



Game: Marine Food Web

Words you need to know

A food chain shows how each living thing gets energy through its food. Plants get energy from the sun. Some animals eat plants (herbivores), some eat both plants and animals (omnivores) and some animals eat other animals (carnivores). In a food chain, each link in the chain (or food source) becomes food for the next link in the chain. Top level predators sit at the top of the food chain. The interconnecting food chains in a particular ecosystem are known as a food web. Food webs are complex systems. Removing or increasing a species in a food web has a flow on effect and can put things out of balance.

Biodiversity (biological diversity) refers to the variety of all living things, including plants, animals and micro-organisms found in an ecosystem and their inter-relationships. Marine Reserves are important in maintaining biodiversity. They provide breeding grounds for many species, and enable scientists and students to study the natural balance of species.

Aim

To create a Tasmanian marine food web and to promote an understanding of marine biodiversity in Tasmania.

To play

1. Split the class into 3 or 4 groups and distribute the cards amongst the groups (later when students understand how it works, groups can be joined together).
2. In their groups, identify and discuss
 - what broad group their card belongs to e.g. micro-organism, plant or animal; and then which specific group e.g. plant, crustacean, mollusc, echinoderm, fish, bird or mammal
 - whether their card is a vertebrate or an invertebrate
 - whether their card is a herbivore, omnivore or carnivore
 - the habitat their card requires e.g. rocky reef, sandy bottom etc
 - the size of their life form e.g. microscopic, up to 5cm, 5cm - 1m etc
3. Now, create a food chain or food web in the group based on what the card life forms eat and what eats them. You can demonstrate the links by placing the cards on a large piece of paper. Form rows based on whether the card life forms are producers or consumers; making sure that producers are at the bottom, followed by herbivores, with top level predators at the top of the food web. Draw in arrows from the food to the animal that eats it.
4. Using the Worksheet and sharing the information cards amongst the class groups, draw in arrows to show who is eating who and to see just how interconnected the marine food web is. Alternatively, pick one top level predator and create a food web for that animal. Compare your results with the ANSWERS sheet.

Further work

- Use the Marine Scenario Cards to explore and debate topics such as oil spills, the pet food industry and the harvesting of kelp and consider their impact on the Tasmanian marine ecosystem.
- There has been a proposal to increase the size of marine reserves around Tasmania. A meeting needs to be organised so that the community can be consulted. Who are the interest groups that need to be present at the meeting? What views would each group hold? Organise a meeting and make a decision on the proposal.
- What are the pros and cons of aquaculture such as the salmon industry in Tasmania?

References: Edgar, G. J. (2008). *Australian Marine Life. The plants and animals of temperate waters*. Second edition.

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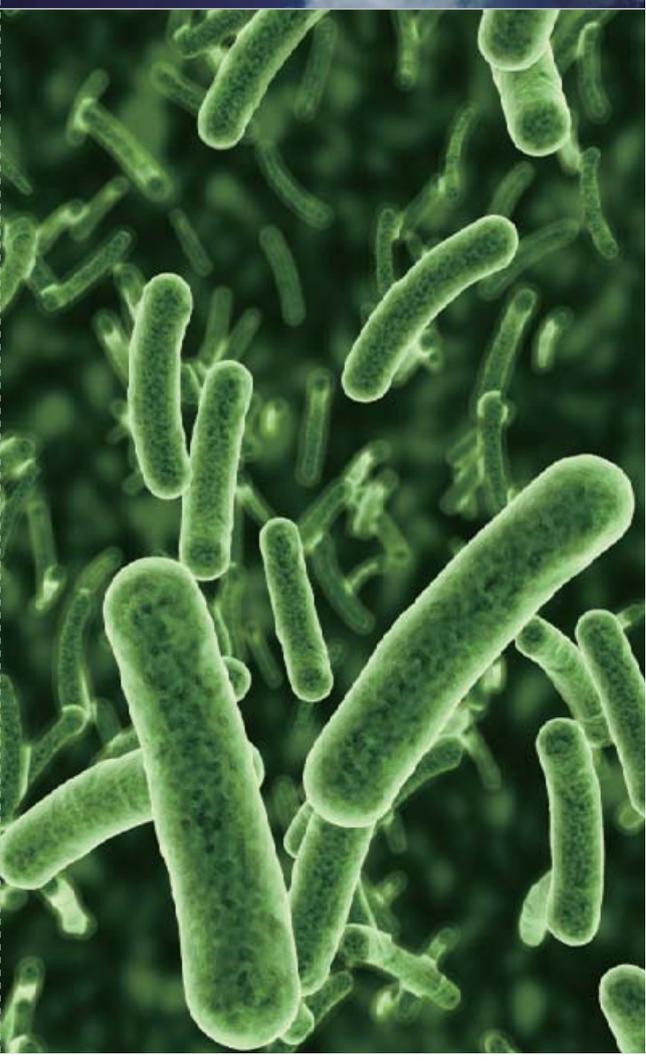
Sunlight



1. Sunlight

The sun provides energy for plants to grow.

SUN



Bacteria



2. Bacteria

Food: break down plant and animal material.

Size: less than 1 mm. They are the smallest and most abundant living organisms on earth.

Habitat: bacteria live everywhere, underwater and on land.

Function: they breakdown and decompose plant and animal material and are essential for the functioning of ecosystems.

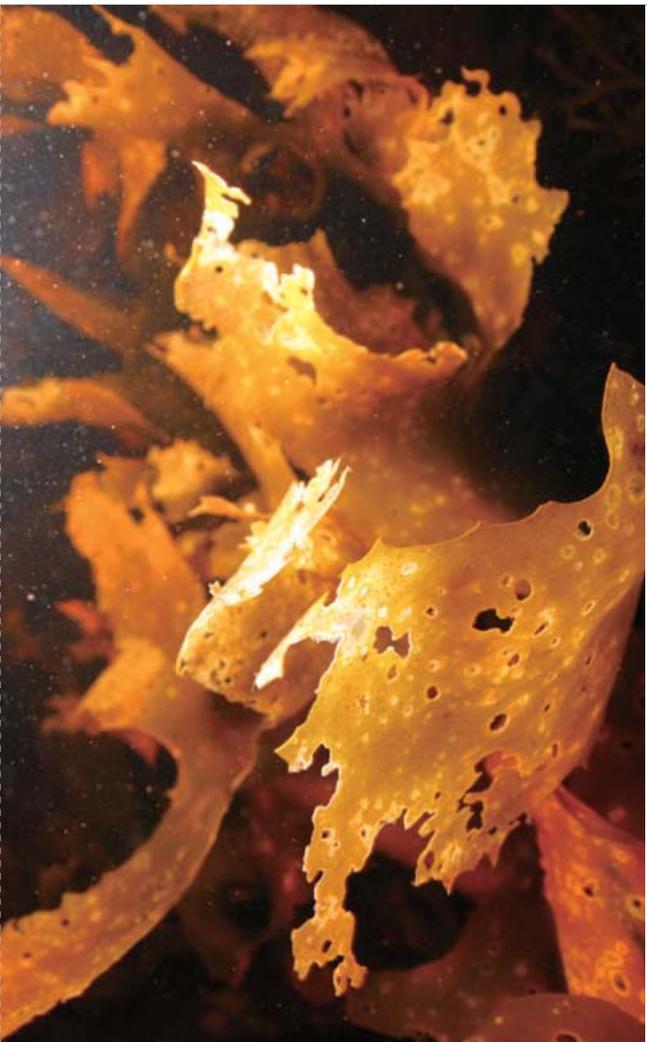
MICRO-ORGANISM

Fold

Fold



Detritus



Phytoplankton



Fold



3. Detritus

DECOMPOSING ORGANIC MATTER

Detritus is decomposing plant and animal material.

Function: bacteria help to break down detritus. This recycles energy and nutrients back into the ecosystem and makes them available for plants and animals to use again.

Fold



4. Phytoplankton

PLANT LIKE

Food: energy from the sun.

Size: microscopic.

Habitat: in the surface layers of the sea.

Function: they make their own food from the energy of the sun and produce oxygen as a result. 70% of the world's oxygen is produced by phytoplankton.



Brown algae – giant kelp



PLANT LIKE

5. Brown algae

(e.g. Giant kelp – *Macrocystis pyrifera*)

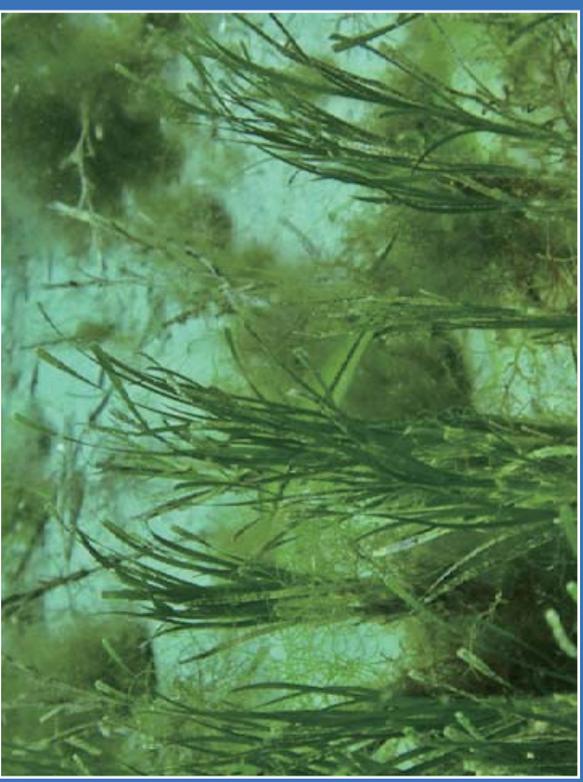
Food: energy from the sun.

Size: its leaves (fronds) can grow up to 35 metres long and can grow 50cm in a day. It is one of the fastest growing plants on the planet.

Habitat: exposed reefs, where they can anchor to the rocks.

Function: to produce oxygen, food and habitat for many marine species.

Seagrass



PLANT

6. Seagrass

(e.g. Tasmanian eelgrass – *Heterozostera tasmanica*)

Food: energy from the sun.

Size: 40 cm.

Habitat: on the sandy sea floor in depths up to 30 metres.

Function: to produce oxygen, food and habitat for many marine species.

Seagrass beds are like meadows in the sea, they are very productive areas and provide different places where many fish like to feed. The grass becomes food as well as the smaller creatures and tiny plants living amongst the seagrass.

Seagrass is one of three primary habitats in Tasmanian waters. The other two are sand and reef bottoms.

fold

fold



Micro-zooplankton (e. g. ciliate)



MICRO-ORGANISM

7. Micro-zooplankton

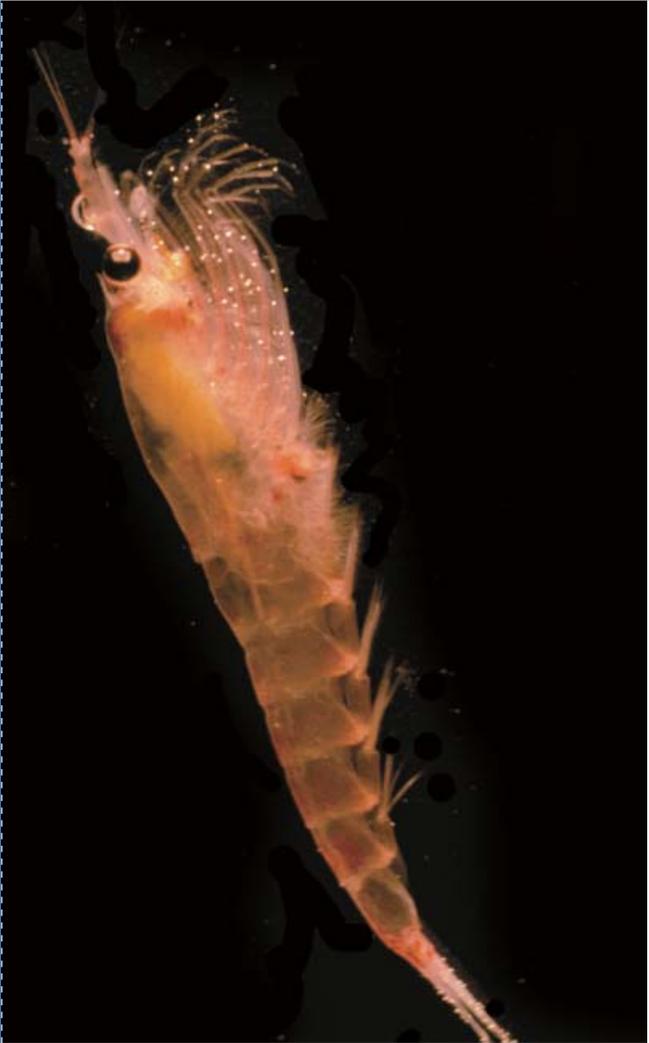
(e.g. ciliate)

Food: phytoplankton and other micro-zooplankton.

Size: microscopic.

Habitat: shallow and deep water.

Behaviour: many move by the action of cilia (tiny hairs) that surround their bodies.



Macro zooplankton (e. g. krill)



CRUSTACEAN

8. Macro zooplankton

(e.g. Southern krill – *Nyctiphanes australis*)

Food: algae, phytoplankton, detritus.

Size: 1.5 cm (Antarctic krill 5.5 cm)

Habitat: inshore waters.

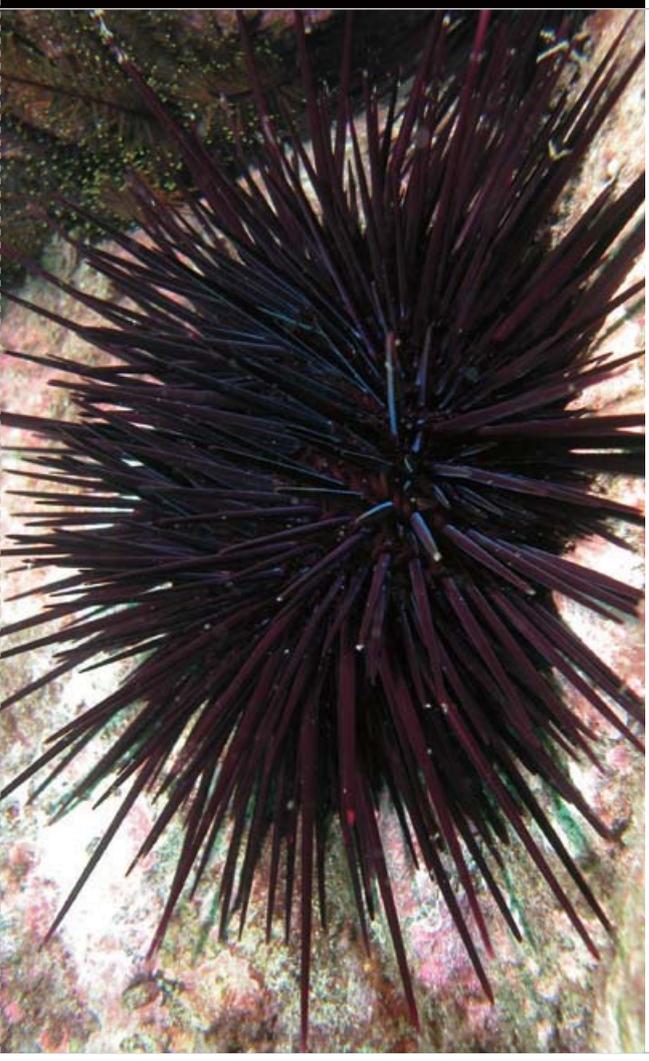
Behaviour: they occur in large swarms in spring and summer and swim weakly, relying on water currents to move them around.

Function: krill is eaten by a variety of organisms such as fish, birds and mammals (including baleen whales).

Mussel



uiniun pauid-sguo7



fold



MOLLUSC

ECHINODERM

9. Flea mussel

(*Limnoperna pulex*)

(*Centrostephanus rodgersii*)

Food: microscopic zooplankton.

Food: invertebrates such as bryzoans and large algae such as kelp.

Size: 2.5cm long.

Size: 20 cm (10 cm body and 10cm spines).

Habitat: hundreds live together on rocky, exposed platforms.

Habitat: found in shallow water and most abundant at depths of 1.5-25m. Recorded to a at 70m off the Tasman Peninsula. It is slowly spreading south from mainland Australia on the East Australia Current (EAC). They may have established in high numbers in eastern Tasmanian waters due to depleted rock lobster numbers and warmer surface temperatures from the EAC.

Behaviour: by waving its gills in the water it 'filter feeds' and extracts tiny food particles from the water.

Behaviour: where they are in high numbers, they will kill kelp communities.
Management: scientists are releasing rock lobster into some affected areas so that they can predate upon this urchin.

fold

Eight-armed seastar



North Pacific seastar



fold

fold

11. Eight-armed seastar

(*Meridiastra calcar*)



ECHINODERM

Food: algae, detritus, mussels.

Size: up to 5 cm.

Habitat: it lives in rock pools, sheltered reefs up to 10 m depth.

Behaviour: like other seastars, it is slow moving and uses its 'tubed feet' to move and find its food. Their stomach comes out of their mouth and they partially digest food outside their body.

12. North Pacific seastar

(*Asterias amurensis*)



ECHINODERM

Food: sea squirts, sponges, other species of seastars and shellfish such as mussels and oysters.

Size: up to 23 cm.

Habitat: an introduced species from Asia that lives mostly on soft bottoms such as sand, but is also found on sheltered reefs.

Behaviour: it is an active predator that consumes many marine species and is destroying marine communities.

Management: volunteer groups sometimes remove these seastars from their local bays.



Anchovy



pinfish



fold



13. Anchovy

(*Engraulis australis*)

FISH

Food: phytoplankton, zooplankton.

Size: 15 cm.

Habitat: coastal and deep waters.

Behaviour: they form huge schools and their presence is often noticed by a large area of rippling on the sea surface and the mass of other fish, seabirds and marine mammals feeding on them.

Human interactions: anchovy are commercially exploited for human consumption and for pet food.

fold



14. Squid

(*Nototodarus gouldi*)

MOLLUSC

Food: crustaceans and fish.

Size: up to 40 cm.

Life span: 1 year.

Habitat: found in the ocean from the surface down to 800 metres.

Behaviour: they gather close to the seabed during the day and at night they spread throughout the water column, coming to the surface to feed.



Octopus



Southern rock lobster



15. Octopus

(Maori octopus – *Octopus maorum*)



MOLLUSC

Food: rock lobster, starfish, sea urchins, crustaceans and molluscs (including mussels and even themselves!).

Size: 1.2 m. **Life span:** 1 year.

Habitat: it lives on the sandy bottom of the sea often amongst sponge gardens.

Behaviour: they hide during the day and come out at night to feed. They can manipulate their bodies into tiny cracks and crevices.

Human interactions: commercially fished in Tasmania.

fold

16. Southern rock lobster or crayfish

(*Iasus edwardsii*)



CRUSTACEAN

Food: molluscs, small crustaceans, echinoderms and seas squirts.

Size: their carapace is up to 25 cm (not including the legs).

Life span: they are believed to live for up to 20 years and possibly longer.

Habitat: rocky reefs in water 1-200 m deep.

Behaviour: they are most active at night, when they can move up to 150m.

During the day they remain stationary.

Human interactions: an important commercial species in Tasmania. There are controls on how many, and the minimum sizes that can be taken each year. Maria Island Marine Reserve provides a place where natural populations can be watched and studied.

fold

Toothbrush leatherjacket



Jack mackerel



fold



17. Leatherjacket

(Toothbrush leatherjacket – *Acanthaluteres vittiger*)

FISH

Food: eat small invertebrates, algae and sea grass.

Size: 32 cm.

Habitat: toothbrush leatherjackets are a common reef fish in Tasmanian waters.

Behaviour: they have sharp teeth for scraping algae off surfaces: rough sandpaper like skin and a defensive spine on the top of their heads. They get their name from the set of bristles on either side of the rear of the body.



fold



18. Jack mackerel

(*Trachurus declivis*)

FISH

Food: krill and other zooplankton, molluscs and fish.

Size: 54 cm. **Life span:** up to 15 years.

Habitat: large schools occur in open water, while small schools are common inshore.

Human interactions: Jack mackerel was once very abundant in Tasmanian waters and was caught to make fish food for the aquaculture (salmonid) industry. Overfishing and increasing water temperatures appear to have caused a decline in its population.



Barracouta



FISH

19. Barracouta

(*Thyestes atun*)

Food: small crustaceans (e.g. krill), fish and squid.

Size: 1.5 m. **Life span:** up to 10 years.

Habitat: coastal bays and open ocean to a depth of 200 m.

Behaviour: they are a large, predatory, schooling fish which is sometimes seen jumping out of the water whilst pursuing prey.

Human interactions: it was once the main fish for the fish and chip industry but stocks collapsed in the 1970s and have never recovered. It is still commercially fished in Tasmania.

Southern right whale



MAMMAL

20. Southern right whale

(*Eubalaena australis*)

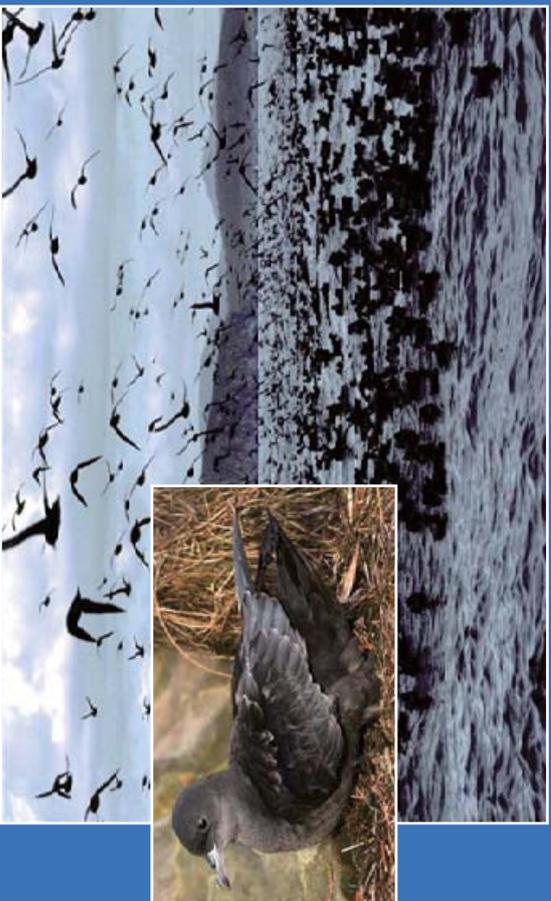
Food: krill. **Size:** up to 18 m.

Life span: at least 60 years. **Habitat:** coastal bays and ocean.

Behaviour: the southern right whale is a baleen whale that spends summer in Antarctic waters and migrates to southern Australian waters to breed during our winter.

Human interactions: in the early days, there were so many in the Derwent estuary around Hobart that the noise kept people awake at night. They were heavily exploited during the whaling industry and populations are now slowly recovering.

Short-tailed shearwater



21. Short-tailed shearwater or muttonbird (*Puffinus tenuirostris*)

BIRD

Food: krill, squid and fish

Size: wingspan up to 1m

Habitat: nest on islands and around the coast of southern Australia. They forage far from Tasmania and even to Antarctic waters.

Behaviour: the most numerous seabird in Australia (20 million). They breed Sept - Apr, nesting in burrows in the sand. In autumn they leave Tasmania and fly 15 000 kms to the northern hemisphere, returning again in spring.

Human interactions more than 50 000 birds drown in fishing nets in the Pacific Ocean each year. There is some harvesting by humans for food.

Little penguin



22. Little penguin (*Eudyptula minor*)

BIRD

Food: fish, squid, octopus, seahorse, krill

Size: 33 cm

Habitat: they nest in burrows along the coast but mostly on off shore islands. They feed mainly in inshore waters around the coast.

Life span: 6-7 years but have been known to live up to 20 years.

Behaviour: they forage during the day and return to their burrows at night. They commonly dive to just 10 metres but can dive to over 70 m.

Human interactions: humans and dogs on beaches can disturb little penguins. Setting 'gill nets' across bay entrances does trap and drown them.

Fold

Fold

Shy albatross



Southern blue fin tuna



Fold



BIRD

23. Shy albatross

(*Thalassarche cauta cauta*)

Food: fish, squid and crustaceans.

Size: wingspan to 2.5 m. **Life span:** they may live for up to 60 years.

Habitat: nest on three islands around Tasmania. They forage in coastal and deep waters within 500km of the breeding colony.

Behaviour: they breed from September to April and lay one egg a year. Their nest is bowl shaped and made of mud, droppings, vegetation, feathers, rocks, fish and bird bones.

Human interactions: like other albatross species, shy albatross albatross are accidentally caught and drown on the long-lines of fishing boats (up to 300 000 albatrosses are caught each year around the world).

FISH

24. Southern blue fin tuna

(*Thunnus maccoyii*)

Food: fish, squid, oceanic invertebrates.

Size: they can grow to over 2 m in length and weigh up to 200 kg.

Habitat: they occur in open ocean.

Life span: live up to 40 years.

Behaviour: they are a very fast swimming species and can dive to 500 m. They are migratory and can travel thousands of kilometres in a year.

Human interactions: they are fished commercially and their populations are in serious decline.

Fold



Australian fur seal



MAMMAL

25. Australian fur seal

(*Arctocephalus pusillus doriferus*)

Food: fish, squid, octopus. **Size:** weigh up to 350 kgs and length to 2 m.

Life span: 10-12 years in the wild, up to 20 years in captivity.

Habitat: they breed on rocky islands in Bass Strait and forage in inshore and open waters as far as 600 km from their breeding colony.

Behaviour: they can dive as deep as 100 metres and can hold their breath for nearly 10 minutes.

Human interactions: they almost became extinct as a result of the sealing industry when hundreds of thousands of seals were slaughtered for their skins in the 1800s. Seals can cause problems at fish farms by taking fish.



Common dolphin



MAMMAL

26. Common dolphin

(*Delphinus delphis*)

Food: squid and fish.

Size: up to 2.3 m and weigh up to 115 kg

Habitat: sheltered bays and open ocean.

Life span: at least 25 years.

Behaviour: they can occur in large groups or pods (up to 1000 animals). They work together to herd their prey into tight a ball which makes them easier to catch and eat.

Human interactions: they are accidentally caught in fishing nets, particularly tuna nets.

Orca



MAMMAL

27. Orca

Killer whale (*Orcinus orca*)

Food: squid, fish and marine mammals.

Size: up to 9 m.

Life span: up to 80 years.

Habitat: open ocean and coastal bays.

Behaviour: the orca is a toothed whale that lives in groups (pods) of 3 to 30 individuals. The male has a large dorsal fin.

Human interactions: orcas sometimes follow fishing boats and take fish from fishing lines.

Great white shark



FISH

28. Great white shark

(*Carcharodon carcharias*)

Food: rock lobster, seals, dolphins, whales, sharks, fish and birds.

Size: up to 6.5 m.

Life span: over 30 years

Habitat: the 'great white' lives in the open ocean.

Behaviour: they have a very strong sense of smell which they use to track down live prey or dead animals.

Human interactions: the population is declining due to deliberate hunting and by-catch with fisheries. They are now protected.

Human being



MAMMAL

29. Human being

(*Homo sapiens sapiens*)

Food: a variety of foods from both the land and the sea. Sea foods favoured include fish, rock lobster, squid, octopus, and even krill.

Size: up to 1.8 m **Life span:** 80 years.

Habitat: live on land but forage for food on land and in the sea.

Behaviour: human beings are omnivorous; eating a wide variety of food. They hunt for food but also 'farm' species for consumption e.g. salmon, tuna and oysters.

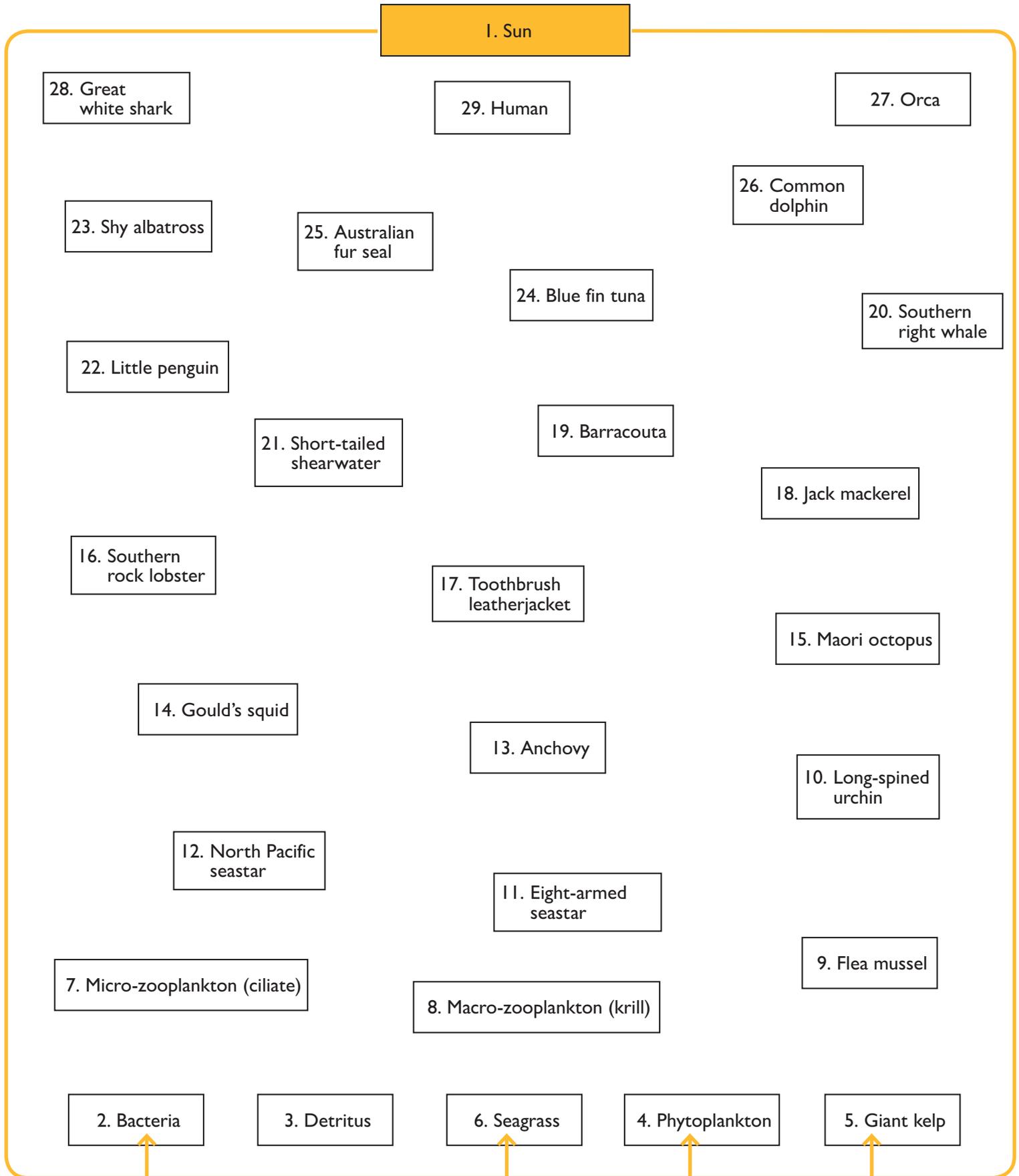
Human interactions: many marine species are in decline due to overfishing by humans e.g. blue fin tuna, jack mackerel and rock lobster.



Worksheet:

Tasmanian Marine Food Web Diagram

Draw in lines with arrows to show the flow of energy up the food chain. (Check the ANSWERS to see how you went.)





Worksheet:

Tasmanian Marine Food Web Diagram

Draw in lines with arrows to show the flow of energy up the food chain. (Check the ANSWERS to see how you went.)

