DEEP-SEA HATCHETFISH

Length: up to 12 cm (5 inches)
Depth range: 50–1,500 m
(164–4,921 feet)



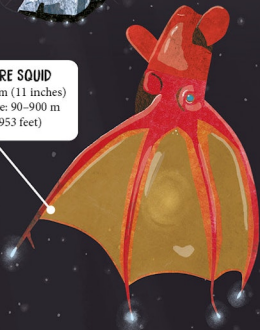
3. SALP

Length: 1–10 cm
(0.5–4 inches)
Depth range: 0–800 m
(0–2,625 feet)



4. VAMPIRE SQUID

Length: 28 cm (11 inches)
Depth range: 90–900 m
(295–2,953 feet)



5. STOPLIGHT LOOSEJAW

Length: up to 30 cm (1 foot)
Depth range: below 500 m (1,640 feet)



6. ATOLLA JELLYFISH

Width: 25 cm (10 inches) in diameter
Depth range: 500–1,000 m (1,640–3,281 feet)



GLOW-IN-THE-DARK-ANIMALS

IT'S NOT COMPLETELY DARK IN THE TWILIGHT ZONE. MANY ANIMALS LIVING HERE PRODUCE THEIR OWN LIGHT THROUGH A PROCESS CALLED BIOLUMINESCENCE. PREY FISH MAY PRODUCE LIGHT ON THEIR BELLIES SO THAT PREDATORS BENEATH THEM CANNOT SEE THEIR SILHOUETTES AGAINST THE LIGHTER-COLOURED WATERS ABOVE. SOME PREDATORS USE BIOLUMINESCENCE AS A MEANS OF ATTRACTING PREY.

- 1. HUMPBACK ANGLERFISH** Female anglerfish have a large mouth full of sharp teeth. A slender piece of their spine juts out above their mouth and acts as a built-in fishing rod. At the end of the rod is a fleshy glowing bulb that lures small fish and other prey.
- 2. DEEP-SEA HATCHETFISH** These fish have light-producing organs in rows along their bellies. The organs shine a pale blue light, which they can adjust to match the light filtering down from the sunlight zone above, hiding them from predators below.
- 3. SALP** Salps are translucent, barrel-shaped, jelly-like creatures that travel up to the surface at night to feed on phytoplankton. Sometimes they form into long chains. They use bioluminescence to communicate with others in the chain, or to attract prey and potential mates.
- 4. VAMPIRE SQUID** Almost entirely covered in light-producing organs, this squid produces flashing light displays that can last up to ten minutes to dazzle and confuse its predators. Despite its name, the vampire squid doesn't suck blood – it feeds on marine snow (see page 28).
- 5. STOPLIGHT LOOSEJAW** This fish has red and green light-producing organs near its eyes, a bit like a traffic light, hence its name. As most deep-sea creatures cannot perceive the colour red, it is able to hunt quite stealthily.
- 6. ATOLLA JELLYFISH** The deep red light of this jellyfish makes it invisible to its predators. When touched, the atolla flashes bright blue circles of light. These attract larger species of predators, scaring away its attacker.



1. COLOSSAL SQUID

Length: up to 14 m (46 feet)
Depth range: 1,000–2,000 m (3,281–6,562 feet)

2. SEA TOAD

Length: up to 30 cm (1 foot)
Depth range: 1,320–2,460 m (4,331–8,071 feet)

4. COOKIECUTTER SHARK

Length: 42–56 cm (1.3–1.8 feet)
Depth range: 0–3,000 m (0–9,843 feet)

5. FRILLED SHARK

Length: up to 2 m (6.5 feet)
Depth range: 120–1,570 m (394–5,151 feet)

6. GULPER EEL

Length: 1–2 m (3–6.5 feet)
Depth range: 500–3,000 m (1,640–9,843 feet)

3. DEEP-SEA DRAGONFISH

Length: up to 15 cm (6 inches)
Depth range: up to 1,500 m (4,921 feet)

PREDATORS OF THE MIDNIGHT ZONE

PREY IS SCARCE IN THE MIDNIGHT ZONE, AND PREDATORS HAVE DEVELOPED ADAPTATIONS TO SURVIVE THERE, INCLUDING LONG, SHARP BACKWARD-POINTING TEETH TO ENSURE THAT PREY, ONCE CAUGHT, CAN'T WRIGGLE FREE. IN THE ABSOLUTE QUIET OF THE MIDNIGHT ZONE, MANY PREDATORS HAVE HIGHLY DEVELOPED HEARING. ONE FAMILY OF SNAKETOOTH FISHES 'LISTEN' WITH THEIR FACES.

- 1. COLOSSAL SQUID** Colossal squid are superbly adapted to hunting in the dark depths. They have the largest eyes in the animal kingdom, and the biggest beaks of any squid. There are 25 rotating hooks on the ends of their tentacles for seizing prey.
- 2. SEA TOAD** The sea toad saves energy by barely moving at all, breathing by pushing water across its gills. It sits on the seafloor and waits, motionless, for prey to come within reach. It doesn't need to feed often, and isn't picky about what it eats.
- 3. DEEP-SEA DRAGONFISH** These fish have light organs next to their eyes that produce blue and red light. Emitting red light effectively makes them invisible to their prey. Dragonfish have large jaws and can eat prey more than half their own length.
- 4. COOKIECUTTER SHARK** This little shark lures predators with bioluminescence, and attaches itself to them with its thick, sucking lips. Then, with its razor-sharp, hook-like teeth, it cuts out a plug of flesh, leaving a crater wound.
- 5. FRILLED SHARK** The frilled shark hunts above the seabed, lunging at its prey like a snake. It has several rows of small, needle-sharp teeth ideal for snagging the soft bodies of squid, its favourite prey; Its long flexible jaws enable it to swallow prey whole.
- 6. GULPER EEL** The gulper, or pelican eel, has an enormous scoop for a mouth, which it uses as a net as it swims into groups of small crustaceans. It then expels the water through its gills. Its tail has tentacles that glow pink to attract prey.

