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USGS Scientists Study Amphibian Declines

Over the last 50 years, many species of amphibian throughout the world have declined and some have become extinct. In some parts of Colorado and California, toads and some common frog species have virtually disappeared.

Declines are often a result of human activities, such as habitat destruction or pollution, acting at local levels. However in the late 1980s, biologists reported amphibian declines in apparently pristine areas, such as national parks. Hypotheses to explain these declines include introduced predators, disease, and increases in ultraviolet radiation (UVB).

Depletion of the Earth's ozone layer has caused UVB radiation levels in northern latitudes to increase over the past 20 years. Amphibians that breed in ponds often deposit eggs in shallow water where they are exposed to direct sunlight. Some studies have shown that eggs protected from UVB have greater hatching success than those not protected. This suggests that increases in UVB could be causing some amphibian declines.

In high-elevation ponds in ONP, USGS and University of Washington scientists took water samples and measured how deeply UVB light was able to penetrate. The ponds where UVB did not penetrate deeply were found to be more likely to have breeding populations of Cascades frog. Other amphibian populations were not associated with UVB penetration levels. UVB may be naturally reduced in the water column by dissolved organic carbon (DOC). This study provided preliminary evidence that Cascades frogs may prefer to breed in ponds containing higher levels of DOC. Cascades frogs are declining at the southern limit of their range (northern California) but are common in ONP.

Amphibians

Amphibians evolved from fishes about 360 million years ago and were the first vertebrates adapted to life on land. The word amphibian means "double life." It refers to the life history of many amphibians, which spend part of their life in water and part on land. There are three major groups of amphibians: salamanders, frogs and toads, and caecilians. Salamanders, frogs, and toads can be found in Olympic National Park (ONP), but caecilians live only in tropical regions. Most amphibians are generalist predators, eating almost any prey they can fit into their mouths.

Salamanders

Salamanders can be split into terrestrial, pond, and stream groups. Terrestrial salamanders spend their entire lives in rotting logs or in moist, rocky areas. The female deposits eggs on land and protects them for several months while they develop. Terrestrial species breed from fall through spring.

Stream-breeding salamanders have a distinct aquatic larval stage and, when mature, may remain in the water (like

the Cope's giant salamander which reproduces while still in the larval body form) or become terrestrial. Stream species appear to have a prolonged breeding season, spanning from spring to fall. Their larvae have the ability to overwinter.

Pond-breeding salamanders have a distinct aquatic larval stage which precedes a terrestrial adult stage. Pond species breed in the spring. Young aquatic salamanders feed on tiny animals called zooplankton. As salamanders grow they also eat aquatic insects, and some can eat other amphibians.

All salamanders in the Pacific Northwest, and almost all salamanders worldwide, have internal fertilization accomplished by the male directly or indirectly transferring a packet of sperm to the female.

Frogs and Toads

Like salamanders, frogs and toads (called anurans) can be split into pond- and stream-breeding forms, but there are no fully terrestrial anurans in the Pacific Northwest. Anurans generally reproduce in the spring and summer and nearly all fertilize their eggs externally, like fish. The stream-breeding tailed frog is one of the few exceptions (see page 4).

Most anuran eggs hatch in 1 – 4 weeks, depending on the species and water temperature. Most tadpoles are herbivorous, feeding mainly on green algae and diatoms.

Other than the tailed frog, all of the anurans in ONP have tadpoles that reach metamorphosis after a few months. Only tailed frogs are known to overwinter as tadpoles. This means that the other anurans must have tadpoles that develop very rapidly so they can metamorphose into adults prior to the onset of winter. This is especially important at higher elevations where the

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Long-toed salamander



Northwestern salamander egg mass



Cascades frog

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growing season is only a few months at best.

Most adult anurans in ONP move away from their breeding habitats during the summer. They feed in forests, meadows, or along streams.



Amphibian Habitats

USGS scientists are studying amphibians that live in low- (sea level to 500 m) and high-elevation (1000 to 1900 m) ponds and lakes in ONP. There are few mid-elevation ponds.

Generally, low-elevation ponds are warm, shallow, rich in nutrients and have abundant vegetation. Many pond-breeding amphibians attach their eggs to aquatic vegetation or

twigs. At high elevations, ponds tend to have cold, clear water, which holds more dissolved oxygen than warm water. The sparse vegetation at high elevations provides less shade from potentially harmful ultraviolet radiation. High-elevation lakes are often covered with ice and snow during the winter so tadpoles must metamorphose before the end of summer. But, salamander larvae can overwinter in frozen ponds.

The Park's coastal land is home to a number of the low-elevation pond breeders including: red-legged and Pacific tree frogs, rough-skinned newts, northwestern and long-toed salamanders, and western toads. These amphibians utilize both permanent and seasonal ponds.

Seeps and streams were also surveyed at varying elevations. Only streams with year-round water can support amphibians, although sometimes the

water may flow below the surface. At low elevations, the streams are often shallow, wide, and muddy. At higher elevations, most streams are steep and narrow with cold water rushing over rocks, clearing out silt.

To date, surveys in coastal streams suggest that no amphibians live in the coastal section of ONP. Perhaps there are few stream-dwelling amphibians present, which would make detection more difficult. USGS scientists continue to look for amphibians here but hypothesize that the slow current, warm temperature, and high sediment loads of coastal waters may not be suitable for stream amphibians.



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Tailed frogs and Olympic torrent salamanders prefer rocky, cold streams.

HABITAT



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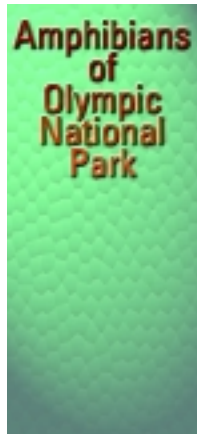
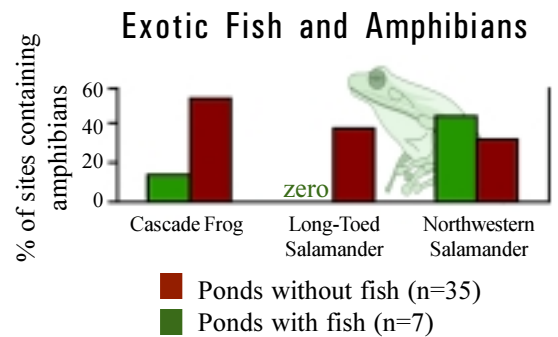
Western toads usually breed in ponds but are also found in the backwaters of rivers along valley bottoms.

There are few indications of a serious amphibian decline in ONP; at least not of the magnitude documented in Colorado and California. All of the species that were not marginal to ONP to begin with, were relatively common in USGS surveys. Although there is little historic information on the distribution and abundance of these species, USGS scientists see little reason to suspect that major changes have occurred.

A possible exception is the western toad, which was more rare than expected in mountain ponds, but was very common in valley bottoms on the west side of ONP. Scientists are trying to determine if some factor has caused toads to decline at high elevations in ONP or whether they always favored lower habitats in this region.

The effect of introduced fish on amphibians does not appear to be a severe management concern because pond-breeding amphibians are common and widespread in the many fishless ponds that are available (see graph). However drought or global climate change could decrease small waters, forcing remaining breeding into lakes with introduced fish. The importance of large waters to amphibians needs further investigation.

The lack of documented declines in ONP does not mean that no declines have occurred or will occur. It is very difficult to determine the status of a species, and scientists are always uncovering new information. The USGS, in cooperation with state and federal land-management agencies, has established a network of sites across North America to monitor amphibians. Olympic National Park is included in this network. The goal of this network is to determine the status and trends of amphibians in North America and to gather information useful in determining the causes of any declines that are observed.



Common Name	Scientific Name	Abundance in ONP	Breeding Habitat	Elevation*
Pacific tree frog	<i>Hyla regilla</i>	Intermittent	Ponds	Low to Mid
Red-legged frog	<i>Rana aurora</i>	Intermittent	Ponds	Low
Cascades frog	<i>Rana cascadae</i>	Common	Ponds	High
Tailed frog	<i>Ascaphus truei</i>	Common	Streams	Low to High
Western toad	<i>Bufo boreas</i>	Intermittent	Ponds	Low to High
Northwestern salamander	<i>Ambystoma gracile</i>	Common	Ponds	Low to High
Long-toed salamander	<i>Ambystoma macrodactylum</i>	Common	Ponds	Low to High
Rough-skinned newt	<i>Taricha granulosa</i>	Intermittent	Ponds	Low to Mid
Cope's giant salamander	<i>Dicamptodon copei</i>	Intermittent	Streams	Low to Mid
Olympic torrent salamander	<i>Rhyacotriton olympicus</i>	Common	Streams or seeps	Low to High
Van Dyke's salamander	<i>Plethodon vandykei</i>	Rare	Seeps	Low?
Western red-backed salamander	<i>Plethodon vehiculum</i>	Common	Forest	Low to Mid?
Ensatina	<i>Ensatina eschscholtzii</i>	Intermittent	Forest	Low to Mid?

* Low elevation is defined as sea level to 500 meters; Mid = 500-1000 meters; High = 1000 meters and above. ? = poorly known range.

Rare Amphibians

Some rare amphibians that exist only in the Pacific Northwest are found in ONP. Cope's giant salamanders are only found in a small area of western Washington and northwestern Oregon. They are most common on the Olympic Peninsula. The terrestrial phase of Cope's giant salamander is very rare. Only six have been observed. Oddly, Cope's were not found in streams from the Elwha to the Duckabush drainages on the northeast side of ONP. There is no historic record of this salamander



**Olympic
torrent
salamander**

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being found in those drainages inside ONP, so it is not known if these data show a decline or unused habitat. The USGS is investigating this pattern.

The Olympic torrent salamander is found only on the Olympic Peninsula. Van Dyke's salamander, which is often found near forest streams

and seeps, occurs in only three areas of Washington: Olympic Mountains, southern Cascades, and Willapa Hills. This species is rare in ONP and populations are small.

Dealing with Predators

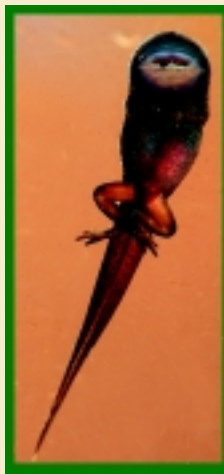
Predators of amphibian eggs and larvae include aquatic insects, fish, snakes, mammals, birds, and adult amphibians. Adults are preyed upon by some mammals, birds, and snakes. All amphibians have poison glands in the skin and some can secrete a mild toxin when they are threatened. Adult rough-skinned newts contain enough poison to kill 25,000 mice! Most amphibians don't secrete enough toxin to seriously harm humans who are just handling them, but be careful not to rub your eyes after contact.

Ensatina, a forest salamander, will break their tail off as a defense mechanism. Predators may attack or swallow the wriggling tail while the owner sneaks off to safety. The tail will grow back slowly.

Tailed Frog: A one-of-a-kind anuran



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The tailed frog is the most ancient species of anuran in the world and is found only in the Pacific Northwest.



It is the only anuran with true internal fertilization. The "tail" is a male copulatory organ. Females store sperm in their oviducts for up to ten months, at which time they fertilize their eggs internally, then deposit the eggs under rocks in streams.



They are the only anuran in ONP that breeds in torrential (fast water) habitats.



Tadpoles (right photo) have large sucker mouths which they use to cling to rocks in fast water.



USGS scientists study the effects of introduced trout on amphibians.

Trout that were historically stocked for fishing in ONP are also potential predators. Fish stocking no longer occurs in ONP, but many trout populations continue to thrive in lakes and ponds that were formerly fishless. USGS and other scientists have found that long-toed salamanders and possibly Cascades frogs do not survive well around introduced trout. However, northwestern salamanders frequently coexist with introduced fish.



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