College and Career Readiness Anchor Standards for Writing

Standard 6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

Standard 7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

Center for Great Lakes Literacy Principles

Principle 5. The Great Lakes support a broad diversity of life and ecosystems.

Teacher Background

Crayfish

Crayfish are **crustaceans** that are closely related to lobsters, their saltwater cousins, and they play an important role in freshwater ecosystems, such as rivers and lakes. They are an important food source for many species of fish, birds, amphibians, reptiles, and mammals, even those that spend much of their time on land, such as raccoons.

Crayfish are opportunistic **omnivores** that eat both dead and living plants and animals, including insects, snails, and fish on river and lake bottoms. Their role in reducing decaying matter and filtering the water is especially important for improving water quality. In addition, their habit of burrowing provides benefits for water quality, although burrowing near the water's edge can sometimes contribute to erosion (Helfrich, Parkhurst, and Nevis 2001). Predators as well as scavengers, crayfish—especially **invasive**, non-native species, can sometimes negatively impact ecosystems in other ways. We will explore the positive and negative roles more fully in later lessons.

There are 620 species of crayfish (also called crawfish, crawdads, or mudbugs) worldwide, and 39 of these species are native to the Midwest United States (Taylor et al., 2015). Crayfish are a diverse group of decapod (10-legged) crustaceans related to shrimp, crabs, and lobsters. Crayfish breathe primarily through gills but can breathe air when necessary, as long as their gills are wet or humidity is very high. They live semi-aquatic lifestyles in lakes, streams, ponds, flooded fields, or ditches. Some species spend most of their lives in underground burrows, while others burrow only if necessary, such as during droughts. Midwestern crayfish species live on average three years but have been known to live up to six years.

The vast majority of the world's crayfish species are found in North America, especially the southeastern United States. They can be found on every continent except Antarctica. Many species are at risk of extinction due to a variety of factors, such as habitat loss, pollution, and the spread of invasive crayfish species and disease (Larson et al. 2020).

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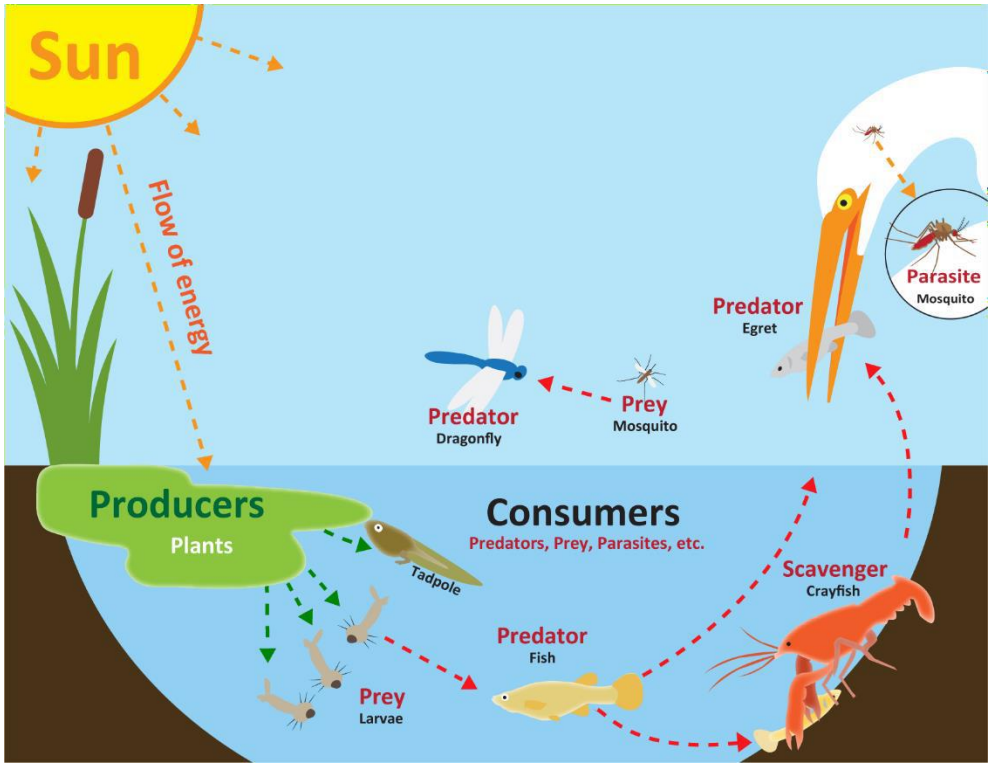
Ecological Concepts

An **ecosystem** is any group of living and nonliving things that interact with one another. Some are relatively small like streams and ponds where crayfish often thrive, and others are large **biomes** like wetlands or forests.

Biodiversity is a measure of the number of different species in a specific area, and it is also used as a general description of species richness, ecosystem complexity, and genetic variation. In general, the more biodiversity, the more stable the environment and the less it is impacted by changes. The organisms that interact with each other in their ecosystems are called a **community** (or **ecological community** for high school students).



Visual model of a freshwater ecosystem showing flows of energy
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Some members of a community, such as crayfish, are particularly important to the community's vitality. For example, crayfish recycle nutrients through the consumption of decomposing organisms. This helps clean the water. They are also an important food source for many predators such as fish, birds, reptiles, and amphibians. Because of all these important roles, crayfish can be considered a **keystone species** for their ecosystem; just like the keystone at the top of an architectural arch that helps hold the whole structure together, a keystone species is vital to the stability of an ecosystem. If it is in trouble, the whole ecosystem can be negatively impacted.

Creating ecosystem **food webs** helps students understand the basic ecological principle that everything in nature is connected. By analyzing the relationships between the various living and nonliving things, students will increase their understanding of community ecology and the underlying relationships that bind living things together.

Materials

- "Crayfish Trivia" handout (one for each student, found at the end of the lesson)
- "Crayfish and Freshwater Ecosystems" PowerPoint presentation available on the Invasive Crayfish Collaborative website: invasivecrayfish.org/products
- Computer access and Microsoft PowerPoint software
- Display screen
- Markers, crayons, or colored pencils for students to share
- Ball of yarn
- Class whiteboard, chalkboard, or interactive whiteboard