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# NORTHWEST WILDLIFE PRESERVATION SOCIETY

## Giant Pacific Octopus

*Enteroctopus dofleini*



Image from the Monterey Bay Aquarium  
<https://www.montereybayaquarium.org>

By Veronica Pagowski

The octopus is an elusive creature with an alien brain. Like humans, these intelligent animals can open jars, recognize faces, and use tools. Yet, only 35% of octopus neurons are located in their brain while 65% can be found in the tentacles. With such powerful, though strangely organized, cognitive systems octopuses have attracted the attention of numerous scientists and aquarists worldwide. The giant Pacific octopus is no exception. Each year, on Valentine's day, the Seattle Aquarium draws crowds to view giant Pacific octopus mating--an event that can last over an hour. In British Columbia, this species is common enough that divers frequently report sightings.

### Characteristics

The giant Pacific octopus is the largest of roughly 300 known species of octopus, often weighing over 23 kg (50 lbs) with arm spans up to 6 meters (20 feet). The largest recorded weight for this species was over 90 kg (200 lbs). Typically, giant Pacific octopuses are dark red in color with mottled skin, but these animals can quickly change colour or texture to blend in with surroundings. Though giant Pacific octopus colour changes are not as dramatic as the transformations in some other octopus species, colouring can nonetheless range from dark red to white or yellow while skin texture varies from smooth to rugged, flawlessly matching that of kelp or rocks. Each octopus arm can have over 200 suckers- each with the ability to taste, grip, and lift 14 kg (31 lbs). In theory, an octopus could lift more than 22,400 kg (over 49,000 lbs) using all its suckers!

Males can be distinguished from females by a distinct third right arm, called a hectocotylus. The hectocotylus tip is not covered in suckers and is inserted into the mantle cavity to inseminate the female. Though 9 species of octopus have been recorded in British Columbia waters, the giant Pacific octopus is the only large species found locally.

**NWPS Headquarters**  
720-1190 Melville Street  
Vancouver, BC V6E 3W1

**NWPS Vancouver Island**  
PO Box 39058  
RPO James Bay  
Victoria, BC V8V 4X8

**t** Vancouver 604.568.9160  
**t** Victoria 778.967.3379  
**e** [info@northwestwildlife.com](mailto:info@northwestwildlife.com)  
**w** [www.northwestwildlife.com](http://www.northwestwildlife.com)

## Life Cycle

The giant Pacific octopus lives longer (3-5 years) and grows bigger than any other octopus species. These massive invertebrates are born from eggs the size and shape of rice grains. After hatching, octopus larvae float with the current for several months. During this period, they are unprotected and susceptible to predation. Though female giant Pacific octopuses have 50,000 eggs on average, only about 1% of the planktonic larvae survive. Once the octopus larvae settle on the seafloor, the survival rate is much higher. Adult octopuses are one of the few mollusks which lack a protective outer shell, so these animals rely on a unique set of adaptations to avoid predation. These animals are masters of camouflage and often also rely on their remarkable intelligence to survive the dangers of the open ocean. After reaching sexual maturity (at about 2-3 years), the giant Pacific octopus typically leads a solitary life. Many individuals are found in dens during the day and hunt during the night.

Breeding occurs late in an octopus's life. Males may breed with several females, whereas females mate with only one individual. Both males and females die within several months after breeding. Male octopuses can be distinguished from females by the presence of an hectocotyized arm (a tentacle used to transfer sperm). Mating occurs throughout the year, but peaks during the winter. The male strokes the females head and abdomen with the hectolyzed arm, before inserting it into the oviduct. Once the arm is inserted, a sac containing sperm bursts, releasing millions of sperm. Females prefer to breed with larger males and mating rituals can be accompanied by dynamic coloration displays. Once mating begins, the octopus pair heads for a den in deeper water at depths between 12-52 metres (40 and 170 feet). The entire mating ritual typically occurs within an hour, but can last up to 3 hours. Eggs are laid a month or more after mating. The female hangs fertilized eggs along the walls of her den and meticulously guards and aerates them for about 4-6 weeks. She shoots streams of oxygen and nutrient rich water over her eggs by contracting her body. In some cases, she may guard her eggs for up to 7 months. During this time, the female does not eat and grows weaker. Aging is accelerated: skin around the eyes begins to retract, behavior is characterized by aimless wandering, and lesions can appear on the body. Colouring can also fade and become white and pale. Eggs begin to hatch after 150 days to a year. Hatching time depends largely on temperature, with incubation times lasting much longer in colder waters. Newly hatched octopus larvae will spend 1-3 months drifting with ocean currents, before settling in the oceanic benthos.

## Habitat

The giant Pacific octopus lives in water 60 degrees or cooler. They can be found in waters from California to Alaska and northern China. Typically, they are found in shallow waters, often near coastlines, however individuals have been found at depths of up to 605 metres (2,000 feet). The giant Pacific octopus can be found hiding in tide pools or rocky cervices during the day. At night, the giant Pacific octopus leaves its den to hunt for food. Octopuses are typically found crawling along the sea floor. Ideal habitats include soft mud, sand, or gravel substrates with large boulders, which are used for creating dens. Giant Pacific octopuses are found in large numbers in dense kelp fields. These animals are ectotherms and their metabolism is dependent on temperature. Temperatures between 7 and 9.5 degrees Celsius are optimal for this species.

## Behaviour

Giant Pacific octopuses display a variety of interesting behaviours. Within seconds, these animals can match their colour and texture to that of their environment, even while swimming. Colour-changes associated with camouflage are also linked to mood changes, reactions to other individuals, and comfort level. Octopuses rely on remarkable camouflage abilities to sneak up on unsuspecting prey. Their suckers provide powerful grip strength to capture and hold on to prey, which may be paralyzed with toxic saliva before consumption. Like other mollusks, octopus use a scraping organ, called a radula, and a parrot-like beak to consume prey. Their diet consists of crustaceans, other mollusks (including clams, squid, and other species of octopus), and fish.

### NWPS Headquarters

720-1190 Melville Street  
Vancouver, BC V6E 3W1

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PO Box 39058  
RPO James Bay  
Victoria, BC V8V 4X8

**t** Vancouver 604.568.9160

**t** Victoria 778.967.3379

**e** [info@northwestwildlife.com](mailto:info@northwestwildlife.com)

**w** [www.northwestwildlife.com](http://www.northwestwildlife.com)

Because these animals have no hard body parts (except for their beak), they can squeeze through tight spaces and are notorious escape artists. Octopuses have been known to invade neighboring tanks in aquaria to sneak a tasty meal and return to their own tanks before their escape is detected. These animals also utilize their tentacles to use tools. When placed in a jar, individuals have escaped by unscrewing the cap from the inside. Since each tentacle has its own set of neurons, tentacles can be engaged in several tasks at once. Giant Pacific octopuses have even been known to learn through observation. They also display an ability to navigate in the ocean. They frequently stray from their dens to find food and can find their way back efficiently.

Scientists are particularly interested in octopus intelligence because these organisms are such an anomaly among the invertebrates. Octopuses possess remarkable abilities, yet their brains are very unlike that of vertebrates. In addition, these animals are largely solitary creatures. Thus, they directly contradict the belief that intelligence evolved only among social animals. In addition to acute visual senses, octopuses possess remarkable senses of touch and taste. Each sucker has thousands of chemical receptors which can taste and detect prey.

## Threats

The giant Pacific octopus is fairly common in its range. High reproductive rates make this species naturally resilient to ecosystem changes. The giant Pacific octopus has few natural predators as an adult. Powerful suckers, cryptic coloration, quick movements, and the ability to release ink to confuse predators often allows these animals to escape predation. Humans are one of the most significant octopus predators. Giant Pacific octopuses are fished commercially in North America and Japan and are popular cuisine in Asia. In North America, they were frequently caught to serve as bait for more desirable commercial species such as halibut in the 1950s and 1960s. This practice is no longer common today. The giant Pacific octopus can also be caught as bycatch. When this occurs, octopuses trapped in fishing nets may be disposed of by fishermen.

Though few studies have investigated the effects of global warming and ocean acidification on octopus populations, it is likely that these ecosystem changes will negatively affect populations over time as these animals are adapted to live in cool water.

## What We Can Do To Help

- Find out more. If you reside in British Columbia, there are many resources that allow you to learn about the giant Pacific octopus and other species. A great place to view a giant Pacific octopus and learn more is at the Vancouver Aquarium.
- Participate in Citizen Science. There are many ongoing citizen science projects and volunteer opportunities in British Columbia. Check out a local organization dedicated to marine conservation and learn about opportunities to get involved.
- The giant Pacific octopus is threatened by many of the same factors that other aquatic animals are. In general, conserving our local waters, following fishing guidelines, and purchasing sustainable seafood are important measures that we can take to create a healthier ecosystem that can harbor larger, healthier populations of aquatic animals. By allowing natural spaces to remain intact, we are taking a huge step forward in conservation. The Great Canadian Shoreline Cleanup (<http://www.shorelinecleanup.ca>) offers some great ways any one can get involved in maintaining the health of our local ecosystems by actively volunteering to help clean them up.
- Be conscious of what you eat. When consuming fish, look for the Ocean Wise logo. Learn more about Ocean Wise and sustainable seafood here: <http://seafood.ocean.org/>. Making sustainable choices when consuming seafood can also help limit bycatch from unsustainable fishing methods.

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## Other Interesting Facts

- Giant Pacific octopus arm spans can be up to 6 metres (20 feet) across
- Giant Pacific octopuses can consume 2-4% and gain 1-2% of their body weight in a day.
- Scientists recently discovered that the octopus genome's massive size is likely driven by the expansion of a few specific gene families which regulate neuronal development, gene shuffling, and the evolution of new genes. In short, octopus brains adapt and change very quickly.
- After hunting, octopuses often dispose of skeletal remains of their prey in front of their dens. These collections of bones are called "octopus gardens" or "middens".
- Octopuses have three hearts: one for circulating blood throughout the body and two to pass blood over the gills to oxygenate it
- Octopuses regulate colour changes using muscles that contract and relax around cells containing pigment. These cells are called chromatophores.

## Where & When to view the animal.

Divers look for clues such as skeletal remains in front of dens to find octopuses. Though they can be seen during the day, these animals are most active at night. A great place to spot octopuses is in tidal pools at low tide. They hide in rocks and crevices and frequently prey on Dungeness crabs and other species which can be found in the intertidal zones. The giant Pacific octopus is also common in dense kelp forests.

## Bibliography

An article from the magazine Futurity: "Alien" genome reveals octopus secrets

This is a great article about new research on octopus intelligence and genome evolution

<http://www.futurity.org/octopus-genome-980572/>

Alaska Fish and Wildlife News Website

This resource describes the role of the Giant Pacific Octopus in the Alaskan ecosystem

[http://www.adfg.alaska.gov/index.cfm?adfg=wildlifeneews.view\\_article&articles\\_id=303](http://www.adfg.alaska.gov/index.cfm?adfg=wildlifeneews.view_article&articles_id=303)

National Geographic

This article from National Geographic outlines some basic facts about the Giant Pacific octopus

<https://www.nationalgeographic.com/animals/invertebrates/g/giant-pacific-octopus/#close>

This document from Sea Grant describes some cool facts about the Giant Pacific Octopus

<http://seagrant.oregonstate.edu/sites/seagrant.oregonstate.edu/files/sgpubs/onlinepubs/g07002.pdf>

Animal Diversity Web

This website is a great encyclopedia resource to learn about a variety of species

[http://animaldiversity.org/accounts/Enteroctopus\\_dofleini/](http://animaldiversity.org/accounts/Enteroctopus_dofleini/)

Seattle Aquarium

This article on the Seattle Aquarium's website describes some characteristics of the Giant Pacific octopus

<https://www.seattleaquarium.org/octopus>

The National Aquarium

This article published by the National Aquarium outlines some facts about the Giant Pacific octopus

<https://aqua.org/explore/animals/giant-pacific-octopus>

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