

## Biology

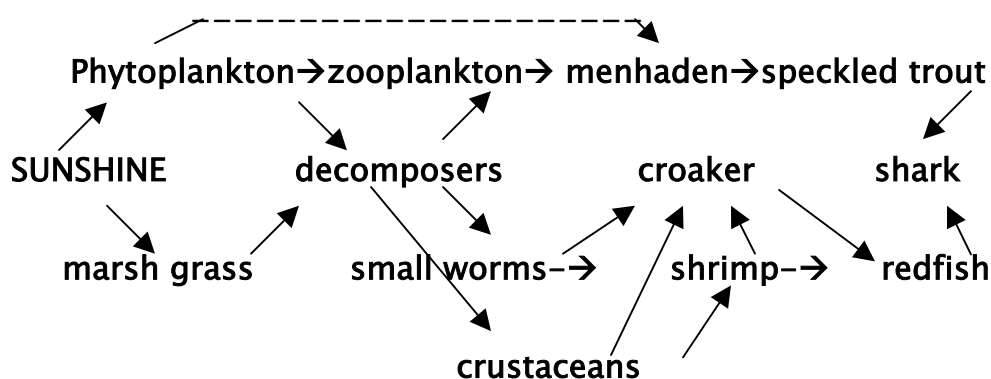
Coastal Louisiana is blessed with abundant wildlife and natural beauty, all very important to its citizens. In order to understand how important, one must first understand the relationships that exist among organisms and between these organisms and their physical environment; their ecology. The scientists that study these relationships, ecologists, are aware that all organisms need energy. Green plants, the producers, can easily meet their energy requirements by photosynthesis, the process that allows energy from the sun to be trapped to form food molecules. Animals, the consumers, must eat plants, or other animals that have eaten plants, to meet their energy requirements. Not only are the molecules of food consumed used for energy, but are also assimilated into the bodies of these organisms during growth (See [Salt Marsh Habitat](#) activity book).

To regain a real understanding of this system would require many years of study. With these materials and the student activities that follow, it is hoped that the students will gain a greater understanding of the problems that affect coastal Louisiana. With a better-informed voting public, it is hoped the solutions can be found that will save or help to save our wetlands.

Let's start at the beginning: A food chain is the transfer of energy in the form of biomass from producers to consumers. For example, marsh grass could provide energy for an insect, which could be eaten by a frog, which could be eaten by a snake.

**Marsh grass--→ insect--→frog--→ snake**

The transfer of biomass in real situations is more complicated. A complex transfer of biomass between populations of organisms is called a food web. Example:



The importance of decomposers cannot be overlooked. They are responsible for the rapid recycling of the nutrients locked into dead plant and animal matter. Seasonal changes in an ecosystem, such as a pond, a forest, or a marsh cause a large

accumulation of plant material such as leaf litter. In the marshes the plants most responsible for this litter belong to the genus *Spartina*. The two most common species of *Spartina* in coastal Louisiana are *Spartina alterniflora* (oyster grass), and *Spartina patens* (wire grass). Decomposition of this litter occurs, and the complex of energy-rich organic compounds and associated microorganisms that's left is called detritus. Detritus is considered to be one of the most important energy pathways in a food web. The detritus complex provides energy for many organisms that feed in or on the marsh and its estuaries. Flushing action of tides will transport detritus from the marsh surface into the adjacent water bodies, making it available to aquatic organisms (Figure 2.). Photosynthetic activity of *Spartina* and subsequent detritus formation contribute greatly to the productivity of our coastal area. Other processes, such as photosynthetic benthic algal and bacterial mats, also provide some energy.

Most people in Louisiana do not realize just how productive our coastal marsh estuarine system is compared to other systems. Productivity can be measured in several ways, but basically, it is the quantity of biomass (mass of plants and animals) in some unit of measure like kilograms/hectare or tons/acre that can be produced in a given area, during a designated time period, usually one year (Figure 3.).

The following table is a comparison of coastal marsh estuarine systems with other ecosystems.

**BIOMASS: Dry weight in tons per acre per year.**

DESERT	0.00 to 0.33
DRY AGRICULTURE	0.33 to 1.50
<b>COASTAL MARSH ESTUARINE SYSTEM</b>	<b>5.00 to 10.00</b>
MOIST AGRICULTURE (RICE)	1.50 to 5.50
COASTAL WATERS	1.00 to 1.50
OPEN OCEAN	0.00 to 0.33

Based on past and present scientific research, there are five major reasons why our coastal areas must be protected.

1. PRODUCTIVITY– Many organisms depend on the marshes as a rich energy source necessary for their survival.
2. SHORELINE PROTECTION– Coastal marshes and land serve as a hurricane buffer, wave barrier, and protection from flooding, etc.
3. POLLUTION FILTER TRAPS– Coastal Wetlands serve as an absorber of pollutants such as raw sewage and pesticides.

4. **WILDLIFE HABITAT**– Coastal wetlands serve as a major breeding ground and nursery area for many species. Estuaries are among the most biologically productive ecosystems on the planet. More than two thirds of the fish and shellfish we eat spend some part of their lives in estuaries.
5. **ECONOMICS**– The economic value of our coastal area can be measured in millions of dollars, involving industries such as seafood, fur, tourism, etc. Estuaries provide essential habitat for over 75 percent of our nation’s commercial fish catch.

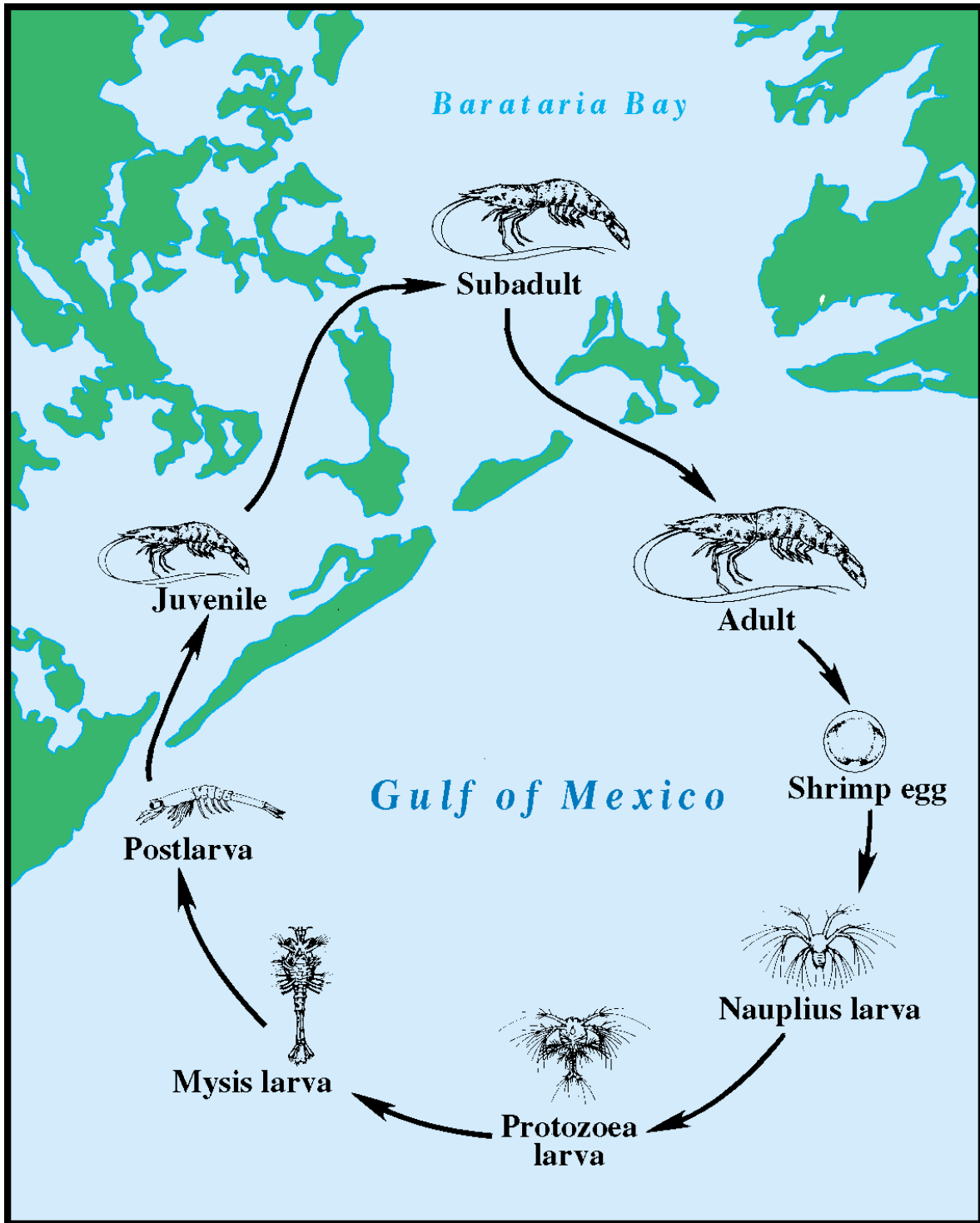
All organisms that live in our coastal areas interact in some way, either directly or indirectly, with each other, creating a community of organisms (biotic community). Organisms also interact with their physical (abiotic) environment. Factors such as temperature, salinity, pollutants, etc. influence populations of organisms. Water quality is the most critical factor in the physical environment of coastal, estuarine areas.

By definition, an estuary is a coastal area where salt water from the ocean mixes with fresh water from rivers, rainfall, and upland runoff. Types of estuaries are defined as:

1. **Coastal Plain**– A drowned river valley; formed at the end of the last ice age; invades the low-lying coastal river valley and salt-water moves in to start a marsh. Example: Chesapeake Bay (MD), Narragansett Bay (RI)
2. **Fjord**– Formed by retreating glaciers that carved out coastal valleys. Example: Bay of Fundy in Nova Scotia, Trondheim Fjord, Norwegian Sea
3. **Bar-Built**– Sediments accumulate and build up sand bars and barrier islands. They are common near rivers. Example: Grand Isle, Barataria Basin
4. **Tectonic**– Created when the sea fills in a hole or basin that has formed by the sinking land. Example: San Francisco Bay area

Salinity (salt content) of estuaries is influenced by several factors. In Louisiana, salt water can be driven inland by tides, wind, and storm surges etc. causing salinity to rise sharply. Water from heavy rains driven by a strong north wind can move freshwater toward the coast, lowering salinity. This never-ending change in salinity creates a high variability in the environment, which organisms must cope with to survive. Many organisms have developed special adaptations for regulating salt content within their bodies.





picture by K. Varden

Figure 2. Shrimp Life Cycle

In addition to salinity, elevation (height above sea level) is also a factor in determining which kinds of communities can exist in a coastal area.

### FIVE COASTAL ZONES BASED ON SALINITY AND ELEVATION

A. SALT MARSH	15 to 32 ppt (sea level)
B. BRACKISH MARSH	3 to 15 ppt
C. INTERMEDIATE MARSH	1 to 3 ppt (mid-elevation)
D. FRESHWATER MARSH	0 to 1 ppt
E. SWAMP	0 ppt (highest elevation)

Each zone has producers and consumers that can tolerate a certain salinity range. However some organisms can tolerate a greater salinity range than others and can exist in more than one zone. Any gradation based only on salinity has many exceptions. Organisms living in the middle zones where salinity varies the most, must be the most flexible of all (see **Estuary Live Video Clip**).

Organisms can be categorized according to where they live in the water column. The two principal categories for aquatic organisms are pelagic and benthic.

**PELAGIC COMMUNITY**– made up of organisms that live in the water column

- A. Plankton– Small organisms that cannot swim strongly and thus are at the mercy of the water currents; floaters or drifters
  - 1. Phytoplankton– photosynthesizing, planktonic plants  
Example: Diatoms, dinoflagellates
  - 2. Zooplankton– non-photosynthesizing, planktonic animals  
Example: Acartia (a microscopic crustacean that can be up to 60% of the plankton) and larval (shrimp and crabs)
- B. Nekton– Organisms that are active swimmers  
Examples: dolphins, sea turtles, sharks, rays, and bony fish, jellyfish, and squid

**BENTHIC COMMUNITY**– organisms that live on or in the bottom sediments or attached to some hard substrate such as a shell

- A. Epifauna– live on the surface of the substrate  
Example: oysters, mussels, and barnacles, crabs, shrimp, and sea stars
- B. Infauna– burrow in sediments; Example: worms, some amphipods, shrimp
- C. Demersal– fish and other organisms closely associated with the bottom; Example: flounders, croakers, black drum.

