The MARINE FOOD WEB

A guide to understand the sensitive marine eco-system

MARINE EDUCATION EBOOK SERIES

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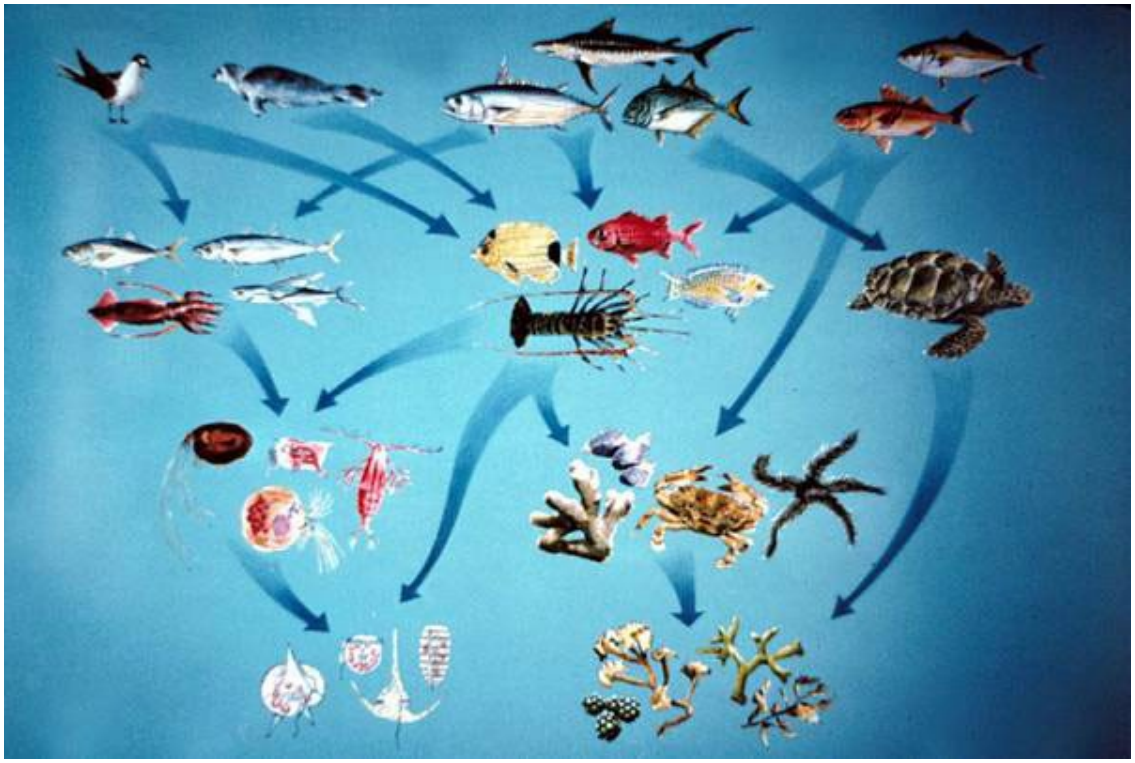
What is a Marine Food web?

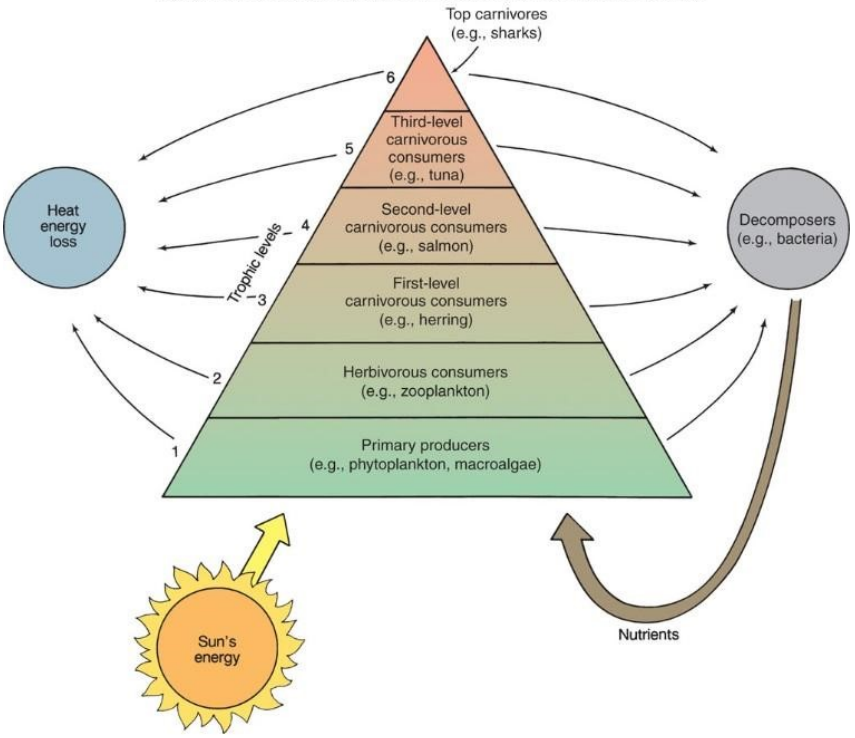
Simply defined, a marine food web illustrates feeding relationships (what is eating what) that occurs in a marine habitat. The concept of a 'food web' shows the link between **producers, consumers and decomposers.**



A typical marine food web

Trophic levels

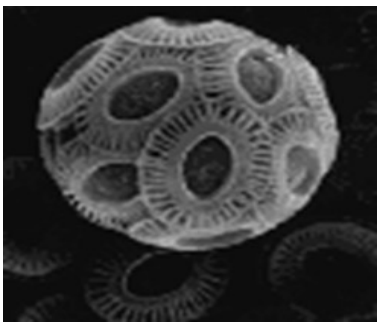
Each organism falls into certain trophic levels this depending on their role in the food web. Organisms are grouped according to their role and illustrated in a Trophic level pyramid. The first level (base) contains groups of **producers**, then the second levels are made up of mainly herbivore **secondary consumers** and the levels that follow consists of **tertiary consumers** that eat the herbivores and so on. The higher you go up the pyramid the smaller number of organisms, in other words it has less biomass on top. This means on the top level of the pyramid, groups such as sharks, are supported by millions of organisms from the base of the trophic pyramid. Although the number and type of species of each level can vary between different ecosystems and habitats, the same basic trophic levels can be found in different food webs.



Marine trophic levels pyramid

Producers

- Producers are the base level of any marine food web
- Producers are considered autotrophic, which means they have the ability to make food on their own.
- This ability is through a process known as photosynthesis, which allows them to convert energy from the sun into food.
- Phytoplankton such as Diatoms and Dinoflagelattes are the most common producers you will find in the marine environment.
- Other producers like seagrass, seaweeds and algae can also be in abundance.



DIATOMS & MARINE ALGAE

Consumers

- Consumers are defined as heterotrophic, which means they eat other organisms or dissolved organic material in the ocean, since they are unable to make their own food like producers.

In a marine food web, consumers are divided into herbivores and carnivores , then further categorized into three groups: **primary consumers**, **secondary consumers**, **and the tertiary consumers**.

- Primary consumers areherbivores feeding on the phytoplankton, algae, seaweed etc.
- A few examples of primary consumers: *zooplankton, shrimps, sea urchins, some snails, some crabs, green sea turtle, herbivorous fish, whales etc*

Green Sea turtle

Zooplankton

- Secondary consumers are mainly carnivores who prey on other animals. Omnivores, who feed on both plants and animals, can also be considered a secondary consumer.
- Examples of secondary consumers: *Carnivorous fish, seals, sea stars, whales, squid, some crabs ,lobsters etc.*

Whale feeding

Species of sea star

- Tertiary consumers, sometimes also known as an apex predator, are usually on top of food chains, capable of feeding on secondary consumers and primary consumers. Tertiary consumers can be either fully carnivorous or omnivorous
- Some examples of tertiary consumers: Dolphins, sharks, killer whales, some sea birds etc.

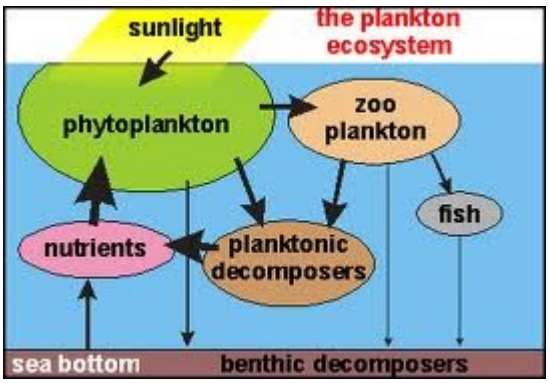
DOLPHINS

SHARKS

- Apex predators: Some tertiary consumers are considered apex predators. An apex predator refers to animals that are on top of the food chain with no real natural predators e.g. Great white Sharks. Humans, on the other hand, are considered as an apex- apex predator in the marine environment.

Decomposers

Decomposers play a very important role in a marine environment. Decomposers are mainly comprised out of bacteria and exist on every trophic level. These bacteria break down dead organisms and waste products into nutrients, and this is then used to support producers and other consumers that feed trough absorbing organic material in the water.



This is why bacteria form a key part of the Nitrogen cycle in oceans. Where Ammonia (NH_4) is converted to nitrite (NO_2) by the bacteria Nitrosomonas, after which the bacteria Nitrobacter then converts the nitrite into nitrate (NO_3). In the end, toxic waste such as NH_4 are kept low and converted into ready to use components for producers.

Then there is a group of organisms called dentrivores, these animals are scavengers and also contributes to the decomposing process by consuming dead or decaying animal and/or plant matter. Some examples of marine dentrivores: Some crabs, snails, sea stars, amphipods, marine worms etc

Specie of amphipodPolychaeta (marine worms)

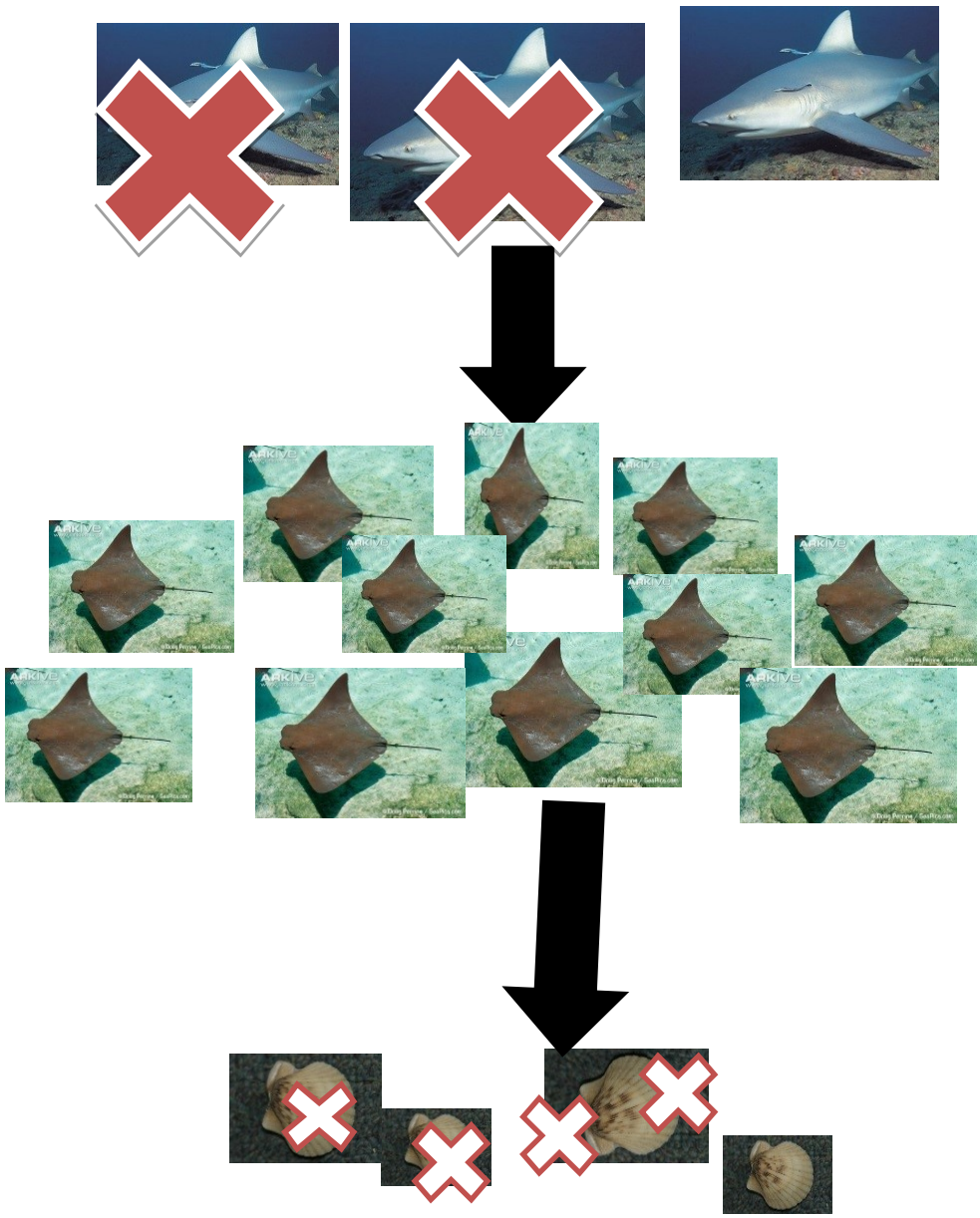
The changes in marine food webs

Many factors can lead to the disruption in a marine food web, mainly due to human interference. A human activity like fishing, that is not monitored and controlled, puts fish stocks under huge pressure and as a result has a direct effect on food webs.

Example of overfishing one specie

Overfishing pelagic fish populations like sardines for example, can have dramatic effects on the food web, because they serve as prey for other species of fish, sharks and sea mammals, so with less food for them their populations will endure serious declines. The same effect but reverse will happen if we reduce and remove predatory species, their prey e.g. fish will increase but in turn their prey's e.g. smaller fish, plants, plankton etc. population will then decrease, leaving an imbalance in the ecosystem. Same goes for the removal of plants species, it can have a negative effect on the entire web, but if the loss of one species of plant only makes out a small part of an herbivorous consumer it may have little to no effect. Subsequently, food webs with lower diversity are more vulnerable to changes than food webs with a higher diversity.

Some species can be considered keystone species due to their importance in a food web. Keystone species have a relatively large effect on the food web relative to its abundance. They can be described as playing a vital role in maintaining the balance of a marine food web structure. Removal of keystone specie can result in disastrous changes to the marine environment and everything that is depended on it.An example of the removal of a keystone specie, is what happened to the scallop fishery along the East Coast of the US, overfishing of large shark species (top-predators, keystone specie of that food web) led to an increase in the numbers of rays (secondary consumers), and greater predation by sting rays on the scallops (primary consumer) has resulted to the collapse of the scallop fishery in the end.



Removing keystone species indirectly affect others

There are also aspects that indirectly affect the food web, like other destructive fishing practices e.g. bottom trawling that leads to the destruction of marine habitats like the ocean sea floor. Destroying these habitats lead to negative effect on marine species populations due to the disruption on their feeding and breeding grounds. Some parts of the food web are also subject to environmental climate changes that are busy occurring around the world. Pollution on the other hand is another big factor that impacts food webs directly; chemical spills and general marine litter can cause major damage to exposed ecosystems. Some chemical substances can be carried in small organisms on the bottom of the food web all the way to the top, and contaminate the top marine predators. This contamination can be harmful to the specie itself and/or to humans, other animals (seabirds) that may eat the effected species.

Sea floor before bottom trawling

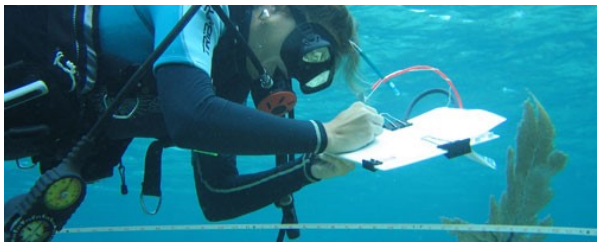
Sea floor after bottom trawling

Effects of bottom trawling

Pipes discharging human waste and chemicals into the ocean

Possible solutions

- To monitor and study food webs to get a better understanding why certain populations collapse and then also identifying keystone species to protect.
- Also to collect valuable data helping to determine possible problem ecosystems, and then setting up protecting measures such as MPA's (Marine protected areas)

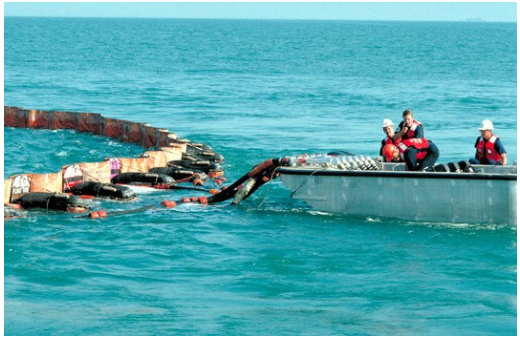


Collecting data

- Because Overfishing and population is two of the major contributing factors to the destruction of marine food webs, we have to take actions control these problem. Adopt more fishing and pollution policies, to control certain fishing activities and the levels of chemicals released in the oceans.

Sign of Marine protected areas

- Alongside these actions, if something happens like an oil spill etc. there needs to be disaster management strategies in place to limit the damage caused.



Protective measures put in place to contain an oil spill

What is a marine food web? Comprehension test.

1) Name the 3 groups that are linked in a food web?

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2) Producers are considered autotrophic, what does autotrofic mean?

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3) True or False

Diatoms and Dinoflagelattes are part of a group called Phytoplankton (T/F)

4) Fill in the blank

Consumers are considered _____ , which means they eat other organisms or dissolved organic material

5) Name the 3 groups that consumers are further divided into?

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6) Give at least 2 examples of apex predators in a marine environment?

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7) Name one example of human interference that can lead to the disruption of a marine food web?

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8) True or False

Keystone specie plays a vital role in maintaining the balance of a marine food web. (T/F)

9) Fill in the blanks

- _____leads to the destruction of marine habitats like the ocean sea floor.

10) Give at least two examples of possible solutions to minimize the changes in marine food webs?
