Food Web

B.Sc. Part-I, Paper-I, Group-B

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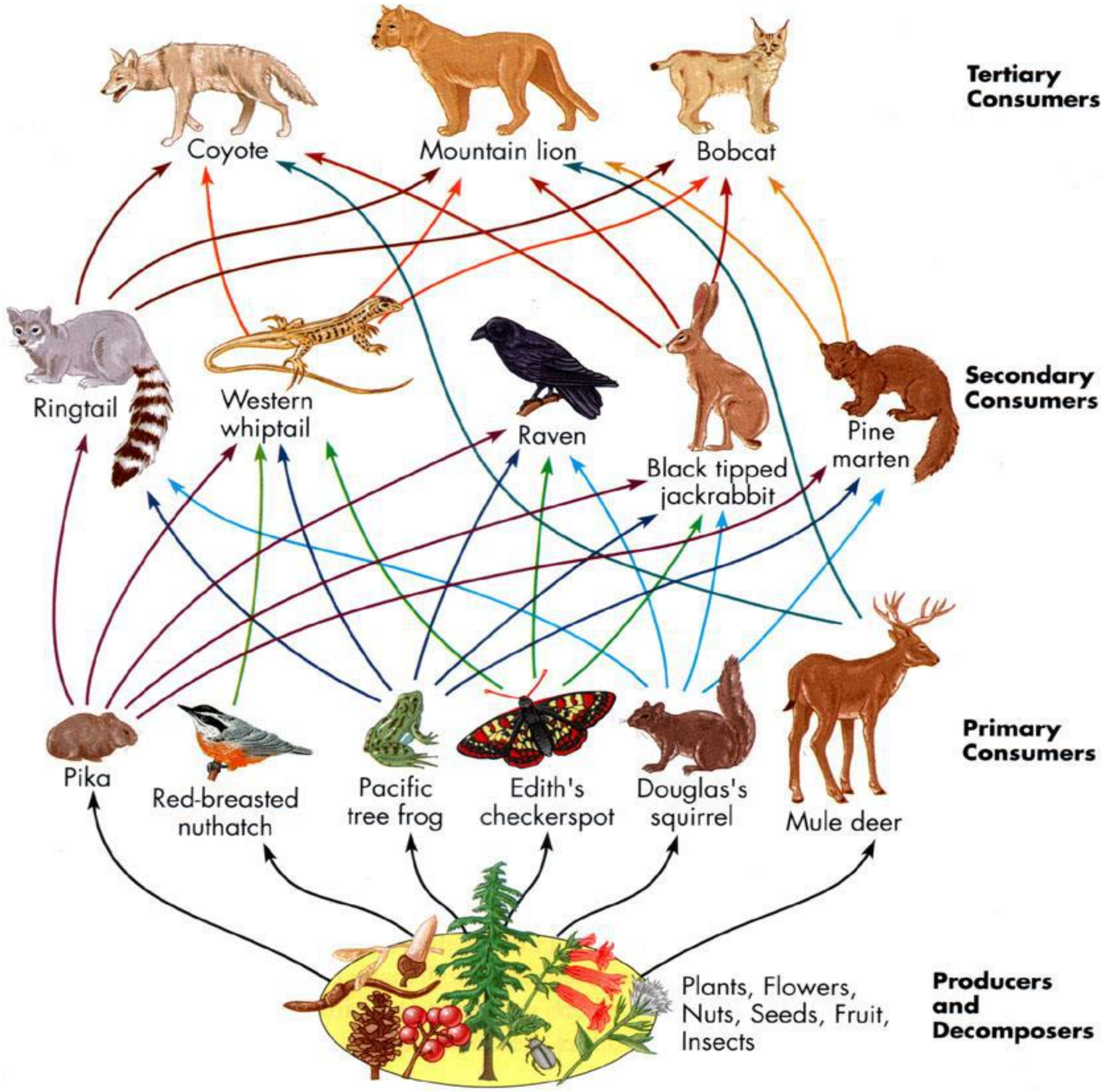
Introduction

- Food webs are the interconnected network of feeding relationship in an ecosystem.
- The concept of a food web, previously known as a food cycle, was given by Charles Elton. He first introduced it in his book *Animal Ecology*, published in 1927.
- In a food web, organisms are arranged according to their trophic level.
- The trophic level for an organism refers to how it fits within the overall food web and is based on how an organism feeds.
- Broadly speaking, there are two main designations: autotrophs and heterotrophs. Autotrophs make their own food while heterotrophs do not.
- Within this broad designation, there are five main trophic levels: primary producers, primary consumers, secondary consumers, tertiary consumers, and apex predators.

- A food web shows us how these different trophic levels within various food chains interconnect with one another as well as the flow of energy through the trophic levels within an ecosystem.
- Food web is a connection of multiple food chains. Food chain follows a single path whereas food web follows multiple paths. From the food chain, we get to know how organisms are connected with each other. Food chain and food web form an integral part of this ecosystem.
- An ecosystem may consist of several interrelated food chains. Often the same food resource is part of more than one chain, especially when the resource is at the lower trophic levels.
- A food web shows all possible transfer of energy and nutrient among the organism in an ecosystem.
- If any of the intermediate food chain is removed, the next level of chain will be affected largely.
- The food web provides more than one alternative for food to most of the organism in an ecosystem and hence increases their chance of survival.

Food web


Coyote
Mountain lion
Bobcat
Tertiary Consumers
Ringtail
Western whiptail
Raven
Black tipped jackrabbit
Pine marten
Secondary Consumers
Pika
Red-breasted nuthatch
Pacific tree frog
Edith's checkerspot
Douglas's squirrel
Mule deer
Primary Consumers
Plants, Flowers, Nuts, Seeds, Fruit, Insects
Producers and Decomposers

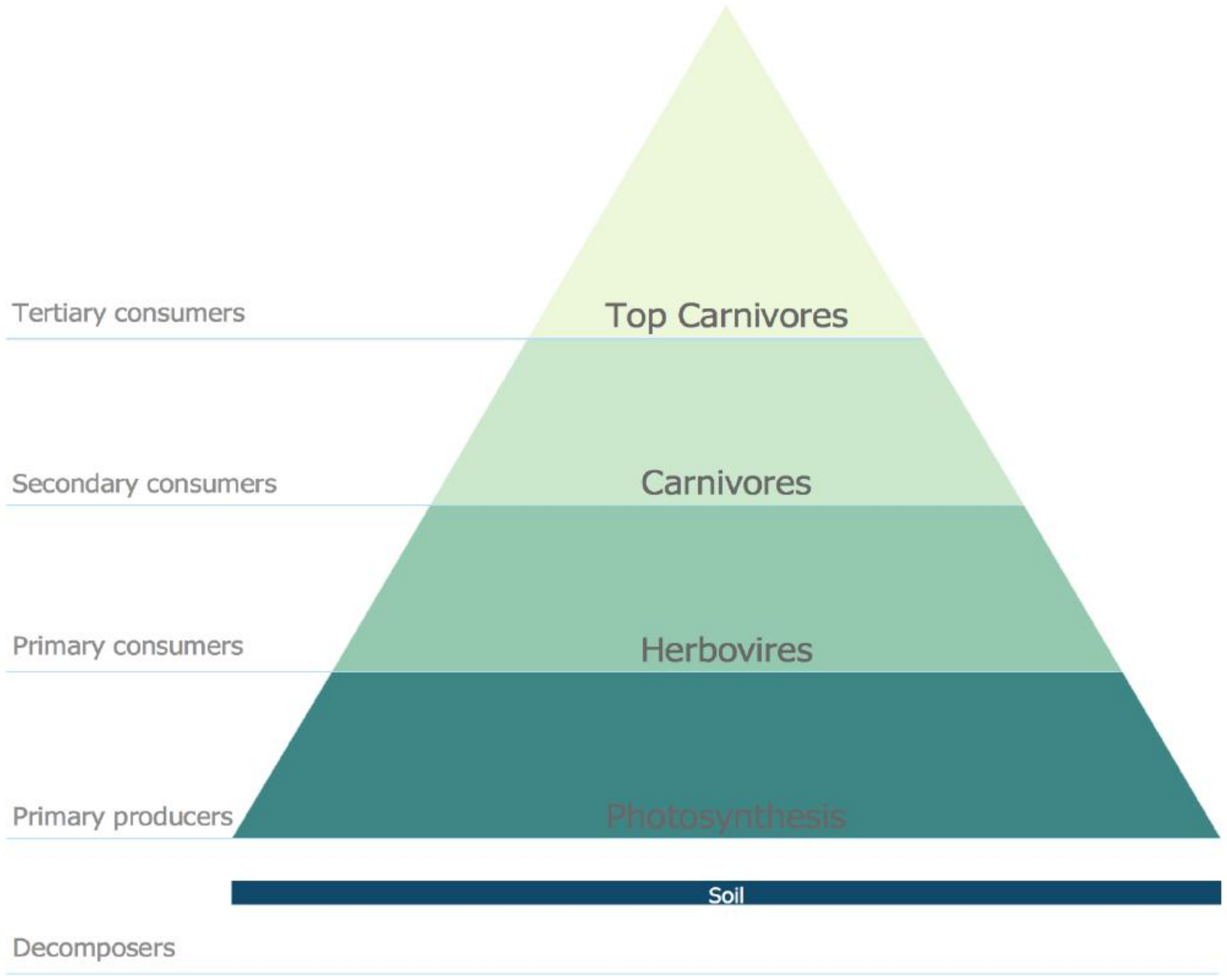
Trophic level

Organisms in food webs are grouped into categories called trophic levels. Roughly speaking, these levels are divided into

I. Producers (first trophic level)

II. Consumers

III. Decomposers (last trophic level)



Producers

Producers make up the first trophic level. Producers, also known as autotrophs, make their own food and do not depend on any other organism for nutrition. Most autotrophs use a process called photosynthesis to create food (a nutrient called glucose) from sunlight, carbon dioxide, and water.

Plants are the most familiar type of autotroph, but there are many other kinds. Algae, whose larger forms are known as seaweed, are autotrophic. Phytoplankton, tiny organisms that live in the ocean, are also autotrophs. Some types of bacteria are autotrophs. For example, bacteria living in active volcanoes use sulfur, not carbon dioxide, to produce their own food. This process is called chemosynthesis.

Primary Consumers

First-level consumers, also known as primary consumers, eat producers such as plants, algae and bacteria. Producers comprise the first trophic level. Herbivores, the first-level consumers, occupy the second trophic level. First-level consumers do not eat other consumers, only plants or other producers. The physical size of first-level consumers varies greatly, ranging from tiny zooplankton to elephants, and all first-level consumers only eat producers.

Higher-Level Consumers

Secondary or second-level consumers eat primary consumers. Tertiary or third-level consumers eat lower-level consumers and are sometimes called final consumers. Some secondary and tertiary consumers eat plants as well as lower level consumers, making them omnivores. Humans are good example of omnivorous upper-level consumers; we eat primary producers (plants) as well as other consumers (animals).

Detritivores and Decomposers

Detritivores and decomposers make up the last part of food chains. Detritivores are organisms that eat nonliving plant and animal remains. For example, scavengers such as vultures eat dead animals. Dung beetles eat animal feces.

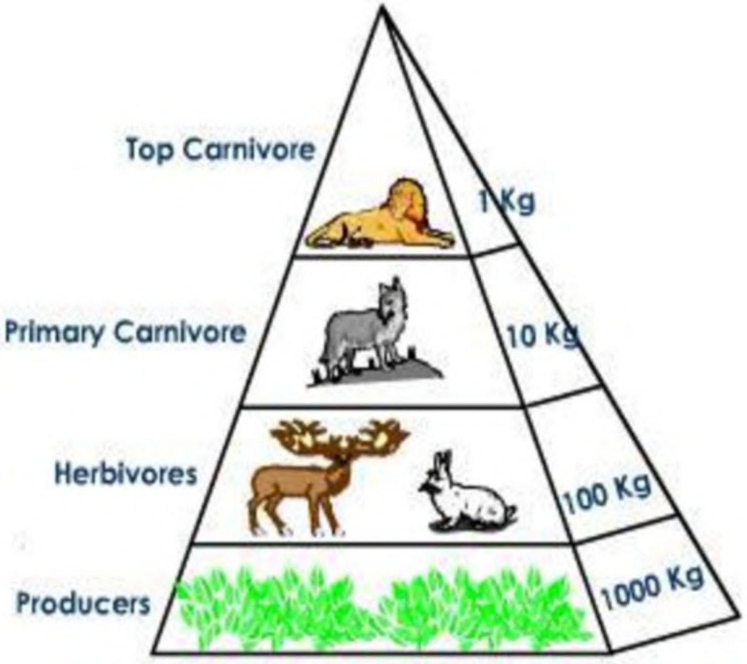
Decomposers, like fungi and bacteria, complete the food chain. Decomposers turn organic wastes, such as decaying plants, into inorganic materials, such as nutrient-rich soil. They complete the cycle of life, returning nutrients to the soil or oceans for use by autotrophs. This starts a whole new series of food chains.

Biomass

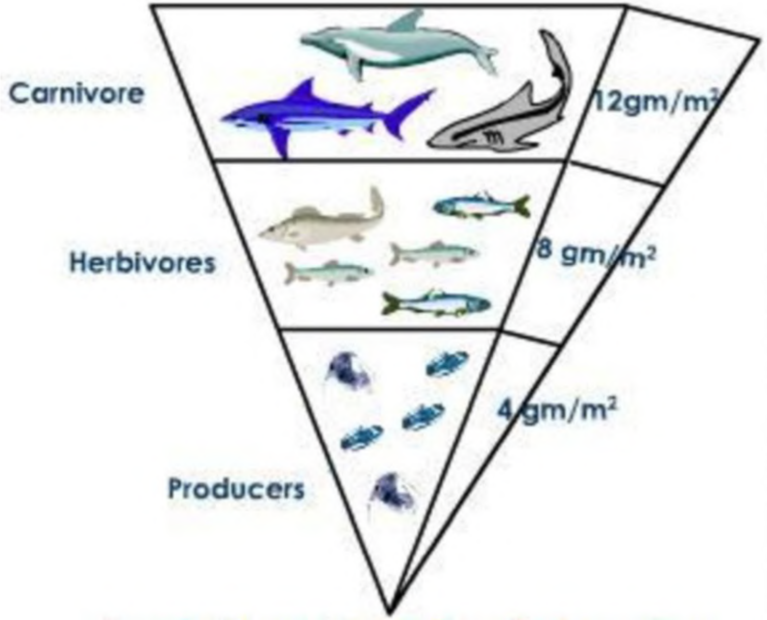
Food webs are defined by their biomass. Biomass is the energy in living organisms. Autotrophs, the producers in a food web, convert the sun's energy into biomass. Biomass decreases with each trophic level. There is always more biomass in lower trophic levels than in higher ones.

Because biomass decreases with each trophic level, there are always more autotrophs than herbivores in a healthy food web. There are more herbivores than carnivores. An ecosystem cannot support a large number of omnivores without supporting an even larger number of herbivores, and an even larger number of autotrophs.

A healthy food web has an abundance of autotrophs, many herbivores, and relatively few carnivores and omnivores. This balance helps the ecosystem maintain and recycle biomass.



Upright Pyramid of biomass in a Terrestrial Ecosystem



Inverted Pyramid in an Aquatic Ecosystem

Importance of the Study of Food Webs

- Food webs show us how energy moves through an ecosystem from the sun to producers to consumers. This interconnectedness of how organisms are involved in this energy transfer within an ecosystem is a vital element to understanding food webs and how they apply to real-world science. Just as energy can move through an ecosystem, other substances can move through as well. When toxic substances or poisons are introduced into an ecosystem, there can be devastating effects.
- Bioaccumulation and biomagnification are important concepts. **Bioaccumulation** is the accumulation of a substance, like a poison or contaminant, in an animal. **Biomagnification** refers to the buildup and increase in concentration of said substance as it is passed from trophic level to trophic level in a food web.

- This increase in toxic substances can have a profound impact on species within an ecosystem. For example, man made synthetic chemicals often do not break down easily or quickly and can build up in an animal's fatty tissues over time. These substances are known as persistent organic pollutants (POPs). Marine environments are common examples of how these toxic substances can move from phytoplankton to zooplankton, then to fish that eat the zooplankton, then to other fish (like salmon) who eat those fish and all the way up to orca who eat salmon. Orcas have a high blubber content so the POPs can be found at very high levels. These levels can cause a number of issues like reproductive problems, developmental issues with their young as well as immune system issues.
- By analyzing and understanding food webs, scientists are able to study and predict how substances may move through the ecosystem. They are then better able to help prevent the bioaccumulation and biomagnification of these toxic substances in the environment through intervention.