Nature Trails

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The Eugene Natural History Society is based out of the traditional homelands of the Kalapuya peoples who stewarded this land for millennia. Today the Kalapuya people are largely citizens of the Confederated Tribes of Grand Ronde and the Confederated Tribes of Siletz Indians and continue to play an active role in local communities and in the stewardship of this land.

Lisa Ballance with killer whale calf, Ross Sea, Antarctica, 2007. NOAA/Robert Pitman

A Mystery Whale Uncovered off the Coast of Oregon

Lisa T. Ballance

Marine Mammal Institute, Oregon State University, Hatfield Marine Center, Newport, OR

Friday, 20 January 2023, 7:30 pm

The Eugene Natural History Society invites you to our January **Zoom meeting.** The Zoom session will open at 7 pm Pacific Time, which will allow time for everyone to connect and join in friendly conversation. You can find our Zoom link at our website https://eugenenaturalhistorysociety.org/, or click on this link: https://zoom.us/j/97499095971?pwd=eE9sdG9hSHMvOHhIUEJuU21wT20rdz09

It's a safe bet that Dr. Lisa Ballance does not suffer from seasickness. Her career as a marine ecologist working on research vessels from the churning eastern Pacific Ocean to Antarctica to the Mekong Delta suggests that she is immune to motion sickness. From the time she began college until now, her research has been connected to the conservation of marine vertebrates, including fishes, oceanic birds, and whales and dolphins. Her line of work has required a strong constitution for maritime travel.

Lisa arrived at a career in marine ecology from unlikely circumstances—she grew up in the landlocked state of New Mexico. Nevertheless, her parents owned a boat, and family vacations were spent on the closest available saltwater, the Sea of Cortez. Lisa recalls one of those trips when she watched a bottlenose dolphin riding the bow wake of the family boat. She was "hooked." The ocean and its animals would be her career path.

From the arid intermountain of New Mexico, Lisa left for maritime California, where she completed her B.A. in biology at the University of California, San Diego. Following graduation from UCSD, she stayed true to the California coast and marine biology. She attended Moss Landing Marine Laboratories, administered by San José State University and located on Monterey Bay. There she received an M.S. in marine science studying the behavioral ecology of bottlenose dolphins, the formative cetacean of her youth. She then moved on to the University of California, Los Angeles, shifting her research focus from marine mammals to birds and completing a Ph.D. on the ecology and flight energetics of tropical seabirds. Just prior to graduating from UCLA, Lisa was awarded a postdoctoral position with the National Research Council of the National Academies of Sciences.

Following her postdoc with The National Academies, Lisa took a position as a marine ecologist with the Southwest Fisheries Science Center of the National Oceanic and Atmospheric Administration. During the next 25 years, she either directed or participated in an amazing array of projects related to marine vertebrates. She was the Director of the Marine Mammal and Turtle Research Division and later was appointed Chair of the NOAA Fisheries Seabird Program. As Chief Scientist of NOAA's Eastern Tropical Pacific Dolphin and Ecosystem Assessment Surveys, she directed a team that provided the scientific basis for the "Dolphin Safe" label found on tuna cans.

How was a highly successful marine ecologist enticed to move north to the central Oregon coast? Lisa was recruited to assume leadership of the Marine Mammal Institute in Newport, Oregon, where she arrived in 2019 following the retirement of long-time director Dr. Bruce Mate. Soon after, she was appointed to the Endowed Chair for Marine Mammal Research in the Department of Fisheries, Wildlife, and Conservation Sciences at Oregon State University. In this role she oversees the vision and implementation of research, education, and outreach for the Institute's 60 professors, postdoctoral researchers, students, and staff. She also advises graduate students and conducts her own research, including leading a multidisciplinary team of eight principal investigators to conduct visual surveys and acoustic monitoring of marine mammals and seabirds and develop predictive density maps of species present in potential wind energy development areas on the West Coast.

Successful careers in science are usually accompanied by passion, and Lisa's is no exception. She says she is fueled by the possibility of the unexpected. Among her many projects while at NOAA was one that revealed a distinct lineage of dwarf killer whale inhabiting the Ross Sea of Antarctica. In addition to an

array of genetic and ecological data, this study produced an iconic photo of Lisa smiling and sitting on pack ice while a killer whale calf raises its head through an ice-free hole near her right elbow. The second emotional driver in her research is the passionate and committed people with whom she works. But there also exists a more ominous motivation. She is quoted on one OSU website as saying, "It is the reality of extinction that keeps me up at night. I have lived it, and I see it in our future. To a biologist, extinction is the ultimate tragedy, a loss for eternity. How to achieve sustainable use of resources provided by our oceans so that we can preserve healthy ecosystems and their biodiversity, including marine mammals—that is the puzzle that I am trying to solve."

Join us at 7:30 on 20 January 2023 for a **Zoom** lecture with Dr. Lisa Ballance entitled "A Mystery Whale Uncovered off the Coast of Oregon." Her talk promises to be informative and inspirational. —Tom Titus

Hubbs' beaked whale (*Mesoplodon carlhubbsi*). Todd Pusser

Plants Can Hear by John Carter

An oak seedling appeared in our yard a few years ago, not far from where a young pine tree had succumbed to a too heavy load of snow. The little oak was about a foot tall when first I noticed it. Because the animal that planted the acorn had picked a fine location, I left the seedling alone. Now, in less than 10 years, it's over 15 feet tall and its trunk is about 5 inches in diameter. I congratulate it on its healthy appearance and rapid growth when I am close by. After reading Karen Bakker's essay "Phytoacoustics" in the November 2022 issue of *Natural History,* I realize that my vocal praise of the juvenile oak (it still holds its leaves all winter) may not fall on deaf "ears."

Bakken's essay was excerpted from her recent book *The Sounds of Life: How Digital Technology Is Bringing Us Closer to the Worlds of Animals and Plants* (I strongly recommend this book!). She summarizes a growing body of research on how animals and plant interact with sound. This is not Zonker Harris in a "Doonesbury" cartoon singing to his plants or being lectured to by a marijuana bush. Nor is it an encore to *The Secret Life of Plants* (Tompkins and Bird). Thoroughly panned by the scientific community, that book was instrumental in generating a decades-long taboo on the research of plants and sound.

Plant-to-plant communication through soil and air is now accepted in scientific circles. But the fact that plants make and respond to sound was news to me. Reading the work Bakker describes so well generated one of those slap-the-side-of-your-head moments. Sound was here on earth before there was life. All living things have evolved in a sound-filled world. Why wouldn't life forms other than animals take advantage of such an information-rich form of energy?

In the past 5 years, work in several labs has revealed that exposure of plants to specific sound frequencies can result in changes in physiology, biochemistry, and gene expression, in turn resulting in changes in such aspects as growth, drought tolerance, and flavonoid content. But the possibility that plants can also make sound has met with more skepticism.

Monica Gagliano, Director of the Biological Intelligence Lab at Southern Cross University in Australia, is a pioneer in this area. She began asking such questions as, what could we learn by applying experimental protocols used in animal research, like playback experiments, to plants? Could we determine which sounds they respond to? Could we find out whether they make sounds? She decided to use the root response of corn seedlings in her initial experiments. As the plants were exposed to various sound frequencies, Gagliano observed that the roots moved in response to frequencies of 200–400 Hertz but not to higher or lower frequencies. The next hypothesis that Gagliano explored was based on a simple but profound idea. Humans produce sounds in the same frequency range that they can hear. What about corn plants? They were sensitive to a narrow frequency range. Did they make sounds in that same range? Using sensitive microphones, she found that yes, they

do! Her 2012 publication ("Towards Understanding Plant Bioacoustics") was the first peer-reviewed article with experimental proof that plants can detect, respond to, and make sound.

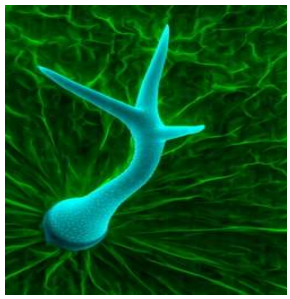
The article was met with objections. Not to the results—they were easily replicated and had met the scrutiny of independent reviewers. No, it was Gagliano's language. She discussed "plant learning" and "plant intelligence." Behaviors that could be labeled as learning and memory don't imply intelligence, her opponents said. She responded that intelligence should be more broadly defined to reflect the ability of organisms, including plants, to perceive and then respond to changes in its environment. Why can only organisms with neurons be intelligent?

Plants have various senses; touch: a root reacts when it runs into a solid object; sight: plant leaves sense the difference between light and shadow; smell and taste: plants emit biochemicals into the atmosphere and respond to them. So why should plants not also possess an analog to an animal's sense of hearing? Gagliano did another experiment. She showed that roots of pea plants grew toward the sound of running water, even though the water was in a tube and did not penetrate the soil in which the plant roots resided. She further found that the roots moved toward a recording of running water but did not move toward a recording of white noise played at the same frequency as the water sound. Thus, she concluded that sound helps plants find water.

Other researchers have uncovered similar behavior. Heidi Appel, at the University of Idaho, found that *Arabidopsis thaliana* (a type of mustard with the smallest known genome of any higher plant and a popular research subject) will produce defensive chemicals when a recording of a caterpillar chewing leaves is played close to the plant, even though the plant is not being and has not been chewed on. Her plants did not respond to the sound of wind or of insect song. Appel next exposed only one of two sets of identical plants to caterpillar chewing sounds. Later, she exposed both sets to the caterpillar chewing recording. The plants that had been previously exposed to the same sounds produced higher levels of defensive chemicals than did the controls. The exposed set had learned their lesson well. When Appel serenaded her plants with sounds made by several different insect species, they ignored those that posed no threat but made defensive chemicals in response to sounds made by predators.

You may have noticed my feeble attempts to avoid the word "hear." I could have said Appel's plants reacted defensively when they "heard" a recording of a predatory insect. A critical component of the human sound detection apparatus is the tiny hairs in our ears that vibrate when impacted by sound waves. Well, plants have tiny hairs, too, called trichomes or leaf hairs. Bakker's *Natural History* essay includes a full-page scanning electron micrograph of a root hair. That trichome vibrates at the frequencies of the plant's primary predator. If plants have hairs that respond to sound waves, as do the hairs in our ears, why not say that plants can hear? Bakker finished her essay with this: "If plants listen with their bodies, from the tips of their roots to their leaves, their sense of hearing would be profoundly different from, and orders of magnitude more sensitive than, our own."

English is almost certainly not the first language of my oak tree, but I am now sure it can hear me. I hope it does not make defensive chemicals at the sound of my voice.



Heiti Paves. Wikimedia commons

P.S. And now we know that when a tree falls in a forest, it will be heard by many living things.

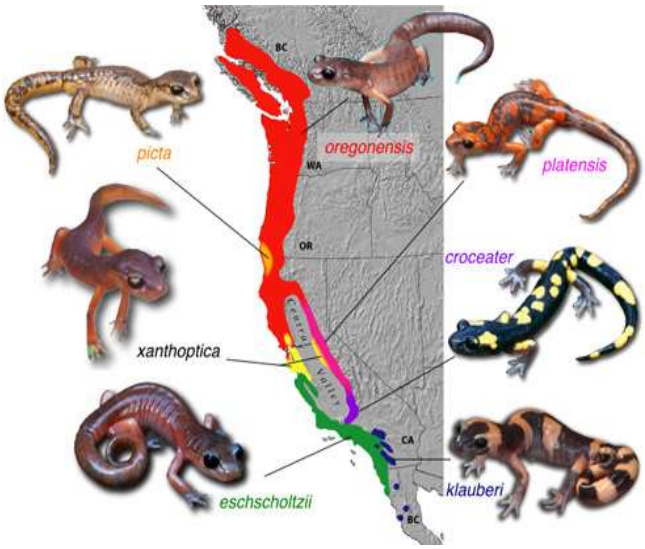
Salamander Paradox by Stanley K. Sessions

According to an old gag, a paradox is two people with PhDs walking down the street together. But in science, a paradox is anything but a joke. In fact, it is a precious thing. Two observations that are each true but contradict each other indicate that there is something we do not understand and thereby something possibly valuable that we can learn. The plethodontid salamander *Ensatina* is a case in point. In fact,

this genus presents us with at least two paradoxes.

I used to think that ensatina (with a single species, *E. eschscholtzii*) were the most boring salamanders in the world. They seemed so mundane: common, easy to find, and identical in size and shape, differing mainly in body color patterns. Their common name is just "ensatina" (meaning "sword shaped," in reference to their teeth), as if no one could be bothered to make up something more interesting. Why would my Berkeley PhD thesis adviser, the late David B. Wake, the world's leading expert on plethodontid salamanders, be so fascinated by this prosaic critter? The main reason seems to be its weird geographic distribution and what that tells us about how species evolve.

Ensatina can be found under rocks and beneath and within rotting logs from British Columbia to northern Baja California. If we look just from British Columbia to Oregon, *Ensatina* lives up to its boring reputation as a rather plain-looking brownish salamander. However, things get more interesting farther south as the populations of *Ensatina* bifurcate around the inhospitable Central Valley of California to reconverge below the valley. This distribution of *Ensatina* populations says something interesting about their evolutionary history.



Ensatina. Tom Devitt (https://evolution.berkeley.edu/)

Currently, *Ensatina* is divided into seven subspecies based mainly on their geographic distribution and body color. The most ancestral *Ensatina* is found along the coast where Oregon and California meet. These populations are currently assigned to the subspecies *E .e. picta* (the painted ensatina) and have a complex pigmentation pattern. From there *Ensatina* is thought to have spread north and south as the plain brown subspecies *E. e. oregonensis*. To the south, *Ensatina* populations are mostly continuous on each side of the Central Valley, one along the coast and the other along the Sierra Nevada. Along the coast, *E. e. oregonensis* gives way in the Bay Area to *E. e. xanthoptica,* distinctly redder in overall body color with yellow eyes, a color pattern thought to mimic the highly toxic California newt *Taricha torosa*. The yellow-eyed *Ensatina* quickly gives way to the dark-eyed *E .e. eschscholtzii,* which continues all the way down the coast into Baja California. Along the Sierra Nevada side, the plain brown Oregon *Ensatina* is replaced by an orange and dark brown spotted form, subspecies *E. e. platensis,* which at the southern end is replaced by populations of a sixth subspecies, *E. e. croceater,* with large yellow splotches on a black background. Finally, and separated by a narrow gap in distribution, we find scattered populations of the subspecies *E .e. klauberi,* black with dramatic wide orange stripes. Here, at this extreme southern extent of the range of *Ensatina, E. e. croceater* and *E. e. klauberi* from the east side finally come into contact with *E. e. eschscholtzii* from the west side!

The continuous distribution of *Ensatina* throughout most of its range means that adjacent populations can interbreed with each other, as is expected of a "good" species. Such interbreeding leads to the exchange of genes between populations. But the Central Valley serves as an insurmountable barrier to reproduction and gene flow between populations on either side. By the time you get to the southern extremes, populations of both branches are in contact with each other, but they can no longer interbreed, behaving like separate species!

Thus, *Ensatina* is often cited as a classic example of a ring species. The paradox of all ring species is that the species is held together by interbreeding and gene flow between populations on either side of the barrier, but by the time the populations reach the distal end they are reproductively isolated even though they overlap. This paradox is considered by most modern evolution textbooks to be an

extraordinary opportunity to observe speciation in action.

Molecular genetic analyses have confirmed that *Ensatina* populations do indeed become more distinct from each other genetically as you move south along either side of the Central Valley. The genetic analyses also reveal some peculiarities. For example, populations of a particular subspecies may be genetically more similar to adjacent populations of a different subspecies than they are to more distant populations of the same subspecies! In other words, genetic differences among these populations simply reflect their geographic proximity to each other, regardless of which subspecies they belong to. However, the genetic differences can be as great as if they were separate species. Thus, the second paradox, unique to *Ensatina,* is that even though the populations forming the ring are considered to be the same species, there is actually little detectable gene flow between populations. (Possible explanations are complex but include the fact that individual *Ensatina,* like other terrestrial salamanders, tend to stay put.) So, what holds all the populations of *Ensatina* together as a single species?

We could easily make this paradox disappear by redefining each subspecies as a separate species. Voila! No more ring species! However, as Dave Wake would no doubt point out, this would just be an artificial way to use taxonomy to make an interesting problem disappear. Redefining *Ensatina* as a bunch of separate species may be inevitable (and perhaps even desirable, in terms of conservation politics), but even if that were to happen, the *Ensatina* paradox presents us with a useful puzzle that forces us to think about the relationship between genes, evolution, and speciation in novel and even provocative ways.

Events of Interest in the Community

- **McKenzie River Trust** https://mckenzieriver.org/events/#event-listings or 541-345-2799

Every Wednesday, Jan. to June; 9–11:30 am. Watershed Wednesdays at Green Island. Join McKenzie River Trust every Wednesday morning at Green Island to help care for this special area where the McKenzie and Willamette Rivers meet! Projects differ based on the season but typically include invasive species removal, habitat care, planting, and tree establishment. Work is easy to moderately difficult. Projects are best for participants 13 years of age and older. Winter: invasive species removal, planting. Sign Up

- **Nearby Nature** https://www.nearbynature.org/ or 541-687-9699, 622 Day Island Rd., Eugene (Alton Baker Park)

Monday, 16 Jan., 8:30 am–4:30 pm. No School Day Adventure: Treasure Trackers. Alton Baker Park. Rain or shine, kids 5–11 in groups of 12. Hike new trails, discover hidden habitats, and find trees of mystery using maps, clues, and wayfinding skills. Put together puzzles, hide prizes for new friends, and discover whether you have what it takes to find your way to tricky treasures on this day-long adventure in nature! $60 members, $70 nonmembers. Scholarships available. Preregister online.
Friday, 3 Feb., 8 am–5 pm. No School Day Adventure: Forest Fairies. Alton Baker Park. Rain or shine, kids 5–11 in groups of 12. Wander the park in search of secret hideaways for tiny people and critters! Learn about our park's winged creatures, both big and small. Make fairies and gnomes and create tiny homes from forest finds. Go on a fairy finders scavenger hunt. $60 members, $70 nonmembers. Scholarships available. Preregister online.
Tuesday, 14 Feb., 10–11:30 am. Green Start Play Day: Love Notes. Alton Baker Park. Rain or shine, kids 5 and under only, with an adult. Enjoy outdoor nature play in our Learnscape plus toddler and preschool activities and stories, this month all about birds and their spring love songs plus other neat noises in nature! Members FREE, nonmembers $8/family. Preregister online.
Monday, 20 Feb., 8:30 am–4:30 pm. No School Day Adventure: Incredible Journeys. Alton Baker Park. Rain or shine, kids 5–11 in groups of 12. Adventure there and back again as we soar across countries and swim between hemispheres. Play migration games, hear incredible stories of strength and skill, design a kite that really flies, do a feeder watch, and observe awesome ospreys! $60 members, $70 nonmembers. Scholarships available. Preregister online.

- **Native Plant Society of Oregon, Emerald Chapter** https://emerald.npsoregon.org/. Zoom links to all presentations will be published on the Emerald Chapter website and distributed to members via email.

Monday, 16 Jan., 7–9 pm Zoom presentation. Climate and plant-pollinator networks in the Cascade Range. Melinda Vickers, Washington Department of Fish and Wildlife. Meadows in the Oregon Cascades are vital and threatened ecosystems that support a tremendous amount of plant and pollinator diversity. Vickers used long-term research at the H.J. Andrews Experimental Forest to get a better understanding of how these networks of plants and pollinators are impacted by climate variation and what that might mean for their future.

Monday, 20 Feb., 7–9 pm Zoom presentation. Emerald Ash Borer: A Threat to Oregon's Ash Trees. Christine Buhl, Oregon Department of Forestry. Status update on Oregon's first detection of the exotic invasive emerald ash borer (*Buprestis planipennis*). Learn how to diagnose potential infestation, identify the emerald ash borer, and manage for it. Also learn about interagency efforts to monitor, slow the spread, and treat for this pest.

- **Mt. Pisgah Arboretum** https://mountpisgaharboretum.com/festivals-events or 541-747-3817

Friday, 20 Jan., 10 am–noon. Winter Mushroom Walk. Join Arboretum Interpretation Coordinator August Jackson for a walk to explore the fungal diversity at the Arboretum. We'll identify as many species as we can find and discuss fungal ecology. Rain or shine. Meet at the Education Building. Don't forget your parking pass. Walk fee $5, FREE for Arboretum members. Limited to 18 attendees. Preregistration required.

- **Lane County Audubon Society** www.laneaudubon.org or 541-485-BIRD; maeveanddick@q.com or 541.343.8664

Saturday, 21 Jan. Third Saturday Bird Walk with John Sullivan. Alton Baker Park. Reservations are no longer required. For more information, check the LCAS website or Facebook page or email audubon@laneaudubon.org.

Tuesday, 24 Jan., 7 pm. Monthly program. Campbell Center, 155 High Street, Eugene. In August 2022, John Sullivan and Laura Johnson joined a tour to Brazil with local birding leader Rich Hoyer. They explored diverse ecosystems, including Brazil's famous tropical wetlands, the Pantanal, the Amazon Basin, and the dry Cerrado tropical savanna highlands. These locations are famous for their birds, reptiles, and large cats. John will share his photo collection of birds and other wildlife.

- **Museum of Natural and Cultural History, University of Oregon** https://mnch.uoregon.edu/museum-home

The Museum is open Wednesday through Sunday, 10 am to 5 pm, and until 8 pm on Thursdays. Admission is free to members, toddlers, UO students, faculty, staff, and members of the military. Regular exhibits such as "Oregon: Where Past Is Present" and "Explore Oregon" are joined this winter by special exhibits: "Magic in Medieval Europe" in winter 2023 and "Outliers and Outlaws, Stories from the Eugene Lesbian History Program," which opens **Jan. 28.** Visit https://mnch.uoregon.edu/programs or call 541-346-3024 for more information.

- **Friends of Buford Park and Mt. Pisgah** https://www.bufordpark.org/ or 541-344-8450

Because people and nature need each other, the Park is OPEN during the COVID-19 pandemic. Please go to the Lane County website for instructions about the park and updates.

- **WREN (Willamette Resources and Educational Network)** https://wewetlands.org

See the website for programs and information.

ENHS welcomes new members! To join, fill out the form below. Membership payments allow us to give modest honoraria to our speakers and pay for the publication and mailing of *Nature Trails*. Find us at:
http://eugenenaturalhistorysociety.org/ https://www.youtube.com/channel/UCEryzVh9lw9y-nLS_t94BVw

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ANNUAL DUES:	Family	$25.00
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	Contribution	_____

Memberships run from September to September. Annual dues for renewing members are payable in September. Generosity is encouraged and appreciated.

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The Eugene Natural History Society meets on the third Friday, September through May, except in December when the meeting is on the second Friday. Meetings are at 7:30 pm in 100 Willamette Hall, University of Oregon, and/or on Zoom, as noted in *Nature Trails* and on our website: https://blogs.uoregon.edu/enhsuoregon/

Parking is available at the UO Physical Plant lot: From Franklin, turn north onto Onyx, go about one block to the lot. After 6pm it's open to the public.

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2023 Speakers and Topics

20 Jan.	**Lisa Ballance**	**A Mystery Whale Uncovered off the Coast of Oregon**
17 Feb.	**Taylor Chapple**	**Sharks of the Pacific Northwest**
17 Mar.	**Pat O'Grady**	**Archaeology of Oregon**
21 Apr.	**David G. Haskell**	**Sounds Wild and Broken: What Listening Can Teach Us about Ecology, Evolution, and Ethics (cosponsored with the Emerald Chapter of the Native Plant Society of Oregon)**
19 May	**Jamie Bowles**	**Sierra Nevada Red Foxes**