NO PREP

Marine Food Chains and Webs

Includes: Student reading, case study, differentiated questions, teacher key

Name: Period: Date:

Marine Food Chains and Webs

The Foundation of Ocean Energy

Marine food chains begin with primary producers, microscopic organisms like phytoplankton and algae that capture sunlight and use photosynthesis to make food. These producers form the base of the ocean's energy pyramid. Without them, all higher forms of marine life would collapse. The energy they create flows upward when they are consumed by primary consumers such as zooplankton and small fish. These, in turn, become food for larger animals, linking the smallest forms of life to the largest. The traditional picture of a food chain shows a straight line: phytoplankton → zooplankton → small fish → larger fish → shark. While this model helps introduce the concept of energy flow, it oversimplifies the reality of marine life. In truth,

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Producers, Consumers, and Decomposers

The ocean's producers include phytoplankton, seaweeds, and some bacteria. These organisms use photosynthesis to produce organic matter, forming the first link in every chain. Consumers are divided into categories depending on their diet. Herbivores, such as manatees and parrotfish, feed on plants and algae. Carnivores like tuna and dolphins eat other animals. Omnivores, such as sea turtles, can consume both plants and animals. At the end of the cycle are decomposers, including bacteria and fungi, which recycle nutrients back into the environment by breaking down dead organisms. This division of labor ensures that no energy is wasted. Every death and every discarded fragment of organic matter fuels new growth. The recycling provided by decomposers is essential for maintaining productivity in marine systems, particularly in nutrient-poor open oceans where resources are limited.

Energy Transfer and Trophic Levels

Marine food webs are organized into trophic levels, or steps in the feeding hierarchy. The first trophic level is occupied by producers. The second level includes herbivores that feed on producers, followed by carnivores at higher levels. At each transfer, about 90% of energy is lost to heat, movement, and metabolic processes, leaving only 10% available for the next level. This 10% rule explains why ecosystems can only support a limited number of top predators. For example, it takes countless phytoplankton to support a small number of krill, which in turn sustain fewer whales. Energy loss explains why food chains rarely extend beyond four or five levels. The efficiency of this transfer also determines how much biomass an ecosystem can maintain at each level.

The Importance of Food Webs for Ecosystem Balance

Food webs are more than scientific diagrams; they represent the interconnectedness of life. If one species is removed, the effects cascade throughout the system. For instance, overfishing sardines can reduce food for larger fish and seabirds, while unchecked growth of certain prey can lead to imbalances. Diverse food webs provide resilience, allowing ecosystems to withstand changes in one part without collapsing as a whole. This resilience is why conservation often focuses not only on individual species but also on protecting the integrity of entire webs.

Key Information: Table: Examples of Marine Organisms and Their Roles

Organism	Role in Food Web	Trophic Level
Phytoplankton	Primary producer	1st
Zooplankton	Primary consumer	2nd
Small fish	Secondary consumer	3rd
Tuna	Tertiary consumer	4th
Bacteria	Decomposer	Recycles all

Case Study: Antarctic Food Webs (Excerpt)

The icy waters around Antarctica may appear barren, but beneath the surface lies one of the planet's most remarkable food webs. At its foundation is phytoplankton, which blooms during the long summer days when light floods the Southern Ocean. These microscopic organisms feed vast swarms of krill—tiny shrimp-like creatures that may be the most abundant animals on Earth by biomass. Krill, in turn, support a spectacular array of predators, from penguins and seals to whales. The blue whale, the largest animal ever to exist, depends on these tiny crustaceans for survival, straining them by the ton through its baleen plates. The Antarctic food web illustrates how energy flows from small producers to enormous predators. When krill populations fluctuate, the effects ripple across the ecosystem. Reduced krill numbers can lead to declines in penguin colonies and put pressure on whales. Climate change and industrial fishing threaten krill abundance, showing how sensitive even the most productive food webs can be to disturbance. Protecting krill habitats is now seen as essential to conserving the larger Antarctic ecosystem.

1. Why are krill considered a critical link in the Antarctic food web?

2. How might a decline in krill populations affect species higher in the food web?

Multiple Choice

1. Which organisms form the base of most marine food chains?

    a) Schools of tuna

    b) Whales

    c) Phytoplankton

    d) Krill

2. What happens to most of the energy as it moves up trophic levels?

    a) It is stored in predators permanently

    b) It increases dramatically at higher trophic levels

    c) It is recycled by decomposers

    d) It is lost as heat and metabolic activity

3. Which category of organisms recycles nutrients back into the ecosystem?

    a) Consumers

    b) Producers

    c) Plant-eating herbivores

    d) Decomposers

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Tuna	A) Primary producer
2. ___ Phytoplankton	B) Primary consumer
3. ___ Zooplankton	C) Secondary consumer
4. ___ Bacteria	D) Tertiary consumer
5. ___ Small fish	E) Recycles organic material

Fill-in-the-Blank

1. The _____ rule explains why only 10% of energy passes to the next trophic level.

2. A network showing multiple feeding interactions is called a _____.

3. The largest animal on Earth, the _____, depends on krill for food.

Short Answer

Answer each question in 2-4 complete sentences.

1. Why are food webs considered more realistic than food chains?

_____

_____

_____

2. Explain why top predators are less abundant than producers.

_____

_____

_____

3. Give an example of how human activity can disrupt marine food webs.

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