2014 Year of the Salamander

Salamander News

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www.yearofthesalamander.org

Saving a Japanese Giant

- by Sumio Okada, Department of Social Systems Engineering, Tottori University

An example of a typical habitat of the Japanese Giant Salamander in the Chugoku Mountains. Giant salamanders can still be found within the village.

My first research experience with the Japanese Giant Salamander (*Andrias japonicus*) was with my teacher, herpetologist Taeko Utsunomiya, at a famous habitat in the Chugoku Mountains of Japan in 1996. During our surveys, we found many large adults but no larvae. We thought this might be a sign of low larval recruitment, and we became concerned about the conservation status of the species. The Japanese Giant Salamander became a nationally protected species in 1951. More recently, the Japanese Ministry of Environment raised its conservation status to "vulnerable" from "near threatened" because of effects of habitat loss and degradation associated with human activities such as dams, the building of protective bank walls, and erosion and flood-control measures.

Unfortunately, baseline data on population size, density, and structure of the Japanese Giant Salamander is limited throughout its range. Since 2000, I have been conducting mark-recapture and radio-telemetry studies of the Japanese Giant Salamander to study population trends, movements, diet, and the impacts of dams within both relatively pristine as well as disturbed stream habitats within the Chugoku Mountains. My results have revealed that the availability of suitable breeding nest habitat is relatively limited, and that most nest habitats are regularly destroyed by disturbances such as floods. Because of the ephemeral nature and limited availability of nest habitat, the Japanese Giant

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Giant salamanders congregating at a natural breeding nest site along the bank.

sponsored by PARC - Partners in Amphibian and Reptile Conservation

Get Your May Photo Contest Calendar - Free!

A North American giant at risk - that's the **California Giant Salamander (*Dicamptodon ensatus*)**, this month's calendar winner by **Ivan Parr**. Native to only a small coastal area near San Francisco, CA, its habitat is threatened by urbanization and climate change. To get the big picture and see our runner-up, also an inhabitant of sensitive habitat, go to **http://www.parcplace.org/images/stories/YOSal/YoSalCalendarMay.pdf.**

Call for Photos for the 2014 Year of the Salamander Calendar Photo Contest

We are seeking close-up, digital photos of salamanders, preferably in their natural habitats or within an educational or conservation context. One winner will be selected each month to be the featured photo as part of the Year of the Salamander online calendar. Runner-up photos will also be included in the calendar. In addition, all submitted images will be considered for use in the Year of the Salamander monthly newsletter and website as well as other Year of the Salamander-related conservation, outreach, and educational efforts. Give us your best shot! For more information and for entry details, please visit **http://www.parcplace.org/images/stories/YOSal/YOSphotocontest.pdf**.

Are Sirens calling you?

We especially need photos of some of our more elusive salamanders, the sirens, mudpuppies, amphiumas, and torrent salamanders, as well as species in the family Hynobiidae, and *Triturus* newts. If you have a good shot of any of these species that you're willing to enter in the photo contest, send them on in!

You Can Participate

Want to participate in a meaninful way in Year of the Salamander? There are lots of opportunities available.

Make a video to enter in our video contest (p. 3).

Help the Orianne Society track breeding times of Wood Frogs and Spotted Salamanders as part of their "Snapshots in Time" project, **www.oriannesociety.org**. Also see p. 9, April *Salamander News*

Help the University of Connecticut Ecology and Evolutionary Biology department collect data on the spring breeding migrations of Spotted Salamanders, Wood Frogs, and Spring Peepers in their Migration Tracker project. See p. 12, April *Salamander News*. **Email: urban.lab.uconn@gmail.com**
Website: http://hydrodictyon.eeb.uconn.edu/people/urban/tracker.html

Attend the Year of the Salamander exhibition, May 24 - June 22, at Art.Science.Gallery, Austin, TX. Visit **http://www.artsciencegallery.com/salamander/** for details.

Contribute to the crowdfunding campaign for a book on Fire Salamanders. See p. 15, April *Salamander News* or go to: **http://www.indiegogo.com/projects/fire-salamander-photo-book** **https://www.facebook.com/firesalamanderbook**

See Upcoming Meetings and Events, p. x, for more activities, including family-friendly events.

April Newsletter Content Coordinator: Elke Wind **Salamander News Facilitator:** Tom Gorman
Design and layout: Kathryn Ronnenberg **Year of the Salamander Committee Chair:** Mary Beth Kolozsvary

Announcing a Year of the Salamander video contest!

Here's how you can participate!

Partners in Amphibian and Reptile Conservation and conservation groups from around the world have designated 2014 as the Year of the Salamander. Through this unprecedented partnership, organizations and individuals will work together to raise awareness of salamanders as well as scale up global salamander conservation, education and research efforts.

Here's your chance to get involved with the Year of the Salamander **by entering our video contest**:

Contest: "Salamanders Matter" video campaign! Make a video that will help raise awareness to the general public about salamanders around the world!

You may want to make a video on:

- Why salamanders are important to people and natural systems;
- What people can do to conserve salamanders;
- Why salamanders are important to you; or
- "Public service announcements" (e.g., watching out for salamanders on the roads during migration).

But you are not limited to just these ideas!

We're looking for videos that not only convey salamander conservation messages, but that also reflect your passion for these amazing species. They can be edited and polished videos, or rough cuts shot from your phone out in the field.

Salamanders Matter
...to aquatic, riparian, and terrestrial ecosystems, and the interconnections among them. Seal Salamander, *Desmognathus monticola*, by Marty Silver, Year of the Salamander Photo Contest.

Whether it is animation, live action, an original song, or something completely different, be sure to tell your story in a clear and creative way. Be sure to also come up with a unique and creative name for your video entry.

Deadline for the "Salamanders matter" contest is **July 31, 2014**.

Complete guidelines and contest details are posted on the Year of the Salamander webpage (**www.yearofthesalamander.org**). If you have any questions, please email us at: **yearofthesalamander@gmail.com**.

Salamanders are...watching you!
Yonahlosee Salamander, *Plethodon yonahlosee*, by Madelyn Messner Year of the Salamander Photo Contest.

Year of the Salamander Podcasts Coming Soon!

Podcasts will soon be posted on the Year of the Salamander webpage (**www.yearofthesalamander.org**). Check the site for details later in May.

Year of the Salamander Collaborating Partners

The Year of the Salamander Planning Team is pleased to welcome the following organizations to our growing list of collaborating partners:

Blue Lion Training www.blueliontraining.com

Blue Lion Training is dedicated to America's natural resource professionals, students and institutions by providing the most comprehensive field training available. This is accomplished through college credit courses, professional field courses, online MOOCHs and weekend based courses.

North American Association for Environmental Education www.naaee.net

For more than four decades, NAAEE has been a leader in promoting excellence in environmental education throughout North America. It is the only national membership organization dedicated to strengthening the field of environmental education and increasing the visibility and effectiveness of the profession. NAAEE's influence stretches across North America and around the world. These members are professionals with environmental education responsibilities and interests across business, government, higher education, formal (K–12) education, nonformal education, early childhood education, science education and STEM, and other sectors of society.

The Wildlife Society www.wildlife.org

The Wildlife Society was founded in 1937 and is a non-profit scientific and educational association of nearly 11,000 professional wildlife biologists and managers, dedicated to excellence in wildlife stewardship through science and education. Our mission is to represent and serve the professional community of scientists, managers, educators, technicians, planners, and others who work actively to study, manage, and conserve wildlife and its habitats worldwide.

Vermont Reptile and Amphibian Atlas http://vtherpatlas.org

The Vermont Reptile and Amphibian Atlas gathers and disseminates data on the reptiles and amphibians of Vermont in a way that involves and informs Vermont individuals and organizations so that they will become more informed and effective stewards of wildlife habitat.

BHHU- ATRA www.rufford.org/projects/emina_šunje

ATRA is the first herpetological Association founded in Bosnia and Hercegovina in the year 2013. ATRA will be mainly involved in solving problems related to the lack of existing data and resources for qualitative studies considering: research, monitoring and protection of BiH herpetofauna as well as in defining and establishing regulations regarding Natural Resources management in BiH. Currently the Association is conducting a project regarding distribution and conservation of the Black Salamander (*Salamandra atra*) from mountain Prenj.

We are still recruiting partners! If you are interested in contributing to the Year of the Salamander efforts, please send an email to **yearofthesalamander@gmail.com** with a brief description of your organization and its efforts. Our full list of partners can be found at **http://www.parcplace.org/news-a-events/2014-year-of-the-salamander/68-uncategorised/281-year-of-the-salamander-partners.html**

***Saving a Japanese Giant**, continued from p. 1*

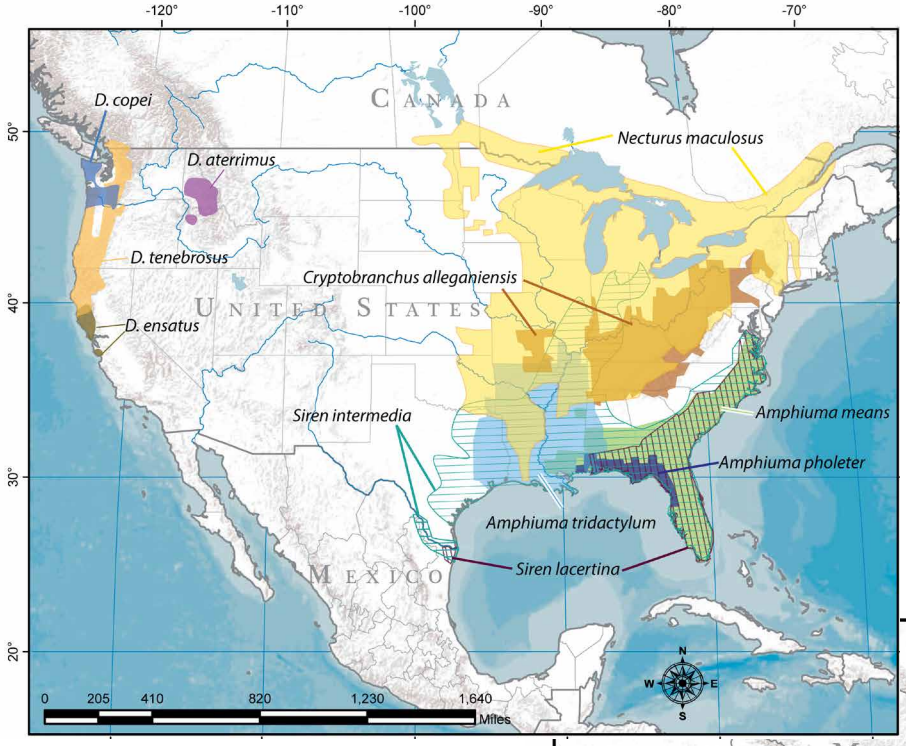
Salamander must be able to migrate between stream sections to reach newly created nest habitats. Compared to the unimpeded movements of salamanders in streams during the breeding season in relatively pristine areas, the movements of many salamanders within disturbed habitats were interrupted (blocked) by dams. It should be noted that this study is limited to a small part of the species' range, and that range-wide, long-term monitoring of the Japanese Giant Salamander is needed.

A giant salamander attempting to climb over a dam and concrete wall during summer.

Working with local people to set up an artificial nest box for the Japanese Giant Salamander.

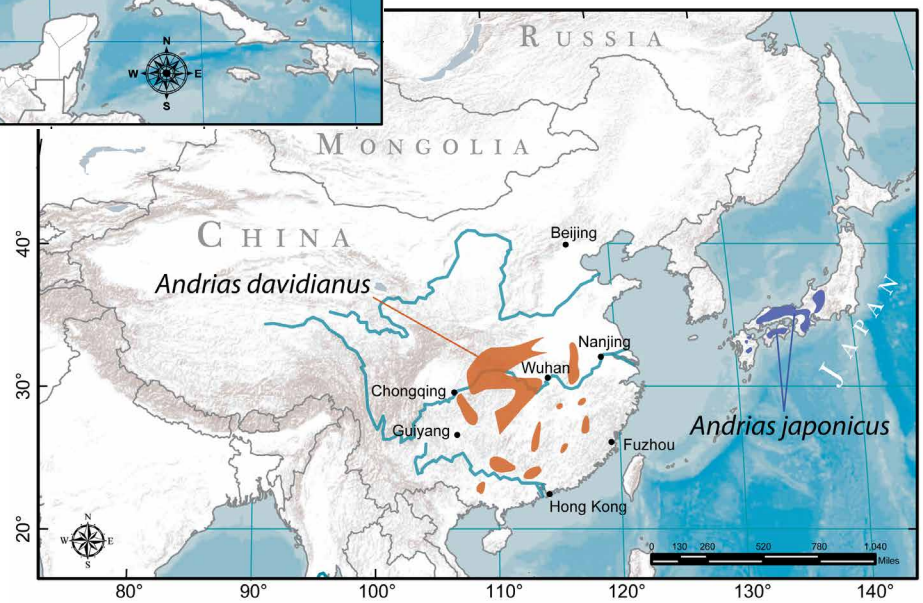
In addition to field work studying the Japanese Giant Salamander, I have worked to educate people living within my study area to raise awareness for future conservation. The 5th annual meeting of the Japanese Giant Salamander Society was held at one of my study areas in the Hino River, Tottori Prefecture, in 2009. This was the first successful meeting hosted by local people. As a result, the local people established a Japanese Giant Salamander conservation group that works with the local community to protect the species. In addition, just this past winter, following my suggestions, the Tottori Prefectural government constructed a total of twelve bypass slopes for reducing dam impacts on the Japanese Giant Salamander in a branch stream of the Hino River (below). In the coming years, I will monitor the effect of these dams on the Japanese Giant Salamander with the help and involvement of the local people.

Bypass slope constructed against one of the highest dams occurring within a stream occupied by Japanese Giant Salamanders. The bypass slope will hopefully allow the salamanders to access upstream nest habitats. Photos courtesy of Tottori Prefecture Seibu Regional Office Hino Promotion Center.



Pulling together this issue of the Salamander News raised an interesting question: Which salamander species count as "giant"? Only those with "giant" in their family common names? Only those attaining more than a certain length? How long do they have to be to count? While others may argue that additional species should be numbered among the giants, this is the summary that we came up with.

Maps by Kathryn Ronnenberg, U.S. Forest Service, Pacific Northwest Research Station



Giant Salamanders: What and Where Are They?

Habitat as adults:
T = terrestrial
A = aquatic

Family	Species	Total length	Habitat	Where
Amphiumidae	Two-toed Amphiuma, *Amphiuma means*	to 116 cm	A	USA
	One-toed Amphiuma, *Amphiuma pholeter*	22-33 cm	A	USA
	Three-toed Amphiuma, *Amphiuma tridactylum*	46-106 cm	A	USA
Cryptobranchidae	Chinese Giant Salamander, *Andrias davidianus*	to 180 cm (avg. ~100 cm)	A	China
	Japanese Giant Salamander, *Andrias japonicus*	30 – 150 cm (avg. 60-70 cm)	A	Japan
	Hellbender, *Cryptobranchus alleganiensis*	30-74 cm	A	USA
Dicamptodontidae	Idaho Giant Salamander, *Dicamptodon aterrimus*	17-25 cm	T, A	USA
	Cope's Giant Salamander, *Dicamptodon copei*	to 20.5 cm	A, T	USA
	California Giant Salamander, *Dicamptodon ensatus*	17-30.5 cm (T), to 35 cm (Ap)	T, A	USA
	Coastal Giant Salamander, *Dicamptodon tenebrosus*	to 33 cm (T), to 30 cm (Ap)	T, A	USA, Canada
Proteidae	Mudpuppy, *Necturus maculosus*	20-49 cm	A	USA, Canada
Sirenidae	Lesser Siren, *Siren intermedia*	18-69 cm	A	USA, Mexico
	Greater Siren, *Siren lacertina*	50-98 cm	A	USA, Mexico

Giants of the Pacific Northwest

by Dede Olson and Alex Foster (US Forest Service), David Pilliod and Adam Sepulveda (US Geological Survey), and Ken Honeycutt (University of Montana)

Figure 1. The Coastal Giant Salamander occurs in mountain streams from southern British Columbia south to northern California. Photo © David Herasimtschuk.

The various giant salamander species of the U.S. Pacific Northwest are not so "giant" on a world scale, but as adults on land, they are the largest salamanders in North America, reaching up to14 inches (35.5 cm) long. By comparison, Chinese Giant Salamanders can be 10 times longer, but they are strictly aquatic. Still, these Northwest giants are remarkable animals and are big enough to make two handfuls! They are important prey and predators in both aquatic and terrestrial ecosystems. On land, they have been observed eating the large banana slugs of the region, and even small rodents. In water, they prey on aquatic invertebrates, juvenile fish, and tailed frog (*Ascaphus* spp.) tadpoles. They have also been heard to growl or bark!

The giant salamanders of the Northwest are members of the family Dicamptodontidae and genus *Dicamptodon.* Historically, they were categorized among the family Ambystomatidae, but today they are considered distinct. This group of salamanders is heralded as an important biodiversity component of cool streams in moist coniferous forests of the Pacific Northwest. Conservation concerns have arisen for these endemic salamanders relating to timber harvest and associated road building activities, especially those practices that result in stream sedimentation, elevated stream temperatures, and altered stream flows. Additionally, terrestrial adults may be affected by timber harvest practices upslope from streams. In western Oregon, studies of giant salamanders living in small headwater streams have found that their numbers did not decrease in streams following forest thinning with protected streamside buffer zones. Questions remain as to the variety of conditions needed in managed forests to retain these salamanders – How wide do stream buffers need to be? What types of upland conditions in managed forests will retain these animals and allow overland dispersal?

There are four giant salamander species across the Pacific Northwest. The California Giant Salamander (*Dicamptodon ensatus*) has a small range near San Francisco, California. The Coastal Giant Salamander (*D. tenebrosus*; Fig. 1) is the most well-known and largest of the four species, with a range overlapping the California Giant in California and extending northward through western Oregon and Washington to British Columbia, Canada. Here, we spotlight the other two species: Cope's Giant Salamander (*D. copei*) and Idaho Giant Salamander (*D. aterrimus*).

Figure 2. Aquatic Cope's Giant Salamander, *Dicamptodon copei*. Photo © L.L.C. Jones.

Cope's Giant Salamander

The Cope's Giant Salamander is the smallest of the Northwest giants, reaching only about 8–9 inches (20.0–22.8 cm) in length (Fig. 1). It occurs in and along cool, small streams in the moist temperate forests of western Washington and northwestern Oregon (Fig. 2). Most populations were originally thought to be entirely paedomorphic (sexually mature adults with gills), spending their entire life cycle in the water. However, this is a little-known species and as new knowledge emerges, the occurrence of metamorphosis into terrestrial adults is becoming known. Genetic analyses support this species to be dispersal-limited, which is consistent with its movements being restricted to stream channels.

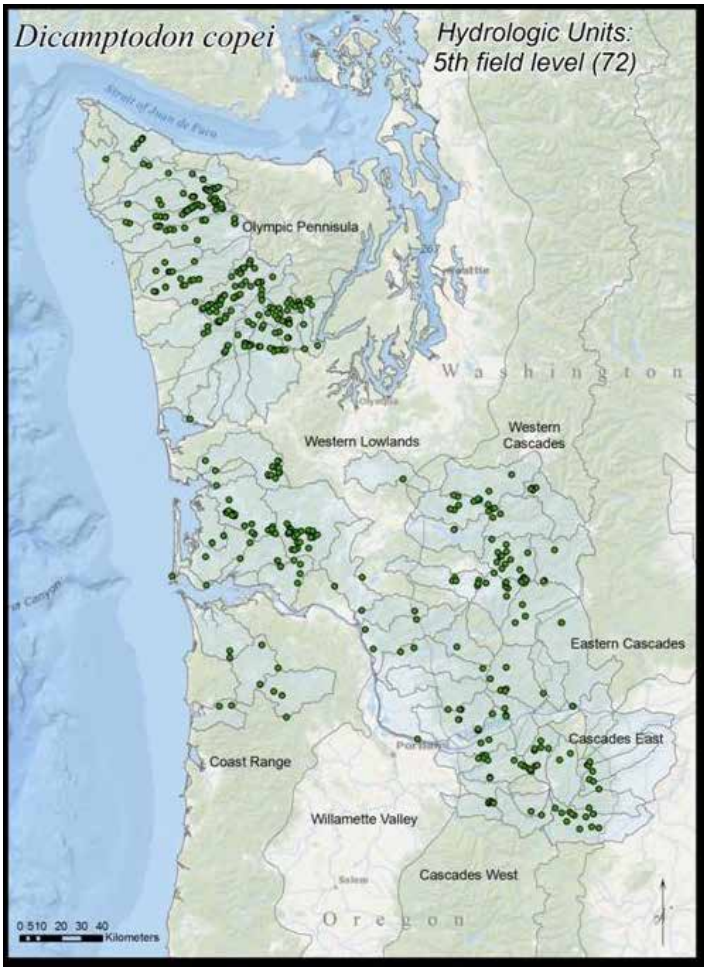


Figure 3. Distribution of the Cope's Giant Salamander, *Dicamptodon copei*, in western Oregon and Washington, USA. This species is currently known from 72 fifth-field watersheds. Map from Foster and Olson, submitted, federal special status and sensitive species conservation assessment.

Cope's Giant Salamander has status of concern in both Oregon and Washington, where it occurs on state and federal lists of sensitive species due to its rarity and known or suspected threats. Land-use activities that alter stream and riparian temperatures, substrates, and stream flow may affect this species. Due to its restricted distribution in coniferous forests, forest management and associated road building and maintenance activities are of greatest concern. The main concerns for Cope's are forest management activities that increase stream siltation and water temperatures, which may be effectively mitigated through riparian buffers. For stream-restricted species such as paedomorphic Cope's Giant Salamanders, ensuring aquatic organism passage at stream-road crossings (culverts) is of paramount importance. Additionally, these salamanders may be affected by water flow changes to small streams associated with climate change projections, as well as chemical applications, introduced species, and disease.

Idaho Giant Salamander

The Idaho Giant Salamander occurs in central and northern Idaho, where it is a "species of greatest conservation need". However, recent surveys using electrofishing techniques have shown the species to be more common than originally thought and it was recently found in a few locations in western Montana. The distribution of Idaho Giants can be very patchy, but where they do occur they can be very abundant. Idaho Giants are usually associated with small headwater streams in coniferous forests, but they have also been observed in larger rivers. They appear to have broad local habitat requirements, as they have been observed in both fine sediment and larger cobble substrate, in riffle, run, and pool habitats, and in low to high stream gradients. As Idaho Giants spend most of their time hidden under stream banks and behind rocks, documenting the distribution and abundance of these animals generally requires backpack electrofishing to spook them out of hiding or sampling for traces of their DNA in the stream water.

Figure 4. Relatively large size and more brightly patterned terrestrial form of the Idaho Giant Salamander. Photo © Michael Capozzoli.

Idaho Giants reach about 9 inches (22.8 cm) in total length and larger individuals can weigh over a quarter pound (113 g). Like other Pacific Northwest giants, populations of Idaho Giants are composed of both terrestrial and paedomorphic adults. The metamorphosed (or "terrestrial") form of adults is quite handsome with deeply contrasting light and dark marbled patterns. The coloration of the paedomorphic form is less striking compared to the terrestrial form, being consistently dark grey to black on top with occasional lighter-colored splotches (Fig. 5). Both adult forms generally have paler underbellies. Though both

forms of adults can be found within streams, the paedomorphic form is more frequently encountered. Because most formal studies on this species have relied on in-stream surveys, the relative abundance of the terrestrial form in the overall population is largely unknown. Regardless of their adult form, these salamanders spend several years within streams as larvae before reaching maturity. Larvae and paedomorphs have a general diet, which primarily consists of stream and terrestrial insects. However, larger individuals can be cannibalistic and can also prey on small fish. In streams without fish, Idaho Giants are a top-level predator.

Idaho Giant Salamanders are not sedentary. Short-distance movements of less than 50 yards within the stream channel are common, but some individuals do move longer-distances, with some recorded movements longer than 100 yards (91 m). The majority of these movements are downstream. However a small, and important, percentage do move upstream, likely leading to population persistence in headwater streams. As a result of these movements, individuals within and among neighboring streams have high rates of gene flow. Because movement along the stream channel is common and because rare upstream movements are likely needed for population persistence, Idaho Giants may be particularly susceptible to the effects of road culverts, which may be a barrier to movement. Not surprisingly, occurrence of Idaho Giants is highest in roadless drainages. Currently, replacement of culverts is a priority in west-side watersheds to mitigate fish passage, and newer culvert designs allowing fish passage are being installed in many locations, including within the range of Idaho Giants. Where Idaho Giants co-occur with fish they will likely benefit from the increased movement opportunities that new culverts afford. However, many populations of Idaho Giants occur in fishless streams that are currently not targeted for culvert improvements. Hence, the connectivity and movement needs of Idaho Giant Salamanders are often overlooked.

Figure 5. Aquatic Idaho Giant Salamander. Photo © Jason Blakney.

Upcoming Meetings & Events

Sabino Canyon Lizard Walk, May 10, 8 am, Sabino Canyon Recreation Area, Tucson, AZ. Meet at the visitors' center.

6th Conference on the Biology of Plethodontid Salamanders, May 18-20, Tulsa, OK. More info at **http://plethodontids2014.weebly.com/**

Search For Salamanders, May 23, 6-8 pm, Horseman's Shelter, Edison Woods MetroParks, Erie County, OH. **www.activityreg.com**

Salamander Open Center Day, May 24, 9 am-3pm, with live salamanders, Sessions Woods Conservation Education Center, Burlington, CT. See <**DEEP link**> for details.

Salamander Art Exhibit, May 24 – June 22, Art. Science.Gallery, Austin, TX. An informal class, Herpetology 101, will be given as part of the exhibition.

EuryceAlliance Scientific Working Group 3rd meeting, May 30, hosted by Art.Science.Gallery, Austin, TX.

Texas Salamander public lecture, June 7, Art.Science. Gallery, Austin, TX.

Biology of Plethodontid Salamanders course, June 9-21, Highlands Biological Station, Highlands, NC. More info at **www.highlandsbiological.org**

"Fate of Salamanders in the Anthropocene", June 15, Discussion panel symposium, Association of Environmental Studies and Sciences (AESS) conference, New York, NY. See **http://aess.info/** for details.

Conservation Genetics of Salamanders course, July 7-19, Highlands Biological Station, Highlands, NC. More info at **www.highlandsbiological.org**

2014 Joint Meeting of Ichthyologists and Herpetologists (SSAR/ASIH), July 30 – August 3, Chattanooga, TN. More info at **www.dce.k-state.edu/conf/jointmeeting/**

Family of the Month: Dicamptodontidae

The Pacific giant salamanders, the family Dicamptodontidae, are found mostly in and along permanent streams of the mountain forests in the Pacific Northwest of the United States (San Francisco Bay area to Washington state) and coastal British Columbia. They rely on cold flowing water, and may occur up to 5,900 ft (1800 m) above sea level. The Coastal Giant Salamander (*Dicamptodon tenebrosus*) reaches lengths of 13 inches (33 cm), and thus rivals its ambystomatid cousins as the largest terrestrial salamander on Earth. Along with a robust body shape and thick strong limbs, Coastal Giant Salamanders are also known for their large jaws and massive tongues, which enable them not only to grasp and consume large prey like rodents, but also to defend themselves against predators such as snakes. Unlike the silent posturing of most salamanders, the Coastal Giant can create a croaking or growling sound when threatened, and the threat isn't empty—they pack quite a powerful bite. All species of Pacific giant salamanders can mature as aquatic paedomorphs, retaining their gills and living out their lives in headwater streams; this life strategy is dominant among Cope's Giant Salamanders (*D. copei*), common in Idaho Giant Salamanders (*D. aterrimus*) and Coastal Giants, and fairly uncommon among California Giants (*D. ensatus*).

Terrestrial form of Coastal Giant Salamander, *Dicamptodon tenebrosus*.

Idaho Giant Salamander (*Dicamptodon aterrimus*) paedomorph.

Family: Dicamptodontidae

Also known as:	Pacific Giant Salamanders
Number of Species:	4 species in 1 genus, Dicamptodon
Region / Habitat:	- found in southwestern British Columbia, western Washington and Oregon, north-central Idaho, and coastal northern California - live primarily in and near cold-water streams - aquatic forms can be very sedentary, and may be found beneath the same boulders or logs year after year
Physical Characteristics:	- maximum length of about 13 inches - robust body shape with thick, strong limbs - possess eyelids - large heads and strong jaws
Behavior / Development	- primarily nocturnal - eggs are laid in cold, fast-flowing water atop or beneath rocks - larvae are aquatic, found in cold-water streams - all species of *Dicamptodon* can mature as aquatic paedomorphs, and adult Cope's Giant Salamanders (*Dicamptodon copei*) are most often found in this form
Fun Fact:	Salamanders in this family have massive tongues and larger jaws, which are very important when hunting or feeding as they help to grasp large or heavy prey. Giant salamander larvae and paedomorphs can be the dominant predators in many headwater streams.

Raising Awareness for Hellbender and Mudpuppy Conservation

by Amber L. Pitt, Bloomsburg University of Pennsylvania, Bloomsburg, PA

Quick survey: Have you ever seen a Hellbender? How about a Mudpuppy? Do you know how to tell them apart? Do you know where they live? Do you know what to do if you find one? Do you know that these salamanders are increasingly imperiled and in need of conservation action? If you answered "yes" to all of these questions, good for you! You are well on your path to helping hellbenders and mudpuppies.

Mudpuppy. Photo © Curt Karboski.

Many people aren't as lucky as you are when it comes to knowing about hellbenders and mudpuppies. Turns out, there are still plenty of people out there that have never even heard of these salamanders, so let's provide a little helpful information: Hellbenders and Mudpuppies are both large-bodied, long-lived salamanders that spend their entire lives in freshwater. There are two subspecies of Hellbenders, the imperiled Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) and the federally endangered Ozark Hellbender (*Cryptobranchus alleganiensis bishopi*). Eastern Hellbenders are native to the eastern United States from southern New York to northern Alabama, but a disjunct population is also found in Missouri. Ozark Hellbenders are endemic to rivers and streams in the Ozarks of southern Missouri and northern Arkansas. Hellbenders are primarily nocturnal, long-lived (estimates range from 30–55 years), large-bodied (up to 2.5 feet [76 cm]), fully aquatic salamanders that live under rocks in clean, fast flowing, highly oxygenated rivers and streams. The skin of the gill-less adult hellbenders has many folds and is the site of gas exchange. Hellbenders are threatened by a variety of factors including habitat destruction and degradation, especially as a result of pollution and siltation, disease, and collection.

Two subspecies of Mudpuppies are recognized. The most widespread subspecies, which is sometimes referred to as the Common Mudpuppy (*Necturus maculosus maculosus*), is native to southeastern Canada and the eastern United States, ranging from southern Quebec, Ontario, and Manitoba to northern Mississippi, Alabama, and Georgia. The Red River Mudpuppy (*Necturus maculosus louisianensis*) is found from southern Missouri and Kansas to northern Louisiana. Mudpuppies are primarily nocturnal, long-lived (average lifespan is estimated to be 11 years, but maximum lifespan estimates range up to 34 years), large-bodied (up to 1.6 feet [48 cm]), fully aquatic salamanders that live under cover objects such as rocks and logs in permanent water bodies including rivers, streams, ponds, and lakes. Unlike adult Hellbenders, the smooth-skinned adult Mudpuppies have large external gills which serve as the site of gas exchange. The current status of mudpuppy populations varies throughout their geographic distribution, but is unknown throughout much of their range. Some populations are considered robust, while other populations have declined or been extirpated. Mudpuppies are threatened by a variety of factors including habitat destruction and degradation especially as a result of pollution and siltation, lampricide application, and collection.

In 2012, the Northeast Partners in Amphibian and Reptile Conservation (NE PARC) Hellbender and Mudpuppy Working Group was formed to address the conservation challenges surrounding Hellbenders and Mudpuppies, especially in the northeastern United States. The working group identified public outreach as a primary tool for Hellbender and Mudpuppy conservation. As a result, members of the NE PARC Hellbender and Mudpuppy Working Group are developing a presentation for mudpuppy outreach, updating a presentation originally created in 2005 for Hellbender outreach, creating outreach materials aimed specifically at the fishing community, and seeking partnerships with companies to create products that will raise awareness and funding for salamander conservation.

To learn more about our efforts or to become involved, visit the NE PARC Hellbender and Mudpuppy Work Group webpage at **http://www.northeastparc.org/workinggroups/hellbender.htm** or send an email to **apitt@bloomu.edu**.

Appalachian Giants

by Kirsten Hecht, Florida Museum of Natural History/ University of Florida

During the summer, people float inner tubes down rivers in the Smoky Mountains. While enjoying their vacations, they probably wonder who that crazy wetsuit-clad person is snorkeling right in their way. They often ask me what I am doing. "Looking for salamanders!" I reply quickly, before the current leads them too far away to hear. While they float away imagining me looking for tiny salamanders in one of the world's salamander hotspots, most don't know about the animal just under their feet. The creature I am after is a Hellbender. It's big (the largest one was 29 inches long), and so ugly it's cute. It slimes profusely when stressed, an inspiration for one of its more lovable nicknames: the snot otter. As Hellbenders usually hide under large rocks or other suitable shelter during the day (Fig. 1), few people encounter them except when they are caught on fishing lines. Although Hellbenders are giants, they begin humbly. Males aggressively guard nest rocks, keeping eggs well oxygenated and weeding out diseased eggs. Hatchling larvae are less than an inch long, but grow quickly (Fig. 2). Individuals reach maturity at around 5-7 years, and may live for decades.

Although once common in cool, well-oxygenated streams in the Appalachian and Ozark regions of the eastern United States, Hellbenders have followed the trend of their amphibian relatives, with many populations of this giant salamander waning or disappearing. While the reasons for their declines appear numerous and can differ among streams, problems facing Hellbenders are caused almost exclusively by humans. As obligate stream animals, they are affected by impacts to both their aquatic habitat and the uplands surrounding their homes.

Fig. 1a&b. Hellbenders are completely aquatic, and live in streams. They have flattened heads and bodies for living beneath rocks in fast moving water. Photos © Phil Colclough.

Fig. 2. Larval Hellbenders are less than an inch long when they hatch but can be over 2 feet long as adults. Photo © Phil Colclough.

Anything that inhibits their ability to breathe through skin folds or find shelter can eliminate them from streams. Common activities in the region, such as development, damming, land-use alterations, coal mining, gravel mining, and poorly managed timber harvesting and agriculture can increase siltation, or alter habitat and water quality in Hellbender streams. Hellbenders face additional threats from persecution, collection for the pet trade, and the introduction of other animal species. Recent studies suggested that Hellbenders in some areas may be faced with problematic pathogens and physical abnormalities.

Hellbenders now receive protection throughout their range, and conservation efforts are in full swing to save the snot otter. Collaborators from groups like zoos, academia, government agencies, and non-profits have been working together to increase knowledge regarding Hellbenders and help find solutions to their predicament (Fig. 3). Thanks to the work of the St. Louis Zoo and the Missouri Department of Conservation, Hellbenders were bred for the first

time in captivity in 2011. We know a lot more about Hellbender ecology and status across their range, but much still needs to be done to facilitate the survival of this amazing creature. So our work continues.

This time as more tubers pass, I am desperately trying to hold on to a Hellbender as it writhes and slimes in my hands. I hear shrieks. "What IS that thing?!" They must think I'm really crazy now...

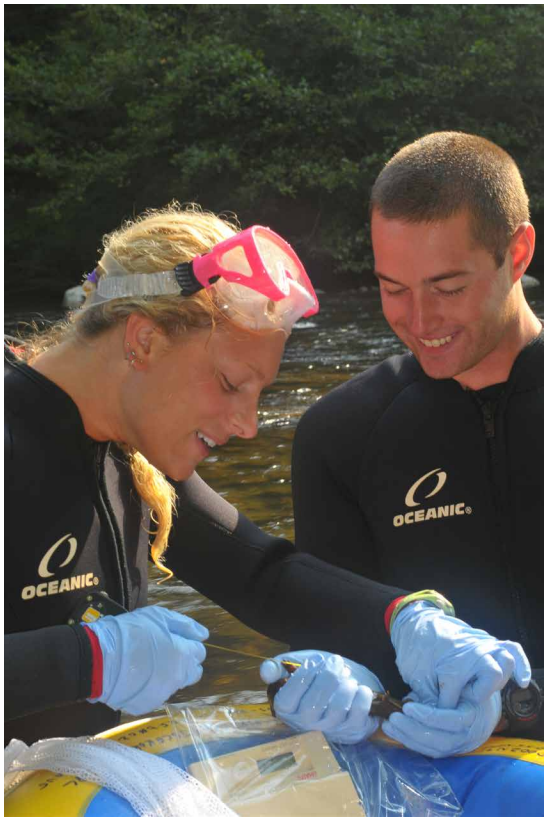


Fig. 3. Researchers take measurements of all Hellbenders found during surveys, swab them to check for disease, and also give each animal their own microchip! Photo © Phil Colclough.

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Searching for Hellbenders, One Liter at a Time

by Stephen Spear, Associate Conservation Scientist, The Orianne Society

In 2008, a study was released that demonstrated that DNA extracted from very small amounts of water could detect American Bullfrogs (*Lithobates catesbeianus*) that had invaded wetlands in France. This one study captivated the minds of many aquatic biologists and opened up new avenues for studying secretive aquatic species. This method was termed aquatic environmental DNA, or eDNA for short, and soon there were studies demonstrating its efficacy with Asian carp, tailed frogs, Pacific giant salamanders, newts, and spadefoot toads.

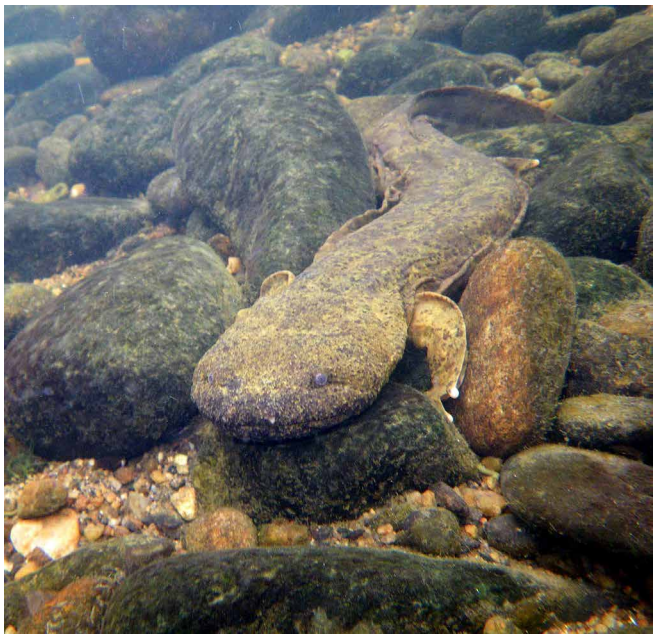


Fig. 1. An Eastern Hellbender out along a river bottom. Photo © T.R. Russ.

The success of this method led to my interest in using it on a species I had recently starting working with, the Eastern Hellbender (*Cryptobranchus alleganiensis*) (Fig. 1). The reason eDNA was so exciting to me for Hellbenders is that it's hard to find them. Hellbenders live under big rocks (Fig. 2). So to find them, we have to take a log peavey to pry up these big rocks while someone snorkels under the rock and look for Hellbenders (not to mention, fully trust that the rock won't be dropped on them!). And what if a Hellbender is under a rock that's too big to lift even with a peavey? Furthermore, if the lifted rock isn't placed down in the same way that it is lifted up, it might not be as good as a hiding place for the individual. In contrast, the eDNA approach only requires filtering some stream water, and once the protocol has been developed, a few hours of lab time.

Fig. 2. An Eastern Hellbender peeking out its head from its favorite microhabitat – underneath a rock. Photo © Lori A. Williams.

I first tested eDNA with Hellbenders during a pilot study in Tennessee working with Dr. Michael Freake at Lee University in 2011. And the method worked really well! We even detected eDNA in spots where we thought that Hellbender populations had really low numbers or didn't occur at all. After this successful first trial, we began to work with partners and collaborators in North Carolina (NC WRC and NC Zoo) and Georgia (Georgia DNR), as well as continuing the Tennessee work. We have continued to have high detections of Hellbenders; we have always detected Hellbenders in sites where populations are currently known to exist, and continue to detect Hellbenders in historic or previously unknown sites. For instance, in 2012 in North Carolina, 23 sites were surveyed both by snorkeling and with eDNA – we had 9 positives through snorkel surveys, but 21 positives with eDNA!

As exciting as some of this work is, we still have a long way to go in our Eastern Hellbender conservation efforts. Hellbenders live a long time (maybe up to 30-50 years) and so we can still find animals in populations that probably haven't been reproducing for a long time. Therefore, just getting an eDNA detection doesn't mean that the population is stable—this is also a reason why we shouldn't abandon field surveys just yet, either. We have discovered a large increase in the amount of eDNA that occurs during the breeding season, which leads us to hope that we

could use eDNA to identify whether populations are reproducing in the wild, a possibility we are currently investigating. Overall, we are very excited about the role environmental DNA has and will continue to play in our efforts to conserve this magnificent and ancient amphibian.

Fig. 3. Collecting an eDNA sample. Photo © John Groves.

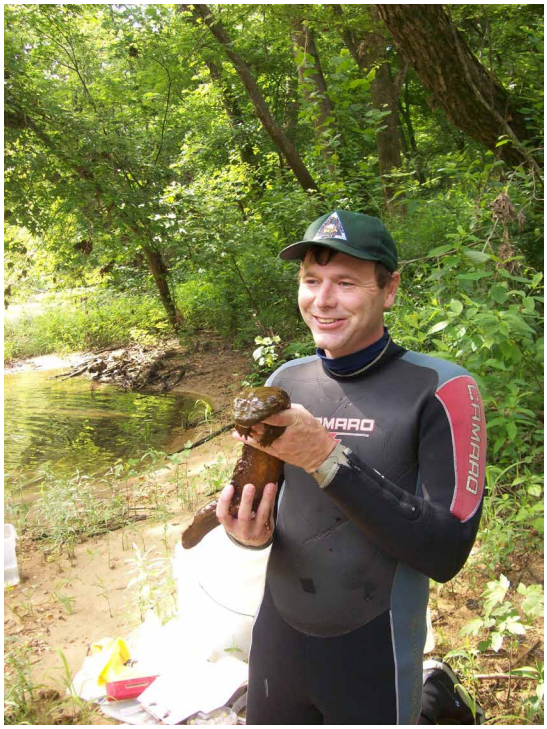
THE Orianne Society
www.oriannesociety.org

An Interview with Jeff Briggler

(a.k.a. the Hellbender Whisperer) and Recipient of the 2014 Alison Haskell Award for Excellence in Conservation

When did you become a herpetologist (what were the circumstances)?

I would say my path to becoming a herpetologist did not start out with this career in mind. While I have always loved spending time outdoors and had an interest in plants and animals from an early age, I never dreamed that I would become a herpetologist. As a boy, I was afraid of snakes and misunderstood amphibians and reptiles in general. However, this all changed when I selected my thesis project at the University of Arkansas, Fayetteville. I looked into studying birds and mammals while investigating potential thesis projects but an opportunity to research pond-breeding amphibians in the Ouachita National Forest appealed to me. I had very little knowledge of this misunderstood and understudied taxonomic group, and it excited me to learn more about them. After completion of my Master's thesis, I knew I wanted to spend my life learning about these creatures and later I completed my Ph.D. with further research on pond-breeding amphibians. I was hired as the herpetologist for the state of Missouri in July 2000. I replaced Tom R. Johnson, who had held the position since its inception in 1977. To this day, not only is it still exciting to learn more about these animals, but also to be in a position to help raise awareness and conserve these species and their habitat.



Jeff Briggler, Herpetologist with the State of Missouri, holding an Eastern Hellbender.

Describe your favourite part of working with Hellbenders.

I will never forget the first Hellbender that I captured by myself in the summer of 2000. My first thoughts were of the impressive size of this salamander with tiny little eyes. At the time I did not realize the impacts of this first capture and the role it would play in leading the charge for Hellbender recovery in Missouri. Since that time, there have been so many achievements with this declining species. However, my favourite parts of working with Hellbenders is learning about the undocumented natural history traits that are vital in guiding recovery efforts, as well as having the opportunity to make a difference in recovering an endangered species.

Congratulations on being the most recent recipient of PARC's Alison Haskell Award for Excellence in Conservation. What aspect of your work do you feel has contributed most to Hellbender conservation?

I wanted to say that I am grateful for even being considered for such an award, and to be selected as the recipient of the Alison Haskell Award for Excellence in Conservation is a little overwhelming. Alison was a good ambassador for amphibian and reptile conservation and her ability to build partnership and lead efforts was remarkable. I am truly honoured to be recognized and selected for such an award by my peers.

There are many aspects of my work that has contributed to Hellbender conservation, but similar to Alison Haskell's achievements, coordinating and building effective partnerships has been the most important for long-term support of Hellbender conservation. The Ozark Hellbender Working Group was formed in September 2001. This group was initially comprised of dedicated researchers and agency personnel with a common interest in the conservation of Hellbenders. The group expanded to include representatives from hatcheries, zoos, and other interested entities. It became clear from the beginning that a coordinated effort was necessary to synthesize the knowledge to date and to provide guidance and support for Hellbender research, conservation, and recovery efforts. Now, this collaborative, multi-agency, multi-discipline working group consisting of researchers and biologists from several universities, public zoos, fish hatcheries, herpetologists, and state and federal agency representatives, and private citizens from Arkansas and Missouri are well over 75 members. Even with the support of these various agencies and researchers, private landowners that live along these rivers with Hellbenders and other interested and concerned citizens have also played a major role in the conservation successes for Hellbenders. Many private citizens have graciously donated funds that continue to support programs aimed to recover Hellbenders in Missouri, and many landowners have opened up their homes and provided access to rivers over the years. It has been an amazing journey working on Hellbenders, and I have been fortunate to play a role and work with many dedicated individuals from various agencies, universities, zoos, and private citizens for the conservation of this species.

Based on your experience and knowledge, what do you think is the greatest threat to Hellbenders?

As with many declining riverine species, there are a multitude of threats facing Hellbenders (e.g., habitat alteration and degradation, water quality, predation, diseases and pathogens, climate change, and exploitation). Habitat degradation from gravel loading and fine sediments likely has been the greatest threat to Hellbenders. A secondary threat would be infectious diseases, especially amphibian chytrid fungus (Batrachochytrium dendrobatidis).

What can the average person do to help protect Hellbenders?

Hellbenders are a good flagship species for aquatic environments and healthy ecosystems. Any promotion of healthy ecosystems from removal of trash, reducing sedimentation, eliminating chemicals, planting of trees along the river corridor, etc. is not only beneficial to Hellbenders and other aquatic life, but also to our drinking water. You can join a local stream team or other volunteer organization that brings young and old together to clean, care for, and monitor river health. Also, since this animal is a habitat specialist that utilizes specific rocks and crevices, it is best to reduce any or all disturbance to habitat, and if you capture one on hook or line, please release the animal unharmed. There are many organizations that help to conserve Hellbenders. Join one and if you wish to donate to "help the Hellbender" efforts, contact your local organizations to learn more.

If you could have any superpower to put to use to save Hellbenders, what would it be?

I would restore the terrestrial forest buffer along the watersheds of historic Hellbender habitat. Changes in land-use practices have resulted in the increase of sediments (e.g., gravels, sands, etc.) that are changing the rivers and reducing habitat for Hellbenders and other aquatic life. The return of adequate riparian vegetation would significantly improve recovery success of Hellbenders and many other imperilled aquatic species.

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That's Not an Eel! Giant Salamanders of the Southeastern United States

by Elke Wind, E. Wind Consulting, Nanaimo, BC

The southeastern United States has its share of giant salamanders—five species in total, three of which are in the genus Amphiuma and two in the genus Siren. In fact, the longest salamander in North America is found in this area—the Two-toed Amphiuma, which can reach over a metre in length (4')! The range of the three Amphiuma species is similar to the two Siren species, although the two genera are not closely related.

Amphiuma and Siren salamanders have a characteristically long body (up to 116 cm and 98 cm respectively) and very small legs (up to 2 cm), which is why they are often mistaken for eels or snakes. Adult Amphiumas lack external gills and have four tiny legs with varying numbers of toes per species, as reflected in their common names— One-toed (*Amphiuma pholeter*), Two-toed (*Amphiuma means*), and Three-toed Amphiuma (*Amphiuma tridactylum*). In contrast, the Greater (*Siren lacertina*) and Lesser Siren (*Siren intermedia*) lack hind limbs, have two tiny forelegs, and retain external gills as adults. The Amphiuma species can be ill-tempered and may inflict a nasty bite.

Not much is known about these salamander species due to their secretive nature, making it difficult to detect and monitor populations. However, they have been found to occur in high densities under suitable conditions. For example, the combined biomass of Lesser Sirens in a Texas pond exceeded the total biomass of the pond's seven species of fish. Amphiumas and Sirens are nocturnal and carnivorous, preying upon invertebrates, crayfish, tadpoles, small snakes, worms, and fish. All five species have a lateral line that is visible on the sides of the body that is used for detecting movement and aiding in hunting.

It's easy to see why Two-toed Amphiumas (*A. means*) are commonly mistaken for eels or snakes. Photo © Kevin Stohlgren.

These unique aquatic salamanders live in quiet waters with mud-bottoms, such as swamps, sloughs, ditches and ponds. In areas where species co-occur they may occupy different habitats or microhabitats. For example, Lesser Sirens typically inhabit waters with a more acidic pH compared to Greater Sirens. In Florida, Lesser Sirens occur in acidic environments such as pine flatwoods ponds and bayheads, while Greater Sirens are found in sloughs, canals, drainage ditches, and lakes. One study only found Lesser Sirens in wetlands that held water for at least 6 months[1]. Despite their small limbs, or lack

[1]Snodgrass, J.W., J.W. Ackerman, A.L. Bryan, and J. Burger. 1999. Influence of hydroperiod, isolation, and heterospecifics on the distribution of aquatic salamanders (*Siren* and *Amphiuma*) among depression wetlands. Copeia 1999 (1): 107-113.

Greater Sirens, *S. lacertina*. Photo © Kevin Stohlgren

thereof, individuals of both Amphiumas and Sirens have been found hundreds of metres from water, crossing land under wet conditions. Wetland drainage has resulted in habitat loss for both groups and has isolated populations.

Compared to other salamanders, Amphiuma fertilization is truly internal (males deposit a spermatophore directly into the female's cloaca), while Sirens are thought to have external fertilization. Female Amphiumas lay eggs on mud near aquatic sites and stay with them until they hatch, which can be months for some species. As with all aquatic salamanders, Amphiuma larvae have external gills. However, individuals go through what is called "incomplete metamorphosis", retaining one pair of gill slits with fully functioning internal gills, as well as developing lungs. Having both lungs and gills means that Amphiumas can survive in warm or stagnant, poorly oxygenated waters that would be inhospitable to most aquatic amphibians. If the conditions of a water source are unsuitable, the larva of these species will shrink their gills to mere stumps, and they may not function at all. These salamanders are capable of burrowing into the mud of drying ponds and encasing themselves with a cocoon of mucus to survive periods of drought. This is called aestivation.

Lesser Sirens, *S. intermedia*. Photo © Kevin Stohlgren

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Southeast Giant Salamander Fun Facts!

Amphiumas and Sirens can be long-lived. One Lesser Siren lived in a zoo for 7 years, and a captive Greater Siren lived for 25 years.

Greater Sirens have been known to make a variety of sounds, such as yelping, hissing, and croaking.