Tales from the Cryptic: The Common Atlantic Octopus
(*Octopus vulgaris)*

Kingdom-Animalia
Phylum – Mollusca
Class – Cephalopoda
Order – Octopoda
Suborder – Incirrina
Family – Octopodidae
Genus – *Octopus*
Species – *Octopus vulgaris*

Cephalopods are one of the world's most misunderstood classes of invertebrates. To many individuals they are slimy, creepy, and …downright ugly. This is why they are continuously featured in starring roles in horror movies about the abyss. But there are many more interesting aspects to these creatures than the heebie-jeebies that they seem to invoke in many people. Cephalopods, especially octopuses, are not only beautiful creatures, but more importantly, they are the most highly "intelligent" invertebrates in the sea.

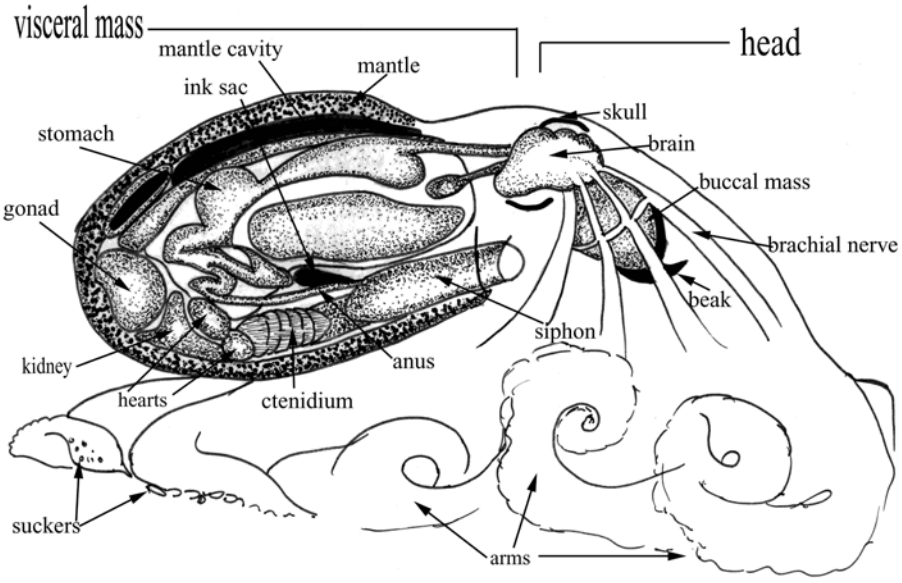
What is a Cephalopod?

Cephalopods are a class of marine mollusks which include squid, octopuses, and chambered nautilus. They are distinguished by having a large head, extremely well developed eyes, and varying numbers of arms or tentacles, ranging from eight to one hundred, depending on the species. The name Cephalopoda is derived from the Greek words kephalo, meaning head, and pod, which means base or foot; accurately describing the appearance of the animals.

What is an Octopus?

An octopus has a bilaterally symmetrical body type with two eyes, 8 arms, and no tentacles. To many people, the terms 'arms' and 'tentacles' are synonymous, but in fact these body parts are distinctly different. A tentacle is a structure that may have a small club of suckers at the end, or it may also have hooks or be sucker-less. The tentacle functions as a sticky extender/retractor that can trap small planktonic organisms, whereas arms are entirely suckered or hooked ventrally, from base to tip. The arms can extend, retract, grasp, seek, and feel independently from one another.

(modified from Brusca & Brusca, 2003)



The anterior, or forward, region of an octopus comprises two parts: the head and the visceral mass. The visceral mass, located in the anterodistal region of the octopus, is covered by the mantle, a muscular organ that consists of a cuticle underneath the epidermis. The octopus mantle serves as the protective layer covering its internal organs. Everything from the stomach, anus, kidney, hearts, gonads, and ink sac can be found in this anterior region. The posterior end of the animal is nothing more than arms, each having one or more rows of suckers and/or spines, the nature and number of which varies between species.

In addition to its protective function, the octopus mantle can also expand to draw seawater into a mantle "cavity" and then contract to expel it through a narrow opening called the siphon. This action provides the octopus with a method for rapid movement. This mantle cavity also contains the gills, or ctenidia, which the animal uses to extract oxygen from the water for respiration. The nervous system of an octopus is highly developed, and the animal has a brain that is partially enclosed in a cartilaginous cranium; however it is not protected by the mantle cavity, but found within the head. The head contains other structures, including the brachial nerves and a buccal mass ("mouth") with a strong beak.

Where do they live?

Octopuses are found from warm tropical waters to the cold deep of abyssal trenches. They create dens by squeezing into crevices or digging holes in the sediment. These dens are often recognizable by the nearby presence of discarded clam and snail shells from earlier meals that the resident octopus can use as a landmark. Only two of the 13 species in the family Octopodidae known from the Atlantic coast of North America have been reported from the continental shelf of the South Atlantic Bight (SAB: Cape Hatteras to Cape Canaveral); *Octopus vulgaris* (the common Atlantic octopus) is the most widely distributed and highly abundant, while *Octopus joubini*, the smaller Atlantic pygmy octopus, is more rarely encountered.

How do they change color?

Octopuses use camouflage either to resemble other animals or to blend into their environment. This cryptic behavior of the octopus is possible because it possesses chromatophores, reflecting cells, and photophores, all of which are used to assist in the rapid change in appearance that make it difficult to spot the animal in its natural habitat.

Chromatophores, which are found within the epidermis, emit long pigmentary wavelengths of yellow, orange, red, brown, and black. There is no evidence that an octopus may possess all five colors of chromatophores; the most common number is three, however, two or four occur in some species.

Iridophores, leucophores, and reflector cells are also found in the epidermal tissue. These produce much shorter wavelengths of white or iridescent colors. Iridophores generate pinks, yellows, greens, blues, and silver; reflector cells absorb all but the blue and green

wavelengths; and leucophores reflect all wavelengths, contributing to the production of the "white spots" found in many species.

The mantle itself may become translucent, allowing internal organs like the ink sac to become visible as a dark spot. Dermal muscles in the mantle can contract to texturize its surface, creating tubercles or papillae, and then they can relax and the mantle becomes smooth. In many midwater and deep sea octopuses, photophores are used to emit blue light at wavelengths that peak at levels equivalent to the open ocean.

In varying combinations of the use of these components, the octopus is capable of cryptic behavior that can result in background resemblance, counter-shading and concealment of the shadow, disruptive coloration, and deceptive resemblance.

When danger lurks…

Although crypsis is the primary defense mechanism of *O. vulgaris*, there are three other behavioral alternatives that can place distance between the octopus and a predator. Jet propulsion, swimming, and burial are forms of flight responses. Flashing of color or cloud displays are forms of deimatic behavior that *O. vulgaris* uses to intimidate potential predators when it is startled or threatened. Finally, inking is a protean behavior allowing the octopus to release a cloud of ink resembling the outlined shape of itself, confusing its predator as it jets away.

Postural and locomotive capabilities are effective tools in the camouflage process of *O. vulgaris*. An erect arm and the rugose appearance of the mantle, while the octopus sits bobbing with the current on a coral structure, is a flamboyant defense display , whereby body position and attitude can prevent detection by a predator.

Beak exposure can also give a lasting impression to a predator or territorial enemy. With outstretched arms and an exposed mouth, *O. vulgaris* may taunt an enemy to take a chance against the powerful arms and crushing beak.

Speaking of putting your foot in your mouth…How do they feed?

Basic sensory skills such as sight, touch, and smell, as well as reception of underwater sounds, give cues to the octopus about the types of prey available and the most efficient way to capture them. *O. vulgaris* has been observed ambushing, luring, stalking, and in pursuit of prey. The use of disguised and speculative hunting techniques have been documented in *O. vulgaris,* which can camouflage itself as seaweed (disguised) or pounce on suspected prey areas in an expanded web- or umbrella-like posture, using its arms to forage, trapping prey in the web (speculative). *O. vulgari*s can immobilize prey using its poison gland, which stuns the prey a behavior liken unto spiders. In some species this reaction can be detrimental or even fatal in humans. Among the known prey items of *O. vulgaris* are clams, shrimps, crabs, and snails. However, other crustaceans like stomatopods and lobsters, some fishes, and even other octopuses are also commonly eaten by *O. vulgaris*.

Reproduction.

Male octopuses have a modified arm called the hectocotylus (generally the 3rd or 4th arm) that assists in copulation with its female counterpart. A ventral groove extending the entire length of the arm transfers the spermatophores from the penis at the base of the hectocotylus to the female oviduct, initiating reproductive exchange that can last over an hour. Because cannibalism is prevalent in partners of unequal size, it is often disadvantageous for males to remain near or guard females after copulation.

Once internal fertilization is complete, the female removes the tear-drop shaped eggs from the oviduct connecting them to a gelatinous "egg string" forming clusters of dozens to hundreds. Afterwards she places them onto a hard substrate within the den. The eggs are closely guarded by the female parent for approximately three months to maximize survival of the developing young octopuses. All of the parental energy is expended to aerate the eggs by passing clean water over them through the siphon. During this period of intense protection, females do not exit their dens, even to feed, a devotion which ultimately brings about their demise.

Research.

Octopus vulgaris and related species have been the focus of much research and observation. Octopuses, in general, are believed to be among the most intelligent invertebrates. They are quickly able to navigate mazes and can be taught to open jars, both abilities that demonstrate cognitive learning. Although it has been shown that, contrary to popular belief, they are color blind, they engage in elaborate crypsis using brightness and contrast with the environment by modifying, with a high level of refinement, their reflecting cells and chromatophores. Recent video recordings of octopuses in their natural habitat show them using bipedal locomotion while in disguise, eluding potential predators by appearing to be seaweeds moving in the surge, and mimicking venomous flatfishes, lionfish, or sea snakes to ward off predators or potential enemies.

Bipedal locomotion:

http://www.berkeley.edu/news/media/releases/2005/03/24_octopus.shtml

Mimicking flatfishes and sea snakes:

http://pharyngula.org/index/weblog/comments/indo_malayan_mimic_octopus/

Since *O. vulgaris* is commonly found in the South Atlantic Bight, it represents a potential commercial fishery along South Carolina's coast. The octopus fishery is prevalent in Japan, Africa, and Mediterranean areas. Although the SAB has potential to be a harvestable fishing ground for octopus, it is not established as of yet. Due to improvements in methods of octopus collection using clay pots and double PVC piping,

catch rates increased over a two year experimental period in the mid 80's, indicating the strong possibility of sustaining a productive seasonal commercial fishery here in South Carolina. Recently, NOAA and SCDNR have received grant funding to further examine the possibility of establishing a small-scale octopus fishery. These agencies will also consider that if the fishery is not substantial enough to sustain a reliable market, there may be an opportunity for it to thrive as a by-catch fishery.

Author:
Nadia Meyers
Wildlife Biologist
Southeastern Regional Taxonomic Center
South Carolina Department of Natural Resources

References.

Brusca, Richard C. and Brusca, Gary J. 2003. Invertebrates. 2nd ed. Sinauer Associates, Inc., Sunderland, MA.

Hanlon, Roger T., and Messenger, John B. 1996. Cephalopod Behaviour. Cambridge University Press, New York, NY.

Whitaker, J. David, DeLancey, Lawrence B., and Jenkins, James E. 1991. Aspects of the biology and fishery potential for *Octopus vulgaris* off the coast of South Carolina. *Bulletin of Marine Science* 49:482-493.