NO PREP

Ecological Niches and Competition in Marine Ecosystems

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

Name: Period: Date:

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The Concept of an Ecological Niche

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The Concept of an Ecological Niche

Every species in the ocean occupies a unique ecological niche: its specific role in the ecosystem. A niche includes what the species eats, where it lives, when it is active, and how it interacts with other organisms. In other words, the niche is like an organism's job description. For example, parrotfish scrape algae from coral surfaces, keeping reefs clear. They fill a role distinct from herbivorous sea turtles that graze on seagrass. By dividing resources in this way, species reduce direct competition and increase overall biodiversity. The idea of niches explains why ecosystems can support many species without them all colliding for the same resources. Even animals with overlapping diets often hunt at different times or in different locations. This partitioning maintains balance and prevents one species from overwhelming the others.

Types of Competition

When niches overlap too much, competition occurs. Competition can be intraspecific, meaning between members of the same species, or interspecific, meaning between different species. Intraspecific competition may involve fighting for mates or nesting sites. Interspecific competition happens when two different species seek the same food or habitat. Competition can be direct (through physical conflict) or indirect, such as one species consuming resources more efficiently. For example, fast-swimming fish may outcompete slower ones for prey. Over time, competition drives natural selection, favoring traits that reduce conflict and promote survival.

Niche Partitioning and Resource Use

Niche partitioning is the process by which competing species evolve to use resources in different ways. In the marine environment, this might mean feeding at different

depths, choosing different prey, or being active at different times of day. Seabirds, for instance, may hunt in different zones of the water column to avoid competition. Dolphins and sharks may both feed on fish, but dolphins often hunt cooperatively in schools, while sharks rely on solitary ambush strategies. These variations allow multiple predators to coexist. Without niche partitioning, competition would reduce biodiversity. When species find ways to specialize, ecosystems become richer, with more layers of interdependence and balance.

Competition and Ecosystem Health

Competition is not always destructive. It keeps populations in check and ensures that only the best-adapted individuals pass on their genes. In marine ecosystems, competition pushes species to become more specialized, which strengthens the resilience of the community. However, when invasive species are introduced, they may disrupt niches and outcompete native organisms, threatening balance. Understanding competition and niches is essential for protecting biodiversity and managing fisheries.

Key Information: Table: Types of Competition and Examples

Type of Competition	Definition	Marine Example
Intraspecific	Competition within the same species	Male crabs fighting for mates
Interspecific	Competition between different species	Dolphins and sharks feeding on fish
Direct	Physical conflict over resources	Damselfish defending algae patches
Indirect	One species uses resources more efficiently	Faster fish outcompeting slower fish
Niche partitioning	Species divide resources to reduce conflict	Barnacles at different tidal heights

Case Study: Barnacles on the Rocky Shore (Excerpt)

On rocky coastlines, barnacles provide a clear example of niche competition and partitioning. Two common genera, Chthamalus and Balanus, often settle on the same intertidal rocks. Balanus grows quickly and dominates the lower tidal zone, where conditions are more stable and food is plentiful. Chthamalus grows more slowly but tolerates harsh conditions better, allowing it to persist higher on the rocks where Balanus cannot survive as well. When researchers experimentally removed Balanus, Chthamalus expanded downward, proving that competition—not just environmental limits—kept it out of the lower zone. This case shows how niches are shaped by both abiotic conditions and competition. The realized niche of Chthamalus is smaller than its potential, limited by its stronger competitor. The balance between these barnacles maintains diversity across the intertidal zone, creating a layered community where multiple species can survive.

1. How does the barnacle case study illustrate the concept of a realized niche?

2. Why does niche partitioning increase biodiversity in ecosystems?

Multiple Choice

1. What is an ecological niche?

    a) Only the list of foods a species eats in its habitat

    b) The predators of a species

    c) A species' role and interactions in its ecosystem

    d) The habitat where a species lives

2. Which type of competition occurs between members of the same species?

a) Direct

b) Indirect

c) Interspecific

d) Intraspecific

3. What is niche partitioning?

a) The role of decomposers in ecosystem nutrient cycles

b) The process of recycling nutrients

c) Species dividing resources to reduce conflict

d) The extinction of competing species

Matching

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

Term	Definition
1. ___ Intraspecific	A) One species uses resources more efficiently
2. ___ Indirect	B) Species divide resources to reduce conflict
3. ___ Direct	C) Competition between different species
4. ___ Niche partitioning	D) Members of the same species competing
5. ___ Interspecific	E) Physical fighting over a resource

Fill-in-the-Blank

1. When a species' niche is reduced because of competition, it is called a _____ niche.

2. Two species competing for the same food source are an example of _____ competition.

3. Specialization that reduces overlap between species is called _____ partitioning.

Short Answer

Answer each question in 2-4 complete sentences.

1. Explain how niche partitioning allows multiple predators to survive in the same ecosystem.

2. Why might invasive species disrupt ecological niches?

3. How can competition drive natural selection in marine species?