NO PREP

Arthropods of the Sea

Crabs, Lobsters, and Shrimp

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

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Name: Period: Date:

Arthropods of the Sea: Crabs, Lobsters, and Shrimp

The Success of Arthropods

Among the most successful animals on Earth are the arthropods, a phylum that includes insects, spiders, and crustaceans. In the ocean, the dominant arthropods are crustaceans, such as crabs, lobsters, and shrimp. These creatures thrive in diverse marine environments, from shallow tide pools to the deepest trenches. Arthropods owe their success to several defining traits: an exoskeleton made of chitin, jointed appendages, and segmented bodies that allow for flexibility and movement. The exoskeleton provides protection against predators, support for the body, and a barrier against water loss. However, it also limits growth, which forces crustaceans to undergo molting. During molting, they shed their old exoskeleton and form a new, larger one. This process leaves them temporarily vulnerable to predators, but it allows them to grow rapidly.

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Crabs: Masters of Adaptation

Crabs are among the most recognizable marine arthropods. With their flattened bodies, sideways walk, and powerful claws, they have adapted to a wide range of habitats. Some crabs live in tide pools and can tolerate exposure to air during low tides, while others inhabit coral reefs, sandy beaches, or the deep sea. Their chelae (claws) are used for defense, communication, and feeding, whether cracking open shells or tearing apart detritus. One of the most remarkable groups is the hermit

crabs, which use abandoned snail shells for protection instead of producing their own. As they grow, hermit crabs must find larger shells, often competing with one another for this limited resource. This behavior demonstrates both the resourcefulness and adaptability of crabs. Crabs also play an important ecological role. Many are scavengers, cleaning up dead organisms and recycling nutrients back into the environment. Some species are predators, while others feed on algae, contributing to balance in ecosystems. Their wide range of diets allows them to maintain healthy marine communities.

Lobsters: Giants of the Crustaceans

Lobsters are another iconic group of marine arthropods. The American lobster, for example, is a major commercial species prized for its meat. Lobsters live in rocky or muddy seafloors, where they dig burrows or hide among crevices. They are primarily nocturnal, emerging at night to scavenge or hunt small fish and invertebrates. Lobsters are notable for their size, with some individuals weighing over 40 pounds. Their chelipeds (large front claws) are specialized: one is typically larger and functions as a "crusher," while the other is slimmer and acts as a "cutter." This division of labor allows them to handle a wide variety of prey and food sources. Like other crustaceans, lobsters must molt in order to grow. Young lobsters molt frequently, but as they age, the process slows. Some lobsters can live for decades, making them one of the longest-lived invertebrates in the ocean. Beyond their ecological role as predators and scavengers, lobsters are a cultural and economic cornerstone in many coastal communities. Their management and conservation are critical to preventing overfishing and ensuring sustainable harvests.

Shrimp: Tiny but Essential

Shrimp may be small, but their ecological and economic importance cannot be overstated. Caridean shrimp live in nearly every marine environment, from coral reefs to deep-sea vents. Many shrimp species are filter feeders or detritivores, helping recycle nutrients and keeping ecosystems balanced. One of the most fascinating types is the pistol shrimp, known for its oversized claw that can snap shut so quickly it creates a shockwave, stunning prey and even producing a burst of light. Another group, cleaner shrimp, form mutualistic relationships by removing parasites from fish, often setting up cleaning stations where larger animals line up for grooming. Shrimp are also a vital link in marine food webs. They serve as prey for

countless fish, birds, and marine mammals. At the same time, shrimp fisheries provide food for humans worldwide, making them one of the most heavily harvested groups of invertebrates. The challenge, however, lies in balancing human demand with sustainable practices to prevent environmental damage.

Case Study: The Blue Crab and the Chesapeake Bay

The blue crab (Callinectes sapidus) is one of the most iconic species of the Chesapeake Bay on the east coast of the United States. Known for its bright blue claws and aggressive behavior, this crab has been a staple of local fisheries for centuries. Blue crabs are both predators and scavengers, feeding on clams, small fish, and detritus, while also serving as prey for striped bass, eels, and birds. Their ecological role makes them a keystone species in the estuary. In recent decades, however, blue crab populations have faced steep declines due to overfishing, pollution, and habitat loss. The destruction of seagrass beds and oyster reefs has removed critical nursery habitats, while nutrient pollution has led to low-oxygen "dead zones" where crabs cannot survive. Conservation efforts, including stricter harvest limits, seasonal protections, and habitat restoration, have been implemented to stabilize populations. These measures highlight how delicate the balance is between human use of marine resources and the health of ecosystems. The story of the blue crab demonstrates both the vulnerability and resilience of marine arthropods.

1. What human activities have contributed to the decline of blue crab populations in the Chesapeake Bay?

2. Why are blue crabs considered a keystone species in their ecosystem?

Multiple Choice

1. What characteristic makes molting necessary for crustaceans?

    a) They lack circulatory systems

    b) They reproduce asexually

    c) Their nervous system is too simple

    d) Their exoskeleton does not grow

2. What special adaptation do hermit crabs use for protection?

    a) Borrowing shells from gastropods

    b) Producing ink to escape predators

    c) Burrowing tunnels in sand

    d) Growing large crushing claws

3. What role do cleaner shrimp play in marine ecosystems?

    a) Preying on sea urchins and starfish

    b) Building coral reefs

    c) Removing parasites from fish

    d) Filtering plankton

Matching

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

Term	Definition
1. ___ Hermit crab	A) Long-lived scavenger with crusher and cutter claws
2. ___ Lobster	B) Aggressive estuary species with blue claws; keystone predator-prey role
3. ___ Cleaner shrimp	C) Uses abandoned shells for protection and growth
4. ___ Blue crab	D) Small crustacean with a snapping claw that creates shockwaves
5. ___ Pistol shrimp	E) Removes parasites from fish at "cleaning stations"

Fill-in-the-Blank

1. The exoskeleton of crustaceans is primarily made of _____.

2. Lobsters use their specialized claws for _____ and cutting.

3. Shrimp are vital in food webs because they serve as _____ for larger animals.

Short Answer

Answer each question in 2-4 complete sentences.

1. Why is molting considered both dangerous and necessary for crustaceans?

_____

_____

_____

2. Explain how shrimp demonstrate both ecological and economic importance.

_____

_____

_____

3. Compare the feeding roles of crabs, lobsters, and shrimp in marine ecosystems.

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