Unit V Consortium of Oceanographic Activities for Students and Teachers-COAST

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On the cutting edge…
The blue crab (*Callinectes sapidus*) supports a large commercial fishery and is also important to the ecology of coastal bays and estuaries. These crabs are abundant, environmentally tolerant animals that are available to the fishery year-round. Commercial fishing for blue crabs dates "back" to the late 1800s in both the Gulf of Mexico and the Chesapeake Bay. Issues facing the fishery include loss of critical nursery habitat, excessive numbers of fishermen and traps, and environmental pollution.

Blue Crabs

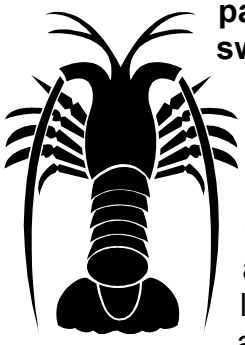
Lesson Objectives: Students will be able to do the following:
- Label correctly the internal and external anatomy of a blue crab
- Conduct a dissection of a blue crab, observing the internal organs
- Identify basic aspects of blue crab life history and current issues facing the blue crab fishery

Key Concepts: crustacean, dissection, blue crab, commercial fishery, estuary, habitat

What is a Blue Crab?

More than 90 different kinds of crabs live in the Gulf of Mexico's coastal waters. They are found in every type habitat from the saltiest water of the Gulf to the almost fresh water of the upper bays. The **blue crab** (*Callinectes sapidus*), favors **brackish** waters and is the most common, edible crab along the East and Gulf Coasts. It is also found on the Atlantic Coasts of Central and South America and has been seen in the coastal waters of France, Holland, and Denmark.

Crabs are **crustaceans**. True crabs have five pairs of legs and belong to a group called **decapods**. In blue crabs, the first legs are modified as pinchers and the next three pairs are used as walking legs. In blue crabs, the fifth legs are modified into **paddles** or **swimming legs.** These legs are used for burrowing and for swimming rapidly. Other familiar crustaceans are shrimps, lobsters, crayfish, and barnacles.



The back of the blue crab is dark or brownish green and is "drawn out" on each side into a long **spine**. When fully grown it may be more than seven inches wide. The **abdomen** and lower legs are white. The claws are various shades of blue, but the claw tips of the female are red.

The sexes can be identified by the shape of the abdominal flap or apron. In the male it is shaped like an inverted T, but in the female it is broader and circular in shape as an adult and triangular when immature.

As with other crustaceans, the blue crab must **molt** or **shed** its hard, outer shell to increase in size. In a complex process called **ecdysis** (molting or shedding) a new soft skeleton is formed beneath the old one. This stage is called the **peeler**. The **buster** stage begins when the hard shell splits, and the crab starts to "back out." After freeing itself from the shell, the crab takes in large amounts of water and expands its soft and wrinkled body. During this soft stage, the crab is easy prey and must seek shelter. The shell hardens in two to three days by absorbing calcium from seawater. During this time it is called a **buckram** or **paper shell**.

A crab may **molt** 20 times during its life and with each shedding may increase in width 1/4 the previous size. Frequency of molting depends on the water temperature, food availability and the age of the crab.

Crabs can "throw off" their legs at will in a process called **autotomy**. They can replace lost **appendages** by regenerating them. The lost limb will attain full size after two or more molts.

Life History of the Blue Crab

The male and female become sexually mature while living in the estuary. Blue crabs reach commercial size in18 months in the Chesapeake Bay and grow to harvestable size in 12 months in the Gulf of Mexico. The female mates only once after she has molted for the last time, but a male may mate many times and will continue to molt and grow.

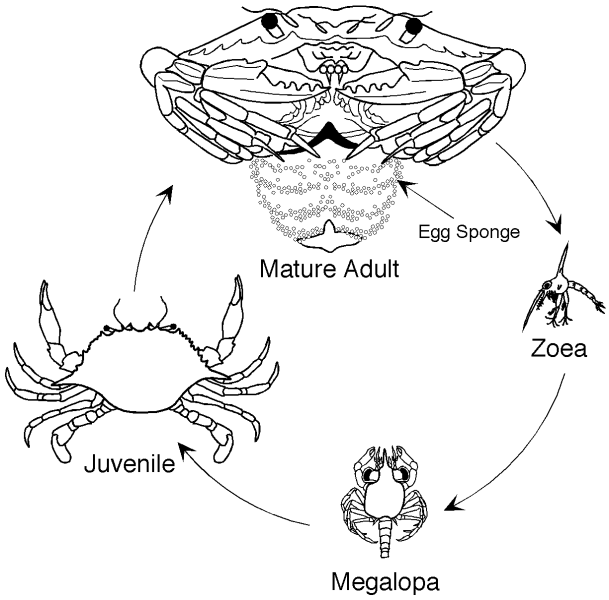
When the female is ready to mate, the male will carry the female beneath him by holding her with his legs. After she sheds her shell, the male transfers the sperm to the female. She carries the sperm internally until she is ready to spawn. Sperm will live up to one year and are used to fertilize successive egg batches. When they are finished mating, the male holds the female until she develops a hard shell; then they go their separate ways.

After mating, the female moves to the saltier portions of the lower bays and Gulf of Mexico while the male remains in the **estuary**. Spawning usually takes place within two to nine months of mating depending on the time of year. Most females spawn twice and then die if they are not harvested. Spawning normally occurs in the warmer months with a peak in the late summer.

When the female is ready to spawn, she fertilizes the eggs with sperm she is holding inside special receptacles. The eggs pass to the outside and are attached to the hairs of the abdominal appendages beneath the apron. The egg mass takes up about 1/3 of her body and is called a **sponge** or **berry.** An average egg mass contains one and one-half to two million eggs and requires about fourteen days to hatch. Of the millions of eggs spawned, only a few survive to become adults.

The young, called larvae, look very different from the adults. The first larval stage is the **zoea**. This is followed by the **megalopa** stage, which is more crab-like in appearance. It takes about a month, depending on the water temperature, for a larva to pass through the two stages. The megalopa molts into the first crab stage which resembles a miniature adult. Zoeae are found offshore. Megalopae are carried toward shore by ocean currents and move into the estuary for the molt to the first crab stage. Estuaries serve as nursery areas for juvenile crabs.

Crab Life Cycle



Parasites are common on crabs. Barnacles and leeches attach themselves to the outer shell, stalked barnacles and worms live on the gills, and the larval stages of small worms sometimes invade the muscles.

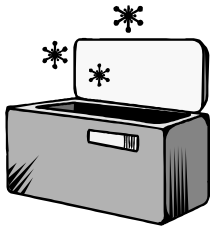
Crabs will eat almost any vegetable or animal matter. However, they prefer freshly dead or freshly caught food. Sometimes young oysters and clams are crushed and eaten.

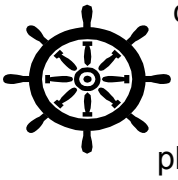
The Commercial Blue Crab Fishery

The blue crab is important to the coastal economies of the Gulf and them and then pick and can the meat. Crabs are sold live to fish houses and supermarkets for sale "over the counter." Most of the crabs caught commercially are taken in crab **traps** or **pots**. A trap is a cubical device made of vinyl-coated chicken wire about two feet in width. It has inverted funnels in the sides, through which the crab can enter but will have difficulty leaving. The trap is baited with freshly dead fish. In some areas crabs are also caught in trawls and by **trotlines**.

Commercial fishing for blue crabs began in the late 1800s with trotlines producing most of the catch in the early years. The introduction of the crab trap in the 1930s greatly increased fishing efficiency and landings began to rise dramatically. Over the past 20 years crab landings have averaged about 82 million pounds in Chesapeake Bay and 58 million pounds in the Gulf of Mexico. Landings in the fishery can fluctuate from year to year and scientists are investigating the reasons for these variations in abundance. Success in return of larvae to the estuary (recruitment) is thought to be an important factor in setting the number of crabs available Atlantic states. Most crabs are sold live to processors who boil or steam for harvest in Chesapeake Bay. In the Gulf of Mexico, recruitment is very high and the number of juvenile crabs that survive to adulthood is important.

In addition to the fishery for hard crabs, both regions support a commercial soft crab fishery. Soft crabs are more valuable economically and are considered a delicacy. In the soft crab fishery, crabs that show signs of shedding are held in circulating seawater systems and watched until they shed their hard shell. The newly emerged soft crab is kept in the water for a short period of time to allow the new shell to stretch. After expanding, the crab is removed from the water and is frozen whole or partially cleaned and frozen. In some areas, fishermen use special gear to capture shedding or **peeler** crabs. In Louisiana, fishermen use a "**bush trotline**" to attract crabs that are about to shed. The crabs hide in the bushes for protection because they are more vulnerable to predation when they are newly molted. On the Atlantic Coast, fishermen bait crab traps with male crabs to attract females that are approaching their final molt. These females are ready to mate and actively seek out male crabs. They enter the trap and are captured. Traps baited with male





crabs are called “peeler pots.” Regardless of the method of capture, shedding crabs are placed in boxes on the boat and covered with wet burlap to keep them cool and their gills moist.

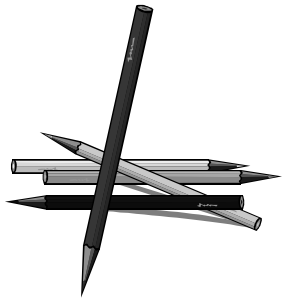
Issues facing the blue crab fishery include loss of critical nursery habitat, pollution of coastal waters, and excessive numbers of fishermen and traps. High fishing effort reduces the economic return to individual fishermen and may lead to overfishing.

Activity: Blue Crab Dissection

The blue crab (*Callinectes sapidus*) is an important commercial fishery organism and is commonly caught throughout the coastal regions of the Gulf of Mexico and on the eastern coast of the United States north to the Chesapeake Bay. Many recreational fishermen also enjoy catching and preparing these delicious crustaceans. Essential to enjoying the meat of this animal is removing the meat from the cartilage, shell, and internal organs. This learning activity will follow essentially the same path as if one were preparing to eat a crab, but with the educational focus of observing and learning the internal and external anatomy of this creature.

Objectives: Students will be able to do the following:
- Label correctly the internal and external anatomy of a blue crab.
- Conduct a dissection of a blue crab, observing the internal organs.
- Identify basic aspects of the history and current issues facing the blue crab fishery.

Materials:
- Internet capable computer
- Dissecting equipment
- Mature blue crabs (recently dead, uncooked, one crab for two students)
- Paper, colored pencils, dissecting pins, and string



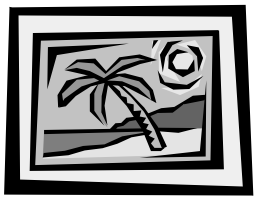
Procedure: Students should (working as lab partners):
1. Use the following web sites for background information and anatomical charts of blue crabs:
    - www.mdsg.umd.edu/crabs/index.html
    - www.vims.edu/adv/ed/crab/anatomy.html
    - www.vims.edu/bridge/crustacean.html
    - www.blue-crab.org
2. Wash and distribute dissecting equipment and crabs.
3. Open the web site, www.vims.edu/adv/ed/crab/anatomy.html. Select the screen option to view the labeled blue crab graphic.
4. Using scissors, open the dorsal surface of the carapace of the crab specimen similar to the opening in the graphic.
5. Using the graphic for guidance, identify the major internal structures of the blue crab. Using dissecting pins, string, paper and pencils, prepare labels for the internal and external structures. Insert pins in the major structures and using string, tie these structures to an appropriate label.
6. When the crab dissection is complete, clean all equipment, properly dispose of crab, and wash their hands thoroughly.

7. Prepare a hand drawing with colored pencils using both the dissected and labeled specimen and the web graphic.
8. On the web site, select the “talking blue crab anatomy” function and check student understanding of the external and internal anatomy of the blue crab.

Possible Extensions:

1. Obtain mailing addresses and contact information for the blue crab research programs at Maryland and Virginia Sea Grant programs from the web sites delineated above. Search these web sites to identify free brochures and materials of interest. Contact these Sea Grant programs and request this information.
2. From the web sites provided, locate and print a copy of the larval stages of the blue crab. Identify the larval stages at which the internal and external structures in the mature crab first appear.
3. Obtain food quality blue crabs, boil and eat these crabs, identifying internal and external anatomy as they are cleaned.
4. Using the carapace and other shell parts of the cleaned crabs and colored modeling clay, prepare clay models of the internal and external anatomy of blue crabs.

Student Information: Blue Crabs



Crabs are jointed-legged (**arthropods**) aquatic invertebrates in the class **Crustacea**. True crabs have five pairs of legs (**decapods**), of which the first pair are modified as pinchers and the last four pair as walking legs. In blue crabs, the fifth legs are modified into **paddles** or **swimming legs** so they can swim rapidly and burrow in soft sediments. Other familiar crustaceans are shrimps, lobsters, crayfish and barnacles.

The blue crab (*Callinectes sapidus*) favors brackish bays and is the most common edible crab along the East and Gulf Coasts in the United States. Blue crabs are also found on the East Coasts of Central and South America and have been seen in the coastal waters of France, Holland, and Denmark.

As with other crustaceans, the blue crab must shed (**molt**) its hard, outer shell to increase in size. In a complex process called **ecdysis** or molting, a new soft skeleton is formed beneath the old one. This stage is called the **peeler**. The **buster** stage begins when the hard shell splits, and the crab starts to "back out." After freeing itself from the shell, the crab takes in large amounts of water and expands its soft and wrinkled body. During this soft stage the crab is easy prey and must seek shelter. The shell hardens in two to three days by absorbing calcium from seawater. During this time it is called a **buckram** or **paper shell**.

The **soft shell** blue crab is a delicacy for eating. Many recreational fishermen enjoy catching these soft shell crabs. The bulk of the commercial crab industry, however, focuses on catching the **hard shell** blue crabs, cooking these and "picking" the sweet, tender meat from the shell and internal cartilage.

Blue crabs are generally caught in **traps** or **pots** as many coastal fishermen refer to them. These traps are cubical in shape and constructed from vinyl-coated "chicken wire" with funnel shaped entrances for the crabs. Crab traps are baited with fresh-killed, fish parts and dropped into shallow coastal waters, usually overnight. The crabs are able to enter, but not exit the specialized entrances to these traps. Driving along a coastal road or over a bridge, one frequently sees the spherical, white foam floats attached by nylon rope to the many submerged crab traps.

Issues facing the blue crab fishery include loss of critical nursery habitat, pollution of coastal waters, and excessive numbers of fishermen and traps. High fishing effort reduces the economic return to individual fishermen and may lead to overfishing.

Blue Crab Vocabulary

Abdomen-the “tail” of the crab

Appendages-legs, attached to the body

Arthropod-joint-limbed animal

Autotomy-the automatic breaking off of an appendage

Backfin-the fifth or last leg of a blue crab, flattened to aid in swimming; also known as the swimmer or paddle fin

Berried crab or crab in berry-sponge crab; a female with an egg mass

Blue or blue claw crab-*Callinectes sapidus*

Brackish-term applied to a mixture of fresh and salty water

Buckram crab-one having a pliable, leathery shell; follows the soft-shell condition

Buster-shedding crab that is beginning to emerge from its shell

Carapace-anterior part of the shell or external skeleton of a crustacean

Crustacean-a large class of arthropods, almost all marine or aquatic

Ecdysis-act of molting

Egg-bearing-female crab with sponge

Estuary-the wide lower part of a river where it becomes tidal

External skeleton or exo-skeleton-outer shell of the crab

Handline, trotline, bush trotline-long line with baits or bushes attached; used to catch crabs with a scoop or dip net

Hard or hard-shell crab-the mature state of the crab shell; crabs with a hard shell following the soft-shell condition

Keepers-legal size crabs that may be kept

Megalopa-the second larval stage

Molt-to shed or back out of the old shell

Paper-shell or paper back crab-having a fairly hard shell, but one that is easily cracked; follows the buckram stage

Parasite-an organism that grows, feeds, and is sheltered on or in a different organism while contributing nothing to the survival of its host

Peeler crab-hard crab having a fully formed soft-shell beneath the hard outer shell; a crab that is going to molt

Pots-a cubical trap used to catch crabs

Shed-the casting off of the shell, molting

Soft crab, soft-shelled crab, or softie-a crab that has just emerged from the old, hard shell and has a new, soft, pliable shell

Spines-points of the blue crab

Sponge crab, berried crab-names given to the female crab carrying an egg mass on the abdomen

Swimming paddles-the rear flat legs of the crab; last pair of legs

Traps-crabbing gear or equipment used to trap and catch crabs

Zoea-the larval stage that hatches from the crab egg

Blue Crab References

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