Teachers' Resource Sheet on

Marine food webs

In the sea, as on land, plant material is eaten by herbivorous animals which themselves are eaten by other, usually larger, animals. This flow of material from plants to herbivores* to carnivores* is often depicted in a diagram called a food web* that shows the feeding connections (what eats what?) in an ecological community.

What eats what?

In relation to the food web below, plants include mangroves (1), algae and seagrasses (2). Mangroves are not present in all Pacific Island countries – see Community Information Sheet 25: Mangroves.

But the most important plants in the sea are so small that most are invisible to the naked eye. These are the phytoplankton* (shown greatly magnified at point 3) that, as plants, must live in the sunlit surface layers of the sea.

Corals (4) and giant clams (5) can also use sunlight indirectly because of the plant cells, called zooxanthellae* embedded in their tissues. This relationship between two different living things that advantages both is called symbiosis.*

Larger plants in the sea are eaten by herbivorous animals such as rabbitfish (6) and sea urchins (7).

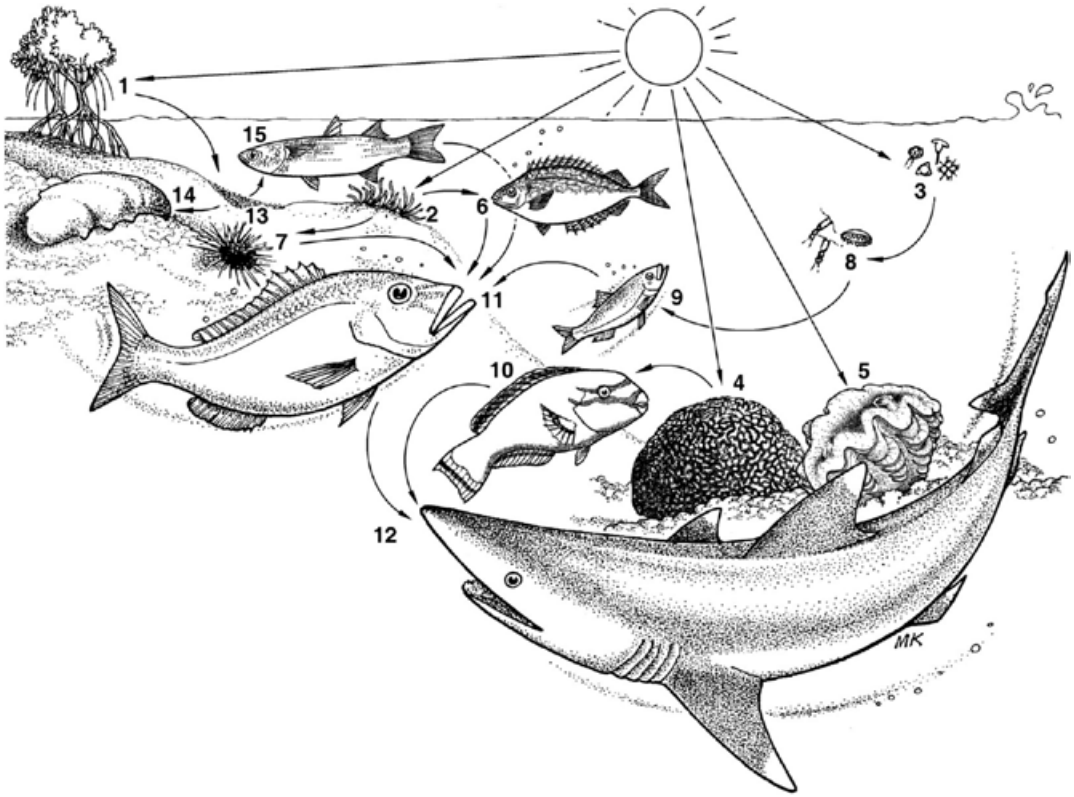
Several larger animals have evolved to take advantage of drifting phytoplankton. Bivalve molluscs,* the cockles and clams, filter out the phytoplankton. But the most important consumers of phytoplankton are the small animals, collectively called zooplankton* (magnified in 8) that drift in the sea and include the larvae* of many marine animals.

Many animals, from barnacles and corals to sardines (9) and baleen whales eat zooplankton. Also, coral polyps trap plankton in sheets of mucus or with their tentacles.

Coral grazers, such as parrotfish (10) feed on algae growing on coral.

Invertebrates* and smaller fish are preyed upon by medium-sized fish including emperors (11) which are preyed upon by large carnivores such as groupers, barracudas and sharks (12).

Bacteria* break down wastes to form detritus* (13), consumed by a wide range of animals such as the sea cucumber (14) and mullet (15).



A simplified, tropical, marine food web.
From: King M. 2007. Fisheries biology, assessment and management. UK: Wiley Blackwell. 400 p.

This resource sheet is one of a series produced by the Pacific Community (SPC) to assist teachers in introducing fisheries topics into school curricula.

Each sheet should be used in conjunction with the Guide to Teachers' Resource Sheets, which contains suggestions for student activities and exercises. All words marked with an asterisk (*) are defined in a glossary in this guide.

Pacific Community
Communauté du Pacifique

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Why are there not many sharks on a coral reef?

Organisms can be thought of as gaining nourishment at different trophic levels* and these may be depicted as the energy pyramid shown below. The first or lowest trophic level in the energy pyramid, the primary producer level, consists of marine plant material including seaweeds (algae), seagrasses and phytoplankton.

Plant material is fed upon by animals at the next trophic level (the herbivore level) which become prey species* for carnivores (the carnivore level). And, as some fish feed on other carnivores, there may be several levels of carnivores.

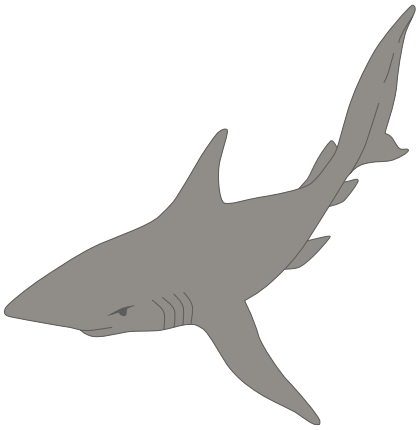
At each level most of the total weight of material or energy (the biomass*) is lost due to the use of energy for respiration, movement and reproduction. As a result, only a small proportion of the food consumed is devoted to flesh growth that may be passed on to the next trophic level. There is, therefore, a large decrease in total biomass of organisms at each succeeding trophic level.

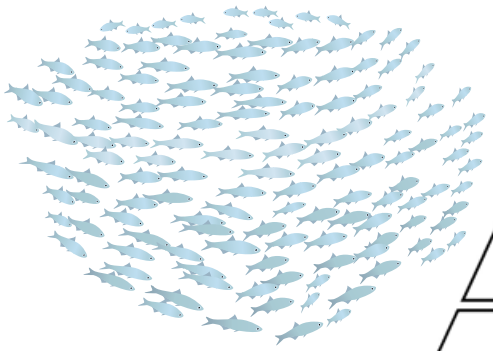
The biomass values shown to the right of the energy pyramid in the figure below arbitrarily assume a 10 per cent level of ecological efficiency – that is, the energy passed from one trophic level to the next. It therefore takes 1,000 kg of plant material to produce one kg of a higher level carnivore such as a snapper.

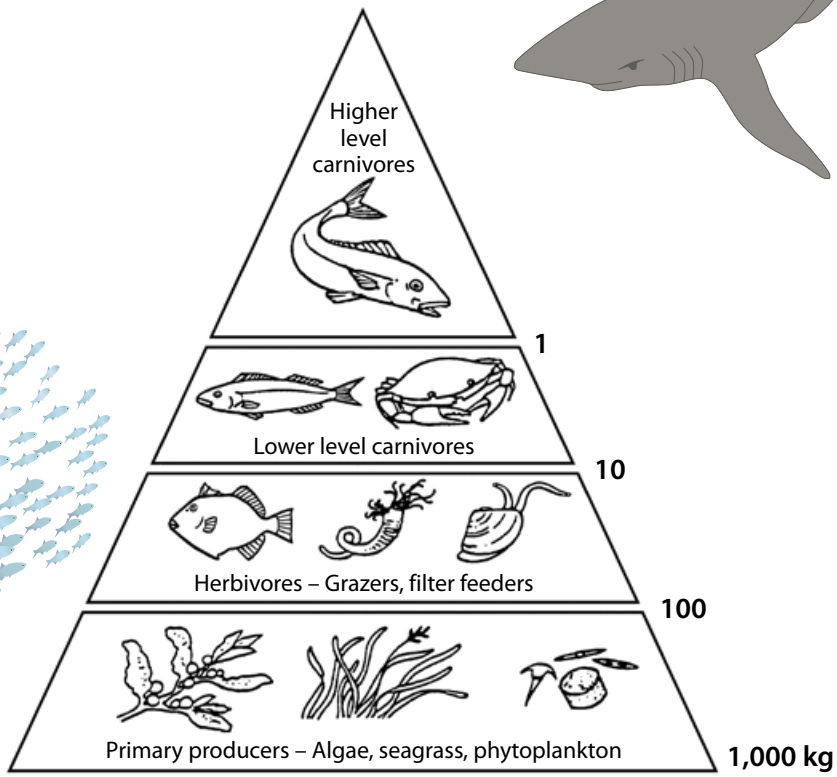
Because of this loss at each succeeding trophic level, animals at high trophic levels are unable to maintain very large populations. A top carnivore such as a large tiger shark is, perhaps thankfully, not common at all and most sharks need to swim over a huge territory to find all the food that they require.

Why we have to look after the sea and its tiny plants?

Life on earth could not exist without plants. Photosynthesis is the process by which green plants use sunlight, carbon dioxide and nutrients* (including nitrates and phosphates) to synthesise proteins,* fats and carbohydrates. Through photosynthesis, plants produce oxygen and food to support all life. Phytoplankton are responsible for half of all photosynthetic activity and produce much of the oxygen present in the Earth's atmosphere – half of the total amount of oxygen is produced by phytoplankton in the sea.*







An energy pyramid. Numbers at the right of the pyramid represent the relative biomass at each trophic level assuming an ecological efficiency of 10 per cent.
From: King M. 2007. Fisheries biology, assessment and management. UK: Wiley Blackwell. 400 p.