

Discovering and Sharing Information about Idaho's Amphibians and Reptiles.

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On a weekend camping trip with friends in July of 2021, Dan Giltz had an encounter with a Columbia Spotted Frog at a campground near Idaho's border with Utah. Because of his experience using the iNaturalist mobile app as a student at ISU, he used his smartphone to photograph the frog and create a record of the observation. *Figure 1*. This is an excellent example of the opportunistic nature of observations made using programs like iNaturalist because Dan hadn't set out with the intention of observing amphibians and did not initially appreciate the importance of what he'd seen. The southern population of Columbia Spotted Frogs in Idaho was previously considered for listing as a threatened species and currently is considered to be a state species of greatest conservation need. As it turned out, this particular species hadn't been documented in southeast Idaho south of Snake River. During the encounter, several children who were fishing at the site said they see these frogs regularly; kids always seem to know where to find frogs. Several months later, another observation of the same species was recorded in the same area, possibly inspired by Dan's sighting. Now that we know a previously unreported population of this sensitive species occurs in southeast Idaho, wildlife biologists and managers can better plan for its protection.



Figure 1. Dan Giltz's iNaturalist observation of a Columbia Spotted Frog. This observation of a state Species of Greatest Conservation Need extended its known state range into southeastern Idaho.

We are currently experiencing a biodiversity crisis in which many, if not most, populations of plants and animals are declining because of threats such as habitat loss, climate change, overexploitation, invasive species, disease, and pollution. As environmental journalist Todd Wilkinson noted, "Without quality data, problems go undetected." To identify conservation problems in Idaho, we need more current information on the occurrence and distribution of Idaho plants and animals, especially nongame species. In the past, most of this information was obtained from scientists employed by government agencies, academia, museums, industry, and conservation organizations. A great deal of the needed data is known to someone but goes *unreported.* The practice of obtaining information obtained by enlisting the services of many people, typically through the internet, is called crowdsourcing. Research conducted through public participation is termed community or citizen science. Increasingly, very large amounts of biodiversity information are being provided by the public through community science apps like iNaturalist (iNaturalist.org) and eBird (ebird.org). For example, since 2002 eBird has provided over 1 billion bird observations from throughout the world, giving us crucial information on their distribution, activity, and population trends. These free apps have made it possible to communicate the public's extensive knowledge to scientists, land managers, and other community members. These apps are examples of "democratizing science, ... allowing the public to access and use their own data and the collective data generated by others." (Wikipedia).

The iNaturalist program originated in 2008 as a graduate student project at the University of California-Berkeley School of Information and is now jointly supported by the California Academy of Sciences and the National Geographic Society. iNaturalist describes its mission as building a global community of 100 million naturalists by 2030 to connect people to nature and advance biodiversity science and conservation. iNaturalists use smartphones or a website to

document observations of organisms which consist of photographs, recordings, geographic coordinates, tentative identifications, and comments. It only takes a minute or two to make and upload an observation with a smartphone to the California Academy of Science database where they are easily shared with other people and organizations. *A key aspect of iNaturalist is the taking of photographs that allow others to provide or confirm species identifications*. As of November 29, 2022, over 2.4 million observers have contributed over 122 million observations of over 400,000 species of organisms from throughout the world. Some of these observations have led to the descriptions of new species or the rediscovery of species thought to have gone extinct. *Public review is important to the quality of the data and is another important aspect of iNaturalist*. Over 280,000 people have helped to identify the species in the observations. *Figure 2*



Figure 2. Home page for the iNaturalist website. It shows the numbers of observations, species, identifiers, and observers worldwide as of 29 November 2022.

As important as these data are to characterizing biodiversity, engaging the public is equally important. Making natural history observations and sharing them via community science applications is fun and rewarding. It helps people appreciate the natural world and commit to its protection and restoration. Observers can get help with making identifications and can share their expertise by identifying the observations of others, creating a social network of naturalists. Public review of the observations is important to the quality of the data and another key aspect of iNaturalist. The free iNaturalist app can be downloaded from the Apple App Store or the Google Play Store. Information on using the app is available on the iNaturalist website (<u>iNaturalist.org</u>). In 2016, Chuck Peterson and Dan Giltz of the Herpetology Laboratory at Idaho State University created the Idaho Amphibian and Reptile iNaturalist project to obtain information on the distribution and activity of Idaho's amphibians and reptiles

(https://www.inaturalist.org/projects/idaho-amphibian-and-reptile-inaturalist-project).

The project summarizes and maps verifiable iNaturalist observations for Idaho amphibians and reptiles. In 2016, Chuck was a professor and Dan an undergraduate student in the Department of Biological Sciences at Idaho State University in Pocatello. Out of curiosity and a desire to conserve Idaho's amphibians and reptiles, we were seeking a way to obtain more information for mapping and modeling the distribution of these animals. We realized that the traditional ways of obtaining the needed data (e.g., government funded surveys) were important but insufficient and thus turned to crowdsourcing and community science approaches. A sabbatical leave during 2016-2017 allowed Chuck to focus on the project and recruit participants from throughout the state through workshops and presentations. Internships from a National Science Foundation / Idaho EPSCoR project and ISU's Career Path Internship program supported Dan's participation in creating the project. From 2017-2019, Dan analyzed the factors influencing the number of observations across Idaho for his M.S. thesis and discovered that our recruitment activities were the most important factor influencing the number of contributed observations, followed by human population, visitation, habitat modification, and species richness. The project is currently managed and curated by Chuck, Dan, and Charlie Justus, a former Idaho conservation officer. We review verifiable observations, (i.e., observations with digital photographs or audio recordings, geographic coordinates, dates, and times) and confirm or correct species identifications. The rate of misidentifications for "Research Grade" observations (i.e., observations with at least 2 out of 3 additional users agreeing on the identity of a specimen) is less than about 2%. Many students, colleagues, and the public have assisted with the project. We collaborate closely with the Idaho Department of Fish and Game to incorporate the observations into the states species diversity database so they can be shared and used in conservation planning. Figure 3.



Figure 3. A conceptual map showing how the iNaturalist app can be used to make and share natural history observations.

As of November 2022, over 1400 observers have contributed over 6,000 observations of 41 species of salamanders, frogs, turtles, lizards, and snakes throughout Idaho. The presence of all 36 native species and 5 introduced species has been documented. Over 600 people have helped to identify the species in the observations. *Figure 4*. The observations come from throughout the state but are concentrated around population centers with universities and colleges. *Figure 5*. Over 1,000 observations are being added per year, making this a primary source of new information on Idaho's amphibians and reptiles. *Figure 6*. iNaturalist observers are a diverse group of amateurs and professionals, including students, teachers, wildlife biologists, and the public at large. Although over 1400 people have contributed observations to the project, about 40% of the observations have been contributed by less than 2% of the observers. *Figure 7*.



Figure 4. Home page for the Idaho Amphibian and Reptile iNaturalist website. It shows the numbers of observations, species, identifiers, and observers as of 29 November 2022. It also shows which observers have the most observations and most species seen, and which species are most observed.



Figure 5. Locations of Idaho amphibian and reptile iNaturalist observations. The blue markers indicate observations without precise coordinates. Note the high densities of observations around population centers.



Figure 6. The number of Idaho amphibian and reptile iNaturalist observations is generally increasing each year. We began the Idaho Amphibian and Reptile iNaturalist Project in 2016.



Figure 7. The affiliations of the top 20 observers in the Idaho Amphibian and Reptile iNaturalist Project. They account for about 40% of all observations in the project. Most of the observers are from educational organizations.

Although most of the observations are for common species from places in their known ranges, some of the observations are particularly important. These include range extensions for the Columbia Spotted Frog (*Figure 2*), the Northern Leopard Frog (*Figure 8*), and the Long-nosed Leopard Lizard (*Figure 9*) and the confirmation of the continued presence of declining or rare species, such as the Western Toad (*Figure 10*) and the Desert Nightsnake (*Figure 11*), respectively. iNaturalist observations are particularly important for documenting the spread of invasive species like American Bullfrogs and Pond Slider turtles (*Figure 12*) and the occurrence of road killed animals (*Figure 13*). iNaturalist observations have also been important for documenting the activity patterns of amphibians and reptiles, revealing that they are sometimes active much earlier or later in the year than we previously believed. (*Figure 14*)



Figure 8. Northern Leopard Frog observation from Castle Rocks State Park near a newly created pond. Although this site had previously been part of a formal amphibian survey, this is the first observation for this species from that area. It was made by park employees.



Figure 9. Chuck Peterson holding a Long-nosed Leopard Lizard. This observation was part of a formal reptile survey for the Camas National Wildlife Refuge. It significantly extended the range of this species to the northeast.

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Figure 10. Western Toad observation. Despite considerable amphibian surveying efforts, this is the first documented observation for this once common species in the Portneuf River Drainage in over 30 years. It was made by an Idaho Master Naturalist. Note that the location has been obscured from the public to protect the population.



Figure 11. Observation of a rare Desert Nightsnake. This is first record of this species in Bannock County in over 50 years and only the third record ever there. It was made by an experienced amateur herpetologist who also has made important observations of rare Ringneck and Striped Whipsnakes in Bannock County. Note that the precise location of this observation has been obscured to the public.



Figure 12. Observation of an introduced species of turtle. Note the numerous other observations in the Boise area. Observations of nesting and baby turtles indicate that this species is now established and reproducing in Idaho.



Figure 13. Observation of a road-killed Gophersnake in the Boise area. Gophersnakes make up the majority of records for road-killed amphibians and reptiles in Idaho. While walking his dog, David Pilliod has recorded many road kills near a new road and housing development in the foothills.

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Figure 14. Recording of a calling Sierran Treefrog on a relatively warm day in January in Boise. This is an example of an unexpected observation that would have been unlikely to have been made in a formal survey.

These crowdsourced data can be used in many ways. Knowing about changes in where these species occur and when they are active is important in conservation planning, such as developing Idaho's State Wildlife Action Plan. For example, iNaturalist records indicate that Woodhouse's Toads are still found in populated areas along the Boise River and are more threatened by urban development than previously appreciated. To document biodiversity in national and state parks, agencies have used iNaturalist to conduct bioblitzes (events that focus on finding and identifying as many species as possible in an area over a brief period of time). The U.S. Fish and Wildlife Service has used iNaturalist data in endangered species listing decisions for Northern Leopard Frogs, Columbia Spotted Frogs and Western Toads. Road-kill locations can be used to prevent road mortalities through helping locate signage or wildlife crossings. The United State Geological Survey uses the data to model and map species distributions. In the future, these data will help us understand the effects of climate change on amphibian and reptile distributions and activity periods. iNaturalist data also have many educational applications, including class bioblitzes of local natural areas, learning how to identify species, and providing data for student research projects. *(Figure 15)*



Figure 15. This Northern Alligator Lizard observation was made by a student on a field trip for a University of Idaho wildlife techniques class. The precise location has been obscured. Over the years, students on field trips have contributed many iNaturalist observations.

Crowdsourced data such as iNaturalist observations have several strengths and weaknesses. Strengths include large amounts of recent data over a broad area, low cost, accurate spatial coordinates, photo/sound vouchers, and public education and engagement. Weaknesses include the lack of a sampling design and the absence of negative data which makes it hard to quantify observation effort. Data that are gathered opportunistically without a study design are termed unstructured and are more likely to be biased (the tendency of a statistic to overestimate or underestimate the population characteristic you're trying to measure). New techniques are being developed to address these weaknesses. It turns out that large amounts of unstructured data are sometimes better than limited amounts of less biased, structured data for revealing changes in species distributions and populations. Depending on the question being addressed, the best approach may be to use both two types of data if they are available.

We invite readers to give iNaturalist a try. You can use it to document any species of organism that can be photographed or recorded. You can also use the website and app to learn what species are being observed in a given area, get help with identifications, automatically create a list of the species you have observed, and share your observations with other iNaturalists. It is fun, educational, and contributes to science and species conservation.

Links

eBird: https://ebird.org/home

Idaho Amphibian and Reptile iNaturalist Project: <u>https://www.inaturalist.org/projects/idaho-amphibian-and-reptile-inaturalist-project</u>

Idaho Species Diversity Database: https://idfg.idaho.gov/species/

Idaho State University Career Path Internship Program: https://www.isu.edu/career/cpi-program/

Idaho State Wildlife Action Plan: https://idfg.idaho.gov/swap

iNaturalist: https://www.inaturalist.org/home

National Parks Service Bioblitzes: https://www.nps.gov/subjects/biodiversity/the-nps-national-geographic-society-bioblitzes.htm

NSF Idaho EPSCoR - MILES: https://www.idahoepscor.org/miles

USGS Northern Rockies Amphibians and Reptiles: https://www.usgs.gov/centers/norock/science/science-topics/amphibians-reptiles

USGS Gap Analysis Project: https://www.usgs.gov/programs/gap-analysis-project/science/species