

Virginia Opossum

Common name: Virginia Opossum
Family: Didelphidae
Order: Didelphimorphia
Class: Mammalia
Species: *Didelphis virginianus*
Other names: Possum
Origin: Southeast United States
Size: Males body length: 16 inches; tail length: 11-12 inches
Female body length: 16 inches
tail length: 11 inches



Photo credit: Wikimedia Commons

Description:

Morphological characteristics:

The coloration of Virginia opossums can change corresponding to different latitudinal distributions. Individuals in Northern areas are typically whiter as they have a thicker undercoat, whereas individuals in Southern regions are darker shades of gray, with a thinner white undercoat (McManus 1974). Males are usually larger than females in both length and weight and males tend to have longer tails. Virginia opossum tails are hairless and are often as long as their bodies. Opossum tails are prehensile, which allows individuals to utilize them as an additional limb, enabling them to grab and climb with it (Barnes 2010). Opossums also have opposable appendages, called hallux, which enable them to grab and climb and this facilitates foraging. Opossums have small, rounded hairless ears and a pointed snout. Their mouths contain 50 teeth, which is the largest number of teeth out of any mammal in North America.

Ecology:

Diet:

Opossums are opportunistic omnivores and will feed on a variety of sources given their current environment. Within an urban setting, opossums are often drawn to and consume garbage, bird seed and pet food left outside, they are also known to prey upon small mammals, and gastropods. Physiologically, opossums store little body fat, therefore they must forage for food year-round (Barnes 2010). Gut content analysis of opossums within the Portland Metro Area found that the majority of contents were mammal carrion (27%), followed by leaf litter (11%), fruits, seeds, and bulbs (10%) and gastropods (10%) (Hopkins and Forbes 1980)

Movement, Range and Behavior:

Virginia Opossum are synanthropic and can be found near human development both inside and outside their native range. Their native range is from Central America through the Southeastern United States and have since been dispersed to the Upper Midwest, and to the Pacific Northwest. Virginia Opossum are currently found within the Willamette Valley in Oregon (Meier 1983; Hopkins and Forbes 1980). In Corvallis, Oregon, opossums were found to have a relatively large home range, with males and females averaging 18.74 ha ranges (males ranged from 2.97 to 102.87 ha, females ranged from 2.39 to 19.07 ha) (Meier 1983). Increased male

home ranges may correlate with breeding period, as larger home ranges were observed during mating season (Meier 1983). A study in Corvallis, Oregon in the early 1980's (city pop: 41,000), found that the majority of total Opossum dens were located in residential areas, and 76% of the dens located were under existing structures (Meier 1983). Dens found in residential areas were in crawl spaces, garages, and where vegetation provided adequate cover (Meier 1983).

Within an urban environment, the movement of the opossum is dictated by temperature and precipitation, with heavier precipitation events and colder temperatures decreasing species movement (Meier 1983). Modeling approaches from a Midwest urban landscape, found that opossum colonization was positively correlated with housing density and distance to water (Fidino et al. 2016). Opossum occupancy modeling shows that individual detections are correlated with location to natural water source, regardless of season; but those observations are greatest at intermediate levels of human-development (Fidino et al. 2016).

Population size and Gestation:

There are two peak breeding seasons throughout the year, early spring, and late summer, with a report in Portland indicating an unexpected third season (Hopkins and Forbes 1979) Gestation for opossums is roughly 13 days, and litter sizes average 6 young per event (Hopkins and Forbes 1979). High fecundity is seen in the opossum with multiple breeding events and larger litters.

A study that examined the external factors that influenced opossum ecology, found that there was no evidence to indicate that population density affected survival probability (Troyer et al. 2014). Recruitment of both males and females was found to be higher in December and lowest in May, and both sexes were found to disperse to new areas (Troyer et al. 2014).

Interspecific Interactions:

Niche overlap between opossums and raccoons (*Procyon lotor*) in Oregon can occur due to the usage of similar habitats, namely in urban areas but also coniferous and deciduous forests. A manipulative experiment found that with the removal of raccoons, the realized niche of opossums shifted and they occupied areas where raccoons were dominant (Ginger et al. 2003). This suggests that raccoons may slow the population expansion of opossums (via biotic resistance).

Interesting Facts

Thanatosis:

Upon threat from predators, the Virginia opossum may feign death, in a final attempt to dissuade predation. This state of "playing dead" is involuntary and results from a series of neurological processes that trigger physical responses in the opossum, like rigid legs and slowed heart rate (Gabrielsen and Smith 1985).

Uniqueness:

The Virginia opossum is the only marsupial in North America.

Impact:

Pathogens and Diseases

Opossum can vector multiple diseases, some of which can impact humans, native organisms, or livestock. In their native range, Virginia Opossum play significant roles as reservoirs of the parasite that causes Chagas disease (*Trypanosoma cruzi*) (Bernasconi 2020). Chagas disease has been found to be vectored by 27 different mammal species in the United States, and its transmission can occur both from one generation to the next and through the environment (Bern et al. 2019). In humans Chagas disease can lead to heart failure.

In Michigan, 7.4% of Virginia opossums tested positive for bovine tuberculosis (*Mycobacterium bovis*)(Witmer et. al 2010). Bovine tuberculosis has been found to impact both cattle and Columbian white tail deer. Cattle serve as an important economic resource for select Oregonians, and the Columbian white-tailed deer is listed as a Critically sensitive species (ODFW 2021).

Within Southern California, Virginia Opossum, have recently been vectors of fleas resulting in subsequent disease impacts associated with parasites such as spotted fever (*Rickettsioses*) (Maina et al. 2016). If bitten by an infected flea, spotted fever can cause fever, vomiting and headaches in humans. Severe cases may require amputation of limbs, paralysis, hearing loss or mental disability (CDC 2019).

Natural Biota:

If present in a novel environment Virginia opossum can impact the native biota which may not have adequate defense mechanisms against it. Virginia opossums were found to have negative consumptive effects on amphibian species in the Midwest, opossums consumed all salamanders and newts regardless of toxicity (Hart et al. 2019). This consumption of amphibian species regardless of toxicity, could negatively impact some of Oregon's sensitive amphibians such as the Red-legged frog (*Rana aurora*) or the Oregon spotted frog (*Rana pretiosa*). Given that gastropods constitute roughly 10% of the Virginia opossum's diet, we can anticipate there will be an impact to Oregon's gastropod communities (Hopkins and Forbes 1980).

Action:

If captured, the Virginia opossum cannot legally be released, transported, or exchanged. Please contact your local ODFW office for more information for guidance with future steps. Division 56 rules indicate that this species may not be possessed as pets.

Status

Division 56 rules:

Didelphis virginiana, Virginia opossum, is currently listed as prohibited under Oregon's Division 56 rules. This means that they may not be imported, possessed, sold, purchased, exchanged, or transported in the state.

Application of OAR 635-056-0130 Classification Rules

A. Whether the species' natural range and habitat is similar to Oregon's climate

Moderate: There is overlap with the Virginia opossum's natural range in the Southeast United States. The species has survived in Northern colder climates, and warmer climates as well, indicating limited if any abiotic resistance.

B. Whether the species has an invasive history

High: The Virginia Opossum has successfully spread from Central America and the southeast US, to much of the US and up to Ontario and British Columbia.

C. Whether the species can survive in Oregon

High: It currently is surviving throughout Oregon.

D. Potential to introduce disease or parasites to native wildlife populations;

Moderate: Opossums are known vectors of Bovine Tuberculosis, which has been found to transfer to Raccoon, White-tail deer and cattle (Witmer et. al 2010). Additionally, opossums are vectors for the parasite that causes Chagas, which has been found to be zoonotic with the ability to transfer to humans, and to woodrats, coyotes and other mammals. (Bernasconi 2020; Bern et al. 2019).

E. Potential for interbreeding or hybridizing with native wildlife;

None: Opossums are the only marsupial found in the United States or Canada. There are no native members of the Didelphidae, therefore there is no risk for interbreeding or hybridization.

F. Possible competition with native wildlife for habitat, food, water, etc.;

High: The Virginia Opossum has high rates of fecundity, short gestation periods, moderate litter sizes and the ability to breed up to three times per year, all increasing potential individuals in a population (Hopkins and Forbes 1979). Additionally, the species has relatively large home ranges averaging 18.74 ha and its presence has been found to be correlated with water availability (Fidino et al. 2016). Physiologically, opossums store little body fat, therefore they must forage for food year-round (Barnes 2010). Their high fecundity rates, in conjunction with their large home ranges suggest overlap and competition with native wildlife.

G. Impacts on the habitat of native wildlife;

Moderate: Modeling approaches from a Midwest urban landscape within a non-native range, found that opossum colonization was positively correlated with housing density and distance to water, but observations are greatest at intermediate levels of human-development. (Fidino et al. 2016). Given this, the opossum appears to be synanthropic and any impacts to native wildlife habitat would result to native wildlife that live in close proximity to human development.

H. Potential predation on native wildlife;

Moderate: Gut content analysis from opossums in the Portland area found seasonal variation in consumption patterns of Virginia opossum. In winter month Virginia Opossum stomach contents consisted mostly of mammalian carrion and gastropod prey remains, while summer months resulted in higher gastropod consumption (Hopkins and Forbes 1980).

I. Feasibility of capturing and eradicating escaped animals;

Not feasible: This would require a massive coordination effort between multiple governmental levels and different NGOs to facilitate hand trapping efforts. The labor and time required to achieve this would be beyond the realm of possibility.

J. Cost of capturing and eradicating escaped animals; or

High: Manual trapping would need to take place. Poison could not be used due to non-target impacts.

K. Any other factor or consideration the commission considers necessary to protect and maintain native wildlife.

Potential consumption of gastropods and amphibians, which may impact already threatened Oregon species.

L. How is the species categorized in "The IUCN Red List of Threatened Species?"

Least concern, with the population trend increasing.

M. Is the species commercially propagated? Unknown, rarely, moderate, common

Unknown: Outside of Oregon, there may be a few states with opossum pet markets.

Northern Crayfish

Common name: Northern Crayfish

Family: Cambaridae

Order: Decapoda

Class: Malacostraca

Species: *Faxonius virilis* (formerly *Orconectes virilis*)

Other names: Virile Crayfish, Eastern Crayfish

Origin: Native west of the continental divide, from Montana to the Great Lakes and Upper Mississippi River Basin of the midwest.

Size: Adults reach a maximum length of 5 inches



Photo credit: Wikimedia Commons

Description

Morphological characteristics:

The coloration of the Northern crayfish is variable both in individual organisms and with respect to body segment (Durland 2023). Abdominal segments vary with colors ranging from reddish brown to dark green. Present on their abdomen are a pair of blotchy, dark markings that run anteriorly to posteriorly. Their chelae and legs can have a bluish tint and the tips of chelae are orange. The tips of adult chelae are whitish yellow in coloration.

Identification:

Northern crayfish can be difficult to properly identify compared to other invasive crayfish species currently in Oregon as coloration can be variable. The features of the chelae (pincers) provide an accurate method for identification of Northern crayfish compared to Oregon's native crayfish. Signal crayfish, native to the Pacific Northwest, have smooth claws that lack bumps, and also have a white hinge in their pinching chelae, whereas the Northern crayfish has bumpy chelae, and the hinge is not white (Durland 2023).

Ecology

Habitat requirements:

Water temperature is the best predictor for finding Northern Crayfish in Western Canada, a recently invaded region (Mierlo et al. 2022). The modeled probability of Northern crayfish occupancy increased exponentially at temperatures above 15.0°C (59.0°F). At temperatures above 18.7°C (65.7°F) there was a 50% probability of a stream reach being invaded with Northern crayfish. In addition to water temperature, turbidity and stream reach complexity were also found to be important variables in predicting probable stream invasions (Mierlo et al. 2022). Northern crayfish prefer water temperatures that are 21.0°C (69.8°F), and their optimal growth occurs at 26.0°C (78.8°F) (Westhoff and Rosenberger 2016).

Reproduction and Gestation:

Northern crayfish are cyclic dimorphic, meaning that they fluctuate between a reproductive and non-reproductive status throughout the year. Male northern crayfish, transitioning from their reproductive to their non-reproductive stage, spend a significant amount of their acquired metabolic energy (foraging) growing their carapace (Cabrera and Griffen 2023). During this period of increased metabolism, individuals may consume more thus having an increased impact to streams. Once in reproductive form, mating pairs of Northern crayfish spawn from July to September before overwintering in this form (Weagle and Ozburn 1972). The high fecundity of the northern crayfish is exemplified by the 200-800 released eggs by females in the spring.

Interspecies interactions:

Interspecific competition trials between Northern crayfish and Reticulate crayfish (*F. erichsonianus*), occurring in the Reticulate crayfish's native range, resulted in more successful contests for the native crustaceans (Rocco and Wofford-Mares 2022). This suggests that in select streams the Northern crayfish may be able to be outcompeted. Observations of Northern crayfish in the Snake River basin, found it to be allopatric with native crawfish (Larson et al. 2018). A laboratory study found that nitrate concentrations decreased Northern crayfish

foraging regimes (James et al. 2021). Increased nitrate concentration also decreased the number agonistic behaviors between Northern crayfish and Signal crayfish, where the Northern crayfish was the instigator. (James et al. 2021). This suggests in agricultural areas impacted by nitrogen pollution, there may be reduced establishment due to biotic resistance. Laboratory experiments examining agonistic behaviors between the Northern Crayfish and another species of crayfish, found that the pair engaged in frequent short duration fights, mostly over shelter space. (Bergman and Moore PA 2003). Researchers found that within oligotrophic systems, that northern crayfish act as prey items for non-native salmonids, (*O. mykiss*) and also directly consume a variety of macro invertebrates (Loffredo et al. 2019).

Status

Division 56 rules:

Controlled Crustacean Species under Oregon's Division 56 rules. This means the possession of this species is limited to educational purposes and immediate consumption within one week from when it was acquired. Live crayfish may not be used as bait except in the water they were taken from, and they may not be released into waters.

Interesting Facts: *interesting things about this species*

It is one of over 330 different crayfish species found in North America.

Impact: *Describe the impact that this species has on both human infrastructure and natural biota. Are these species a vector for disease, do they damage crops?*

Pathogen, Disease and Toxins:

Within its native range, the Northern crayfish, acts as an intermediate host for trematode parasites (*Microphallus* spp) and it was found that the presence of these parasites doesn't alter aggression or behavior of these species (Reisinger et al. 2015). Trace amounts of metals and metalloids have been found within Northern crayfish and while amounts are below the safe consumption level, human consumption of Northern crayfish should be done in moderation (Ikem et al. 2021). These metallic compounds are not only a threat to humans, but through bioaccumulation and biomagnification other trophic levels may experience threats.

Consumption of Native Biota:

The Northern crayfish is an opportunistic omnivore, consuming aquatic plants, larval fish, snakes, turtles, insects, and other invertebrates (USFS 2023). They feed on fish eggs which means there are less fish to be caught as a food source. Especially salmon and steelhead which are of great importance and significance to indigenous tribes in the Pacific Northwest.

Action: *What to do if you capture/trap one?*

You may dispose of them by eating them or using them as bait only in the waterbody in which they were found. If using them as bait, they may not be returned to the waterbody alive. Possession is strictly prohibited unless it's for educational purposes with proper permission.

Application of OAR 635-056-0130 Classification Rules

N. Whether the species' natural range and habitat is similar to Oregon's climate

Moderate: Currently, not all of the rivers in Oregon are suitable for the Northern crayfish as temperature is a major determining factor in their survival. Given alteration due to climate change, we expect this to be greater in the future.

O. Whether the species has an invasive history

High: This species has successfully invaded other river systems in the United States.

P. Whether the species can survive in Oregon

Moderate: There are current populations of Northern Crayfish in Southern Oregon streams.

Q. Potential to introduce disease or parasites to native wildlife populations;

Low: Crayfish plague (*Aphanomyces astaci*) has been found in populations of invasive Rusty crayfish (*Faxonius rusticus*), in the Northern Midwest (Panteleit et al. 2019). Additionally, Panteleit et al. (2019) found that crayfish plague vectored by invasive Rusty crayfish had been found in the native crayfish species. While this study was focused on Rusty crayfish, the potential for this disease to spread to Northern Crayfish (*Faxonius virilis*) is possible, which could impact Signal Crayfish in Oregon. Researchers have found that Northern crayfish can also contain trace amounts of metal and metalloid elements (Ikem et al. 2021). The presence of metals in organisms poses a risk for both bioaccumulation, and biomagnification which could potentially impact mammals and bird species that prey upon Northern Crayfish.

R. Potential for interbreeding or hybridizing with native wildlife;

Low: The risk to Oregon's Signal crayfish is low, as it is grouped in a different phylogenetic clade than the Northern crayfish (Wolfe et al. 2019). All risk is not mitigated due to these phylogenetic differences as researchers have found that Northern Crayfish have hybridized with both Rusty crayfish (*Faxonius rusticus*) and the Spothand crayfish (*Faxonius punctimanus*) (Rozanksy 2021; Simon 2002). The hybridization of the Northern crayfish and the Spothand crayfish yielded individuals that were nearly indistinguishable from each other, thus making potential eradication much more difficult (Rozanksy 2021).

S. Possible competition with native wildlife for habitat, food, water, etc.;

Moderate: They are opportunists, so they will eat pretty much anything including other crayfish. Since Northern Crayfish are very aggressive, they will be more likely to prey on Oregon's native Signal crayfish (Boatner 2022). In areas exposed to higher nitrate concentrations, researchers found that the foraging success of the Northern Crayfish decreased (*Faxonius virilis*) (James et al. 2021). This study was performed in laboratory conditions, not in Oregon but it is particularly relevant considering that Northern Crayfish are currently located in an agriculturally dominant area. The northern crayfish was found to recruit and consume less

macroinvertebrates, than a native crayfish, and also have lower activity (Reisinger et al. 2019). This experiment examined crayfish in the Northern Midwest, and may not reflect the relationship between the Northern crayfish and Oregon's signal crayfish, but it suggests that the presence of the Northern crayfish alone will exhibit additional stress on existing trophic systems.

T. Impacts on the habitat of native wildlife;

High: Northern crayfish are known to be cannibalistic and are more likely to prey upon Oregon's Signal crayfish. The Northern crayfish are extremely capable of out competing Signal crayfish (Boatner 2022). When exposed to higher nitrate concentrations Northern Crayfish (*Faxonius virilis*), were found to exhibit a greater number of agonistic interactions with another species of crayfish, thus increasing their likelihood of negatively affecting native crayfish (James et al. 2021).

U. Potential predation on native wildlife;

High: They will eat anything they can get their claws on and are able to be a risk to most aquatic native wildlife (Boatner 2022). A mesocosm predation experiment found that the Northern Crayfish, significantly preyed upon both fish and crayfish (Reisinger et al. 2019).

V. Feasibility of capturing and eradicating escaped animals;

Not feasible: Capturing these crayfish is relatively easy, but trying to eradicate them entirely would be difficult due to their high fecundity. Also due to them being in the same waters as endangered fish, putting chemicals in the water could impact those natives as well. Northern crayfish can be eaten, but this will not likely be the solution to getting rid of these crayfish for good (Boatner 2022).

W. Cost of capturing and eradicating escaped animals; or

Very High: Due to the abundance of northern crayfish and the waters they're located in are also home to native and endangered wildlife. This means eradication would not only have a high monetary cost, but also a cost of other wildlife that could be affected by eradication efforts (Boatner 2022).

X. Any other factor or consideration the commission considers necessary to protect and maintain native wildlife.

High: The impact on native and endangered fish is that the Northern crayfish will prey on their eggs. Along with the fact that introducing chemicals in the water would negatively affect these threatened and endangered species as well, using that as a way to eradicate the Northern crayfish is not feasible (Boatner 2022).

Y. How is the species categorized in "The IUCN Red List of Threatened Species?"

The species is not categorized in "The IUCN Red List of Threatened Species".

Z. Is the species commercially propagated? Unknown, rarely, moderate, common
Unknown: The propagation of Northern crayfish is not allowed in Oregon under Division 56.

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