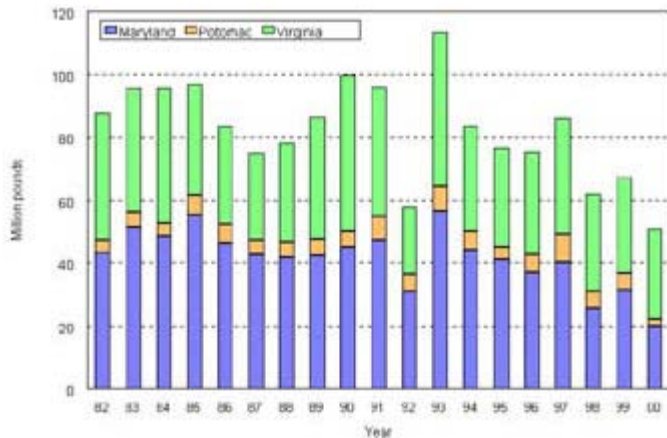


Life History and Management of Blue Crabs

By Brenda Davis and Glenn Davis

Program Background



Chesapeake Bay commercial blue crab harvest, 1982 - 1999.

Blue crabs have become the most recognizable icon of the Chesapeake Bay region. Throughout their range from Maine to South America, their life cycle is dependent on estuarine habitat. Since the Chesapeake Bay is the western Atlantic's largest estuary, it is not surprising that the blue crab has become intertwined with the ecology, the economy, and the culture of the region. Millions of people enjoy and utilize this important resource each year as restaurant fare, as recreation, and as livelihood. Despite the combined Maryland and Virginia commercial harvest in 2000 (50.9 million pounds) being the lowest in over 20 years, blue crabs are still the most valuable commercial species in the Chesapeake. With a dockside value of \$54.2 million, blue crabs topped all other commercially harvested

species. When all aspects of commercial and recreation harvest are factored in, the blue crab has an enormous economic impact in both Maryland and Virginia. This is one reason that steps are being taken to reduce the pressure on the blue crab population, in the hope that declining trends in abundance can be reversed.

Here in the Chesapeake, the blue crab's life cycle extends from the upper reaches of the Bay and its tributaries to the Atlantic Ocean. Mature females produce egg masses (referred to as sponges) from May to October when the water temperature is warm and food is abundant for the newly hatched blue crab larvae. The first larval stage, known as a zoea needs salty water to survive, so most of the spawning takes place near the mouth of the Bay. Once the eggs hatch the zoea are swept out of the Bay by water currents. Most of the early development takes place in the Atlantic Ocean. After several molts the zoea metamorphoses into the second larval stage, known as a [megalopae](#). During this stage, the megalopae can swim vertically in the water column to take



advantage of incoming tides or wind-blown surface currents, which transport them back into the Bay. The larval crabs then settle into the grass beds in the lower Bay where they metamorphose into the true crab stage. These first crabs are about 1/5 inch from point to point. Shortly after settlement, the juvenile crabs begin migrating north in the Bay and grow very quickly. By their first winter most juvenile crabs will be between $\frac{3}{4}$ and $1\frac{1}{4}$ inches, although a few may be as large as 3 inches. Their range extends as far north as the Susquehanna Flats, with the largest concentrations of over-wintering juvenile crabs found in the Tangier and Pocomoke Sound area. In the spring, crabs will emerge from the mud and continue moving upstream in the Bay and its tributaries. Most blue crabs will reach legal size (5 inches for males) or become mature by August of the following summer.



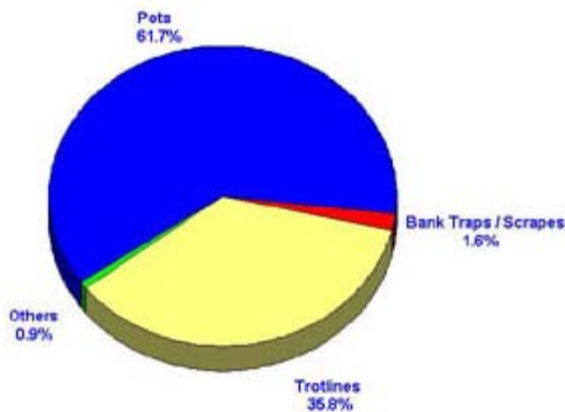
Blue crabs grow by producing a new, soft shell underneath the existing one, then shedding their old hard shell. In crabs close to shedding, referred to as peelers, this new shell can be seen through the old shell most noticeably on the swimmerette and the [apron of immature females](#). The crab secretes enzymes which dissolve its old shell at strategic points known as sutures. This allows the crab to back out of its old shell (as pictured at left), leaving even the muscle membranes and gill membranes behind. The newly emerged soft crab then takes in water, which allows it to expand its soft shell to a size larger than its previous shell. When the new shell hardens in a few hours it will typically be 30 percent larger, point to point, than the old shell. This molting process occurs often when the crabs are small and less frequently as the crabs become larger. Crabs less than two inches often shed twice in a month, and by

the time male crabs are six inches they may not shed again for several months or even a year or more. Females have a terminal molt at maturity, meaning that this is the last time they will shed. This is where the apron changes from a triangular shape to one that is [darker and more rounded](#). It is during this final molt that the female will mate, before her shell hardens completely. Despite a rather narrow window of opportunity, nearly 95 percent of all females are mated. The peak of mating activity generally occurs in late summer. That is why you often see a large number of "doublers" (males carrying females) during that time of year. In the fall, the newly mated mature females will migrate toward the mouth of the Bay. The males will stay in the upper portions of the bay and tributaries and immature females will be found mostly in lower to mid-Bay tributaries, but mature females will primarily over-winter in the bay mainstem south of the Rappahannock River and prepare for spawning the following spring. The females will not return to Maryland, but rather stay in Virginia waters until they die.

Blue crabs are known as "serial spawners", which means they can produce more than one egg mass, or brood, from a single mating. Females in Chesapeake Bay will produce multiple broods, possibly as many as three to five. This allows them to release eggs over an extended period to take advantage of favorable environmental conditions that may exist for only part of their spawning season. Each brood contains between 500,000 to 2 million eggs. When the egg mass first develops it is yellowish-orange in color and becomes darker as the young crabs develop inside, until it is dark brown or black when it is time for the larvae to hatch from the eggs. A large number of eggs are produced, but a large number of larval and juvenile crabs never survive to become adults and reproduce. Small crabs and even large crabs, when they are soft just after shedding, are eaten by a variety of predators including rockfish, croakers, sharks, flounder, otters, and herons. Larval crabs are eaten by a host of other predators including grass shrimp and menhaden. Cannibalism also accounts for a large percentage of mortality in the crabs' early life stages.

Crabs have a varied diet, consisting mostly of invertebrates. The smallest crabs consume zooplankton and copepods, while juvenile to adult crabs prefer soft-shelled clams, mainly *Macoma* clams, other blue crabs, and worms. Crabs can eat small hard clams and oysters and can also catch fish. Decaying plant material can be consumed, but it is an insignificant part of their diet.

The fishery for blue crabs in Chesapeake Bay is made up of numerous gear types for both recreational and commercial fishermen and targets different stages of the life cycle in different seasons and habitats. Baywide, crab pots targeting hard crabs or peelers account for roughly 80 percent of all crabs harvested



Distribution of Maryland commercial harvest by gear, 1989 - 1999 average.

commercially. Because crab pots are prohibited for use in most Maryland tributaries except by waterfront property owners, trotlines make up 35 percent of Maryland's commercial blue crab catch (14 percent Baywide). Bank traps and crab scrapes, used to catch peelers, are fished primarily on Maryland's lower Eastern Shore and in Virginia and account for two percent of the Baywide commercial harvest. Crab dredges,

which are used exclusively in Virginia during the winter, caught less than four percent of the blue crabs harvested Baywide in 2000.

Popular recreational gears include trotlines, collapsible traps, net rings, and hand lines. Two crab pots are allowed for waterfront property owners in Maryland and Virginia sport crabbers are allowed two per person or five with a license.



Chesapeake Bay, Maryland, and Virginia catch composition by market category, 1999.

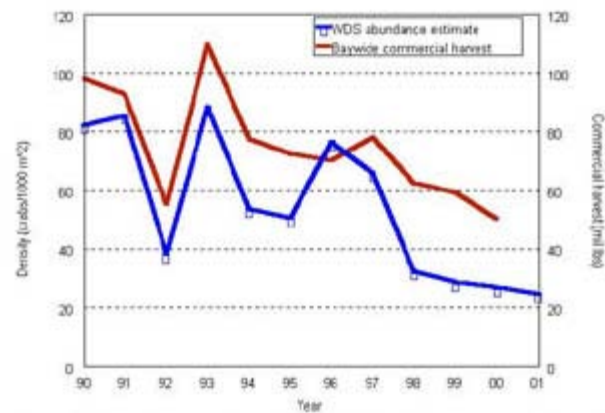
The annual blue crab catch between Maryland and Virginia is usually turns similar, with the Potomac River typically accounting for about seven percent of the Baywide commercial harvest. Because of the different habitats that crabs utilize during different life stages, Virginia's catch, by weight, is 70 percent female, while Maryland's is mostly male. Over the last ten years, peelers have contributed less than seven percent to each state's crab harvest by weight. But because the average peeler weighs less than half of what the average hard crab does, the peeler fishery's contribution by number of individuals in

2000 was 16 percent in both Maryland and Virginia.

Due to this wide ranging life cycle and diverse fishery it is necessary that Maryland, Virginia, and the Potomac River coordinate their efforts to manage the blue crab resource. In 1996 the Bi-State Blue Crab Advisory Committee (BBCAC) was established for just that purpose. The 25 member Advisory Committee serves under the Chesapeake Bay Commission, and is made up of the natural resources secretaries from each state, key legislators, watermen, fisheries managers, recreational crabbers and individuals from the crab industry. The BBCAC, along with the supporting Technical Work Group (TWG) which is made up of a select group of scientists and economists look at issues that affect the blue crab and make recommendations to each state's legislature.

Data from surveys conducted by the Maryland Department of Natural Resources (MDNR), Virginia Institute of Marine Science (VIMS), Academy of Natural Sciences, as well as commercial harvest records from both Maryland and Virginia, have been used to estimate the status of the blue crab population in the Chesapeake. The conclusion is that harvest pressure on the crab resource is near an all-time high. It was this conclusion that spurred agencies in both states and the Potomac River to propose regulations that would restrict the recreational and commercial effort targeting blue crabs.

The winter dredge survey, conducted since 1989



Baywide winter dredge survey (WDS) estimated blue crab abundance and Baywide commercial blue crab harvest.

by the MDNR and VIMS, is the only bay wide blue crab survey. Each year from December to March 1500 sites are sampled from Poole's Island in Maryland to the mouth of the Bay in Virginia and nearly all tributaries in between. The sampling gear used is a six foot crab dredge outfitted with a ½ inch nylon mesh liner to retain juvenile crabs. The survey has been an accurate barometer of crab harvest in the following season, and has documented a decline in blue crab abundance since the early 1990's. Similar declines have also been measured by the trawl surveys conducted by VIMS and MDNR. Graphs of trawl abundance A study conducted since 1968 by the Academy of Natural Sciences has shown a

[decrease in the average size of blue crabs available for harvest.](#)

In addition to a shrinking population, fishing effort targeted at females has intensified. While the overall blue crab harvest has been cut in half, females make up an increasing fraction of that harvest. Mature females comprised approximately 27 percent of the Maryland blue crab harvest in the early 1990's and now make up 40 percent. Peelers, of which the majority harvested are female, have increased from 8 percent to 16 percent of the harvest in Maryland. The peeler fishery has expanded in similar fashion in Virginia as well.

Recent studies suggest that the size of the males in the population or the number of large males available may have a role in determining fecundity. This would mean that managing for larger males in the harvestable portion of the population would have a reproductive benefit as well as improving the quality of the fishery and possibly increasing economic benefits.

Based on this evidence and other data, it has become clear that conservation measures are needed to preserve the blue crab as a resource sustainable for everyone's use and enjoyment. Given the diverse nature of the blue crab and its fishery it is important that both Maryland and Virginia, both recreational and commercial fisherman play a part in blue crab conservation.