



DELAWARE'S BLUE CRAB

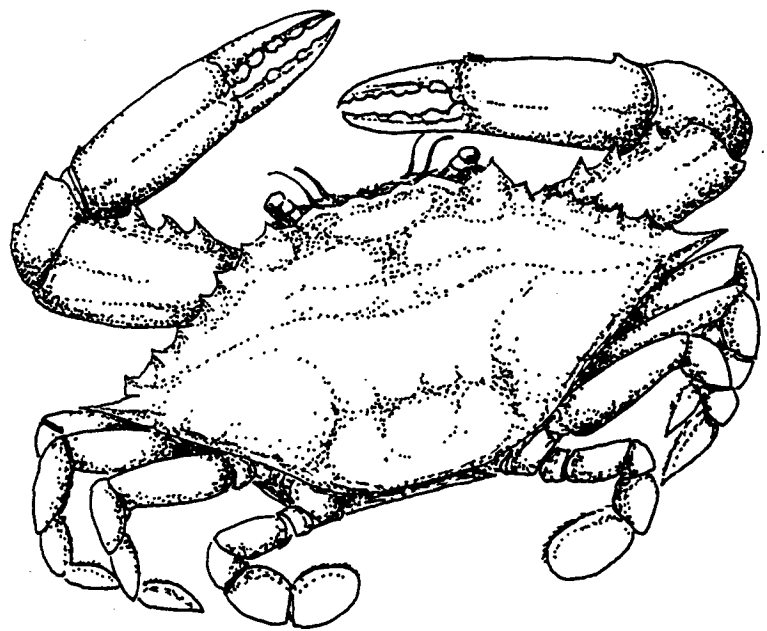
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Delaware waters offer many types of fishing but probably the blue crab gets the most attention. Whether on a yacht or dingy, a pier or mud bank, the sight of a string tied to a chicken neck or fish head is common in the coastal zone. Crabbing has universal appeal and the blue crab does not discriminate as to sex, age, or color as many have discovered when they inched a hand or foot within a claw's reach.

Many people associate the blue crab with only the Delaware and Chesapeake estuaries; however, the fishery exists from New Jersey to Florida and a subspecies is fished in the Gulf of Mexico. Blue crabs range north to Nova Scotia and south to Uruguay. Occasional specimens are found along the European coast from France to Denmark; and the Mediterranean Sea has a sizeable population.

What is a Blue Crab?

Blue crabs are invertebrates belonging to the largest group or phylum of animals called the Arthropoda, or joint-legged animals. More specifically they are decapod crustaceans, meaning that they are arthropods having 10 legs and a hard shell. Scientists know the blue crab as *Callinectes sapidus*, quite descriptive since *Callinectes* means beautiful swimmer and *sapidus*, savory.



Life History and Biology

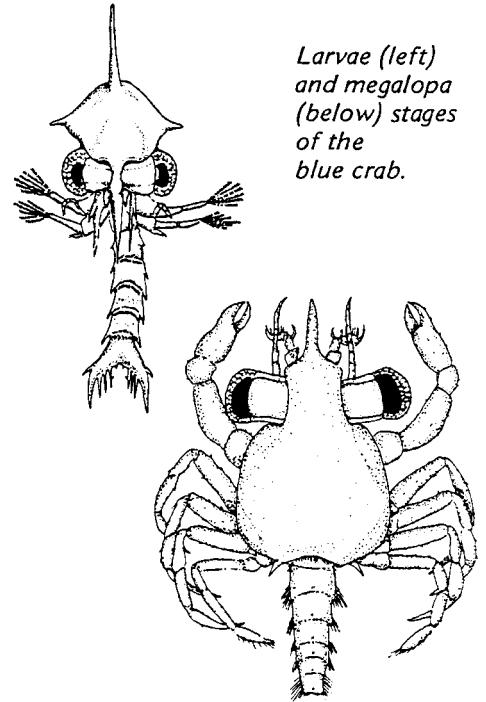
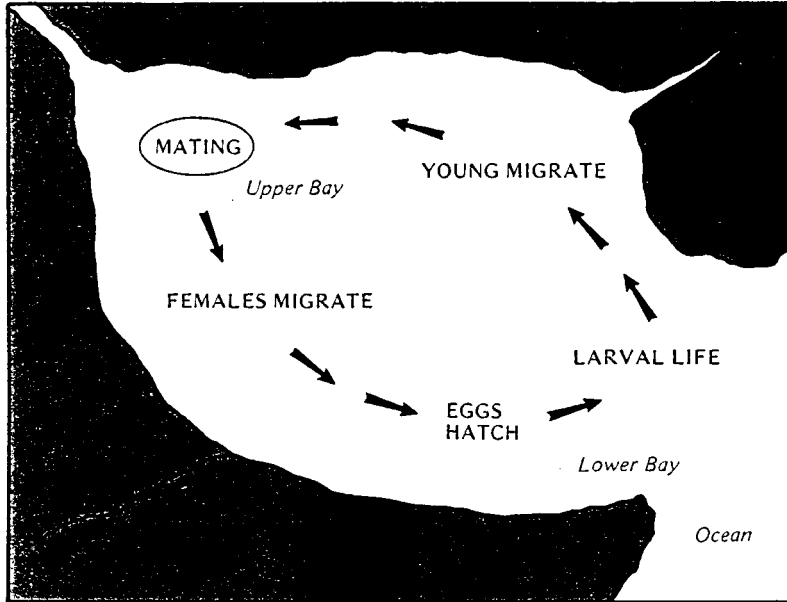
Mating. The blue crabs of Delaware's estuaries mate in brackish waters (less than 2 parts per thousand [0/00]) between May and October, reaching a peak in late summer. Ordinarily females mate only once, while they are in the soft shell state following the last molt. Males may mate any time during the last three or four molts. Just before the last, or terminal molt, the female secretes a pheromone (sex attractant) that attracts and calms the pugnacious male's blue claw. The two crabs then assume the doubler position (male carrying female) and may stay this way for 2-3 days both before and after mating, which

lasts 5-12 hours. Females are about 1-1/2 years old at this time and will store the sperm for use in two or more spawnings over the course of their 3-year life. Adult males are distinguished by the blue claw; females have red-tipped claws.

After mating, the female instinctively migrates down the tributaries and bays seeking water of higher salinity. Two to 9 months later (depending on whether it is spring or fall) she will attach 700,000 - 2,000,000 eggs to the swimmerets on the underside of her abdomen. Only one out of 1,000,000 eggs will reach adulthood. The eggs are orange, but gradually turn yellow and finally

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LIFE CYCLE OF A BLUE CRAB



Larvae (left) and megalopa (below) stages of the blue crab.

dark brown during the 2-week incubation period. Salinity is critical; if less than 23 ‰ (ocean water is 32 ‰), the eggs will hatch prematurely and the zoeae (larvae) will not survive. Once hatched, the zoeae become part of the oceanic plankton and drift for 40 days or more, growing and molting through the megalopa stage to the first crab stage.

Current and ongoing research in the Delaware and Chesapeake Bays has brought to light an oceanic phase of this intricate web of life. The hatching of the eggs is synchronized with darkness and ebb tide so that the first zoeae are washed out of the bay and onto the continental shelf. Zoeae of various stages, excluding the first and megalopa, are commonly found at least 60 km offshore, so it appears that the larval stages mature in the shelf waters and return to the bays as megalopae. Molting to the first crab stage occurs shortly after returning to the estuary as they begin their migration up the bays to less saline water.

Molting. The young crab is only 2 mm wide (.1 in), but grows rapidly during the summer, molting every 3 to 5 days and increasing up to 1/3

its size with each molt. As it grows the time between molts increases. At 10 cm (4 in) the crab molts every 20 to 50 days depending on food availability and temperature. At cooler temperatures, molting is less frequent. Molting usually does not occur from November until the first two weeks in April.

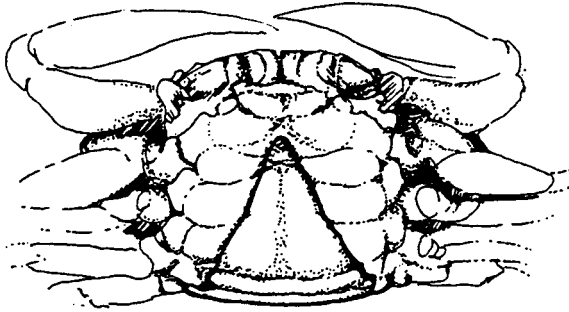
Females molt 18-20 times to reach their terminal molt, males 21-23 times, hence their larger size. When molting starts, the shell cracks along the back between the carapace and the abdomen. The crab or *buster* slowly backs out in a soft shell condition. The time varies, but a 10-14 cm (4-5 in) crab takes up to 2 or 3 hours to molt. During the last few minutes before, and just after the molt, the crab takes in large amounts of water to expand the new shell. Over the next 9-12 hours, the shell has a papery or leathery feel giving it the name *paper shell*. The *paper shell*, sometimes called *buckram*, condition follows during the next 12-24 hours as the crab becomes stiff and brittle.

After about 72 hours the shell is hard, but the crab contains relatively little meat and is referred to as a *water gall*. As the days pass the meat content increases, the shell fills

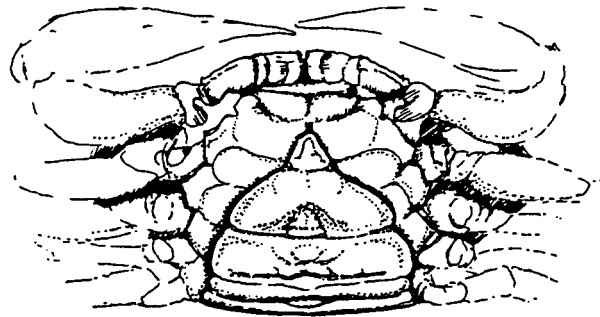
with meat, and a new "soft" shell starts forming beneath the hard outer shell. The new shell can best be seen on the last two segments of the fifth or paddle leg where it appears as a faint line or *hair sign* just inside the outer brown edge of the hard shell. This is the *white sign* and to the watermen it means 5 to 10 days before molting. The *white sign* crab becomes the *pink sign* crab 2 to 5 days before molting, and the *peeler* or *red sign* crab 1 to 3 days before molting. *Peelers* stop feeding a day or two before molting and are *rank* or weak because of the muscles releasing from the old shell as the crab gets ready to bust.

In the fall, the water cools and the crabs migrate to deeper water seeking out the bay channels. They bury there in the mud at a 45° angle with only the tips of their antennae and eye stalks exposed, and remain this way for the winter. As the water warms, usually in April, the crabs come out of their winter beds to begin the cycle again.

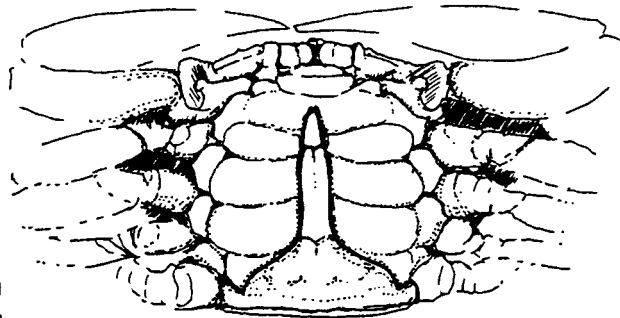
Food. Blue crabs have a varied diet but are most often thought of as scavengers that feed on a variety of dead animals. Decaying animals produce odors that the crab detects



Immature female
"she-crab"



Mature female
"sook"



Male
"jimmy"

Crab drawings adapted from *Beautiful Swimmers*, William W. Warner, Little, Brown and Co., Boston.

and locates with its extremely sensitive antennae. Actually, crabs prefer live or fresh food over decaying matter. At night blue crabs can be seen swimming around lighted piers preying on bait fishes and smaller blue crabs. Crabs will also lie motionless on the bottom waiting for an unsuspecting by-passer. Clam, oyster, and mussel beds are often feeding areas for blue crabs. Some biologists have estimated that an adult blue crab may eat over 1,200 juvenile clams a day. Vegetation such as salt-marsh cordgrass (*Spartina*), eelgrass (*Zostera*), sea lettuce (*Ulva*), and a number of other plants are also part of the blue crab's diet.

Parasites. The parasites that infest the blue crab are host specific and do not affect humans. One common parasite is a protozoan that forms spores in the muscle tissue of the crab. When the infested crab is cooked, the spores appear as small specks, hence the common name salt and pepper disease. Crabs infected with the disease always die, usually within 15-20 days after infestation. However, infested crabs are safe to eat and the taste of the meat is not affected.

Commercial Fishery

The blue crab is Delaware's most valuable fishery with an average commercial catch of 50,000 bushels of hard shells and peelers per year. Commercial catches have increased in the last few years, most likely due to the increased number of fishermen.

Two methods are most common in commercial crabbing: potting and dredging. Potting accounts for the majority of the catch and commercial licenses are issued based on the number of pots used. The largest concentration of pots in Delaware is found from Bowers to Augustine Beach. Dredging is a winter fishery starting December 15 and continuing to March 30. The crabs winter in beds from Bigstone Beach to Breakwater Harbor in depths over 30 feet. Dredges are pulled through the beds catching the wintering crabs. The vast majority are females and usually are sold to the picking houses.

Crabs are sold according to size and/or sex. Large male crabs usually 6 inches or more are called *No. 1 Jimmies*, and command a premium price. *No. 2 Jimmies* are males 5 inches or more. *Sooks* or

mature females are sometimes mixed with the No. 2's and often No. 2's and sooks go for the same price. However, price and size limits vary depending on supply and demand.

Commercial picking houses expect a 10-15% yield of meat from a crab. In the Delmarva area, the other 85-90% (shell, viscera, and unpicked meat) is ground and added to chicken feed. Sea Grant scientists at the University of Delaware and other institutions across the country are researching different ways to use this shell waste. The shell contains a cellulose-like substance called chitin (kite'n) that has shown potential for industrial use. Possible uses for chitin include biodegradable films for packaging, sausage casing, surgical sutures, and as a clarifying agent in distilling processes.

Recreational Crabbing

What makes crabbing such a popular sport fishery? Three reasons: 1) crabbing areas are usually easily accessible; 2) expensive gear or years of experience are not required for successful crabbing; 3) the possible reward of an evening's meal is always present.

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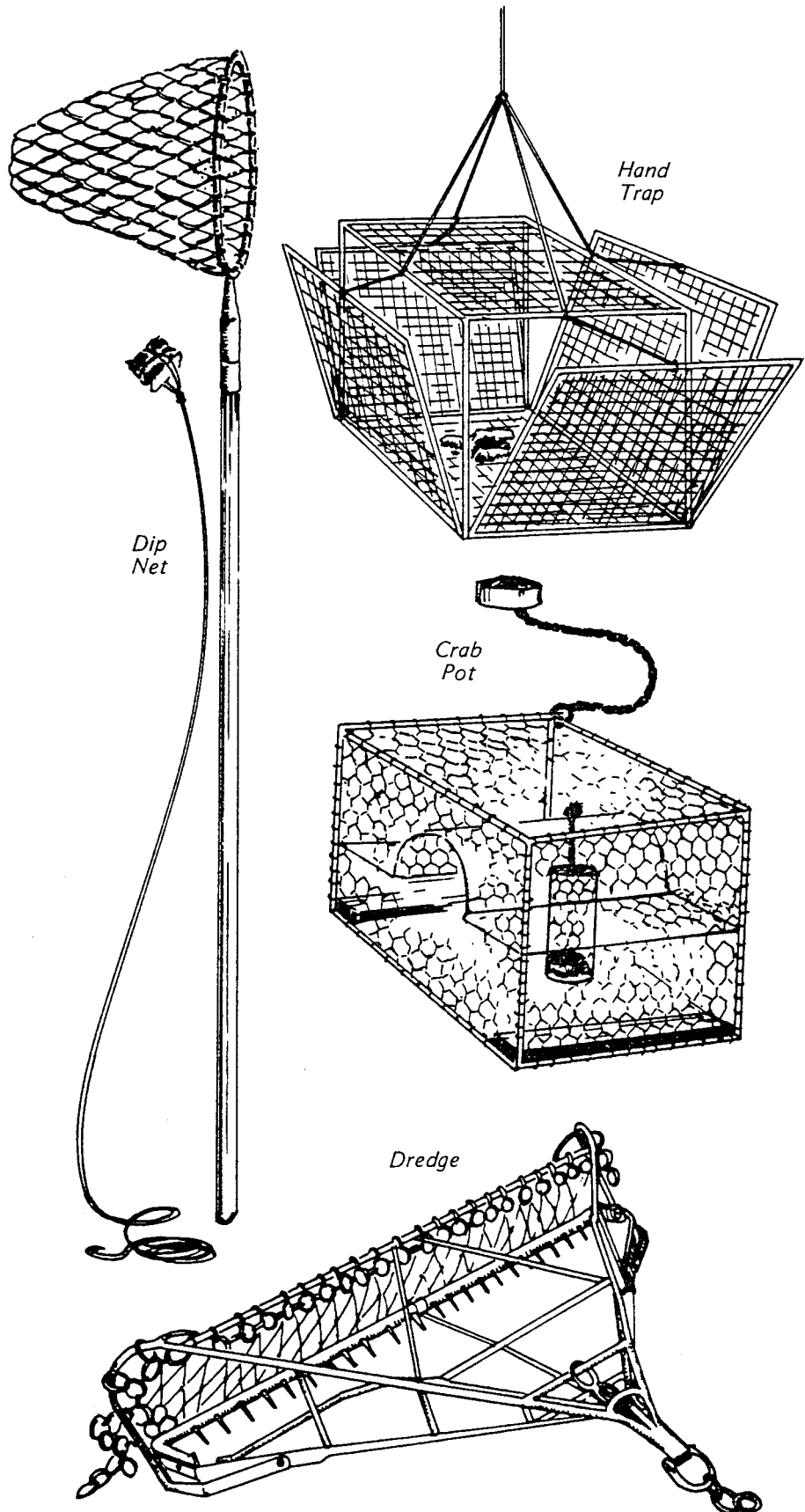
Crabbing is allowed in any of Delaware's coastal waters unless otherwise posted by the State Department of Natural Resources and Environmental Control. Gear for the *hand line* method consists of line, weight, bait, and long-handled dip net. Baits vary, but oily fishes such as bluefish, menhaden, or herring are superior to less oily fish such as weakfish or flounder. Chicken is often used because chicken parts such as necks and backs are convenient and inexpensive. For nets some crabbers use twine, but many prefer chicken wire because the crab cannot become entangled. This technique is simple. Let the baited line sink to the bottom and periodically feel to see if a crab is feeding on the other end. If you feel a crab on it, slowly raise the string until the crab is visible. Then, sweep the dip net under the crab, bait, and weight, catching all three.

A bushel basket with a lid makes an excellent container for holding crabs. Never place crabs in a closed container with water because they will die from lack of oxygen. If possible, keep a wet burlap bag over the crabs and keep out of direct sunlight.

Another method of crabbing is *dipping*, and for this only a dip net is needed. Crabs swimming around lighted piers, attracted by the lights and/or the bait fishes, can be netted by agile fishermen.

The *hand trap* method consists of lowering a trap to the bottom and periodically raising it to check for crabs. The traps are collapsible and have an advantage over hand-lining. The dip net is not used, so the chance for error is eliminated. Hand traps are useful when crabbing from a bridge or in deep water, where a net is not practical or the crab could drop off the line on the way up.

One other method of crabbing involves the *crab pot*, essentially a small fish weir (trap). It does not have to be tended continuously but checked only once or twice a day to replace the bait and take out the trapped crabs.



Cooking the Catch

Recent research findings from the Louisiana State University indicate that using red color as an indication of thoroughly cooked blue crabs can result in an undercooked and potentially contaminated product.

The shell of an uncooked blue crab is normally blue-green. During cooking, the shell takes on its familiar red-orange color. Researchers found that crabs cooked in boiling water for 30 seconds generally appeared the same as crabs that were cooked for 16 minutes. Longer cooking times did not enhance the color of the shell.

In cooking blue crabs it is critical that the crabmeat reach an internal temperature of 70°C (158°F) and maintain it for at least one minute to insure the destruction of the bacteria *Vibrio cholerae*, which may contaminate blue crabs. For safety, steam the crabs for 25 to 30 minutes, or boil them for approximately 15 minutes. Either method is good.

Steamed Blue Crabs

2 dozen live, hard-shell blue crabs
3 cups vinegar
3 cups water or beer
1 cup Old Bay or other seafood seasoning

Use a steamer or a large pot with a rack and a tight-fitting lid. Pour vinegar and water or beer into steamer and bring to a boil. Add crabs, a few at a time, and sprinkle each layer with seasoning. Steam 25-30 minutes. Serves 4.

Boiled Blue Crabs

2 dozen live, hard-shell blue crabs
6 quarts boiling water
1/3 cup salt

Place crabs in boiling water. Cover and return to boiling point. Simmer 15 minutes. Drain and serve hot or cold. For a different flavor, add celery ribs and lemon slices to the boiling water. Serves 4.

Here are some other tips for buying and preparing blue crabs:

- Do not buy or cook dead blue crabs. You can buy blue crabs either raw or cooked in the shell.
- Blue crabs bought in markets usually range from 5" to 6" long and are sold by the dozen or by the bushel.
- Under NO circumstances should live blue crabs and cooked blue crabs touch each other. Live crabs may have bacteria that could contaminate the cooked crabs. For the same reason, never place cooked crabs back into the bushel basket in which they were purchased alive.
- One 6-ounce steamed crab yields approximately 3 ounces of picked crabmeat. One pound of crabmeat yields about 3 cups.
- Three and a half ounces of crabmeat provides 78 calories, 15.9 g protein, 1.3 g fat, 102 mg cholesterol, 244 mg potassium, and 337 mg sodium.
- The shelf life of steamed crabs and cooked, fresh crabmeat is 3-5 days under constant refrigeration.
- Frozen, cooked crabmeat held at 0°F has a storage life of 3 months; if uncooked, 6 months.
- Frozen crabmeat tends to lose its flavor and become tough or watery. However, prepared crabmeat, such as crab cakes or crab imperial, yields better results than unprepared.
- Store all crabmeat products in a moisture-proof, vapor-proof wrapping or in a rigid, airtight container.

DELAWARE SPORT CRABBING FACTS

1. Legal size crabs are 5" or better; soft shells 3-1/2", peelers 3".
2. It is lawful to take non-egg-bearing female crabs of legal size.
3. It is unlawful to scrub off eggs from any female crab or have such a crab in possession. This also includes a female from which the apron has been removed.
4. Legal sport methods are:
 - a. Hand lines
 - b. Dip nets
 - c. Collapsible hand trap and the crab pot
5. Sport crabbers may not use more than two pots at a time; more than two pots in use is considered commercial crabbing and a license is required.
6. Pots should also be marked with white buoys with the letters N.C. followed by a dash and the owner's initials.
7. It is unlawful to sell crabs without a commercial crabbing license.
8. It is legal to crab at night with a light.
9. Commercial crabbing is not permitted in Indian River, Rehoboth, and Assawoman Bays.

For specific details a booklet entitled "Delaware Shellfish Laws and Regulations" is available from:

Division of Fish and Wildlife
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