

Nature Trails

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Olm salamander (*Proteus anguinus*) Photo courtesy D. Dalcsai

HOPEFUL SALAMONSTERS

Linking Sex Chromosomes to Cave Adaptations
in the European Blind Cave Salamander, *Proteus anguinus*

Stanley Sessions and Lilijana Bizjak-Mali

**Hartwick College, New York (S.S.) and University of Ljubljana,
Slovenia (L.B.-M.)**

Friday, 21 May 2021, 7:30 p.m.

The Eugene Natural History Society invites you to their May Zoom meeting.

Here is how to join the audience for this presentation. The Zoom meeting will open at 7:00 but our meeting will begin at 7:30. This allows everyone time to get connected and join in informal conversation.

Time: 21 May 2021 07:00 p.m. Pacific Time (US and Canada)

Join Zoom Meeting: <https://zoom.us/j/97499095971> This Zoom link will expire after this meeting. Because we don't know when large, indoor, in-person meetings will be safe, we will hold the September meeting remotely. The link will be given in the September issue of *Nature Trails*.

The ENHS board recognizes that some persons cannot attend virtual presentations. We are eager to return to in-person meetings and will do so as soon as we can.

We are in for a real treat. Our May lecture will feature two researchers, both recipients of Fulbright awards, who have wonderful stories to tell about the



rare cave salamanders inhabiting the beautiful limestone Karst caves characteristic of the mountainous Balkan region of southeastern

Europe. We will get a view into the exciting research they are conducting involving the sexual characteristics and unique complex sex chromosomes of these rare animals. Unlike the tamed and human-dominated landscapes of most western European nations, Slovenia's rugged terrain features rich and diverse ecosystems including cave environments that are home to the rare olm salamanders (*Proteus anguinus*). In ancient days, the pale blind salamanders that made their homes in the very deep waters of the caves were believed to be baby dragons. But the real creatures are weird enough without being classed with mythological beasts. They are the only exclusively cave-dwelling chordates in Europe and the largest cave-dwelling animal in the world. Though they are functionally blind, *Proteus anguinus* do have functional light-sensitive photoreceptors in their retinas and pineal glands, and indeed in their entire bodies. The eyes develop normally during the embryonic stage and then gradually degenerate. Their long snouts have masses of receptors, giving an enhanced sense of water movements, smell, and the electric fields emitted by their prey. They also are able to sense magnetic fields. Instead of the normal vertebrate complement of digits, they have only three toes on the front limbs and two on the back. They can live to be at least one hundred years old! A new subspecies of *Proteus anguinus*, *P. a. parkelj*, discovered nearly 300 years after the first *Proteus* were described, is endemic to a tiny region of the lower karst in southeast Slovenia. The *parkelj* subspecies has a very different appearance and life strategy. These "black *Proteus*" are darkly pigmented with completely developed functional larval eyes. Some evidence points to the black *Proteus* as a possible case of evolutionary reversal from a "white *Proteus*" ancestor.

Dr. Lilijana Bizjak-Mali (Lila) is an Assistant Professor in the Department of Biology at the Biotechnical Faculty of the University of Ljubljana, Slovenia, and Dr. Stanley K. Sessions (Stan) is Professor Emeritus in the Department of Biology at Hartwick College, Oneonta, NY. Lila is currently

working at Hartwick College with Stan on a project funded by their most recent Fulbright grant. Their project concerns a study of the very unusual sex chromosomes that they discovered in proteid salamanders, carrying forward earlier research about these unique creatures.

Although it is easy to understand how budding biologists are drawn to study charismatic flagship species like wolves or elephants, how do biologists discover a passion and a life's work in the study of small and slippery creatures like salamanders? Where did Lila and Stan find the inspiration for their careers? Lila told me that she did not come from a family of scientists but that a biology teacher in grammar school inspired her to seek a career in science. As a child she collected different kinds of animals, but her real interest was plants. At the University she realized how unique her country and its ecology were and became involved in studying Slovenia's endemic species. Her commitment to studying the cave salamanders came only when she was in graduate school. As a graduate student, she chose to work with the Zoology group that has long been, and still is, the epicenter of *Proteus* research and to study the lateral line system of *Proteus*, essential to a blind creature living in a dark environment. She considers *Proteus anguinus* the "flagstone species of the subterranean world and a symbol of the natural heritage and biodiversity of Slovenia." Because of the rarity of *Proteus*, Lila's research has emphasized studies that are non-lethal, such as use of cultured blood cells. Her approach is to integrate molecular biology, cytogenetics, developmental biology, and morphology to investigate the evolution of cave adaptations in these salamanders. Reproductive biology, including reproductive abnormalities, has been a major focus of Lila's work. Much of the work in the next few months in Sessions' lab at Hartwick College will be centered around studying the important developmental gene Sonic Hedgehog (*shh*) and how it could be involved in the evolution of cave adaptations in *Proteus*.

It was a teacher who inspired Stan as well. His parents unwittingly nurtured an evolutionary biologist by innocently buying him Time-Life science books that filled him with seditious ideas and inspired his passion for Darwin. But why salamanders? Stan attended the University of Oregon. He learned research techniques working as a lab technician for Chuck Kimmel, tending the axolotls that were the lab's research focus then and setting up the Toadery, a salamander colony that included "Little Stanley," a three-foot long Chinese giant salamander, for Chuck's "Waterdogs" class. But the

inspiration for Stan was University of Oregon professor Jim Kezer. Jim had an explosively vibrant way of teaching. As if it were to be the greatest moment of their lives, he and his students would go forth to explore the then common salamander



Discovery of *Bolitoglossa gigantea*,
from left to right: Chuck Kimmel, Jim Kezer, Stan Sessions.

populations of Western Oregon, collecting specimens for their chromosomes. Kezer was a cytogeneticist, and Stan said that he made salamander meiosis really exciting! Kezer took students to Mexico to study salamanders, and Stan accompanied him (as did Chuck and Tom Titus on other trips). Travel with Kezer was a special experience, unless you expected to be allowed to explore ruins or beaches or taste anything but “pollo con papas.” But it was an *Aneides* salamander found on a walk in Oregon that captured Stan’s heart and made salamanders, their chromosomes, and their evolution his life’s work.

Following graduation, Stan did his PhD graduate study with the world’s foremost expert on plethodontid salamanders, David B. Wake, at the University of California at Berkeley.

Perhaps because of the wonderful examples of their early mentors, both Lila and Stan have strong commitments to teaching and to involving students in their research. Lila mentors numerous students of various levels in her classes and laboratory. Before retiring, Stan made biennial winter trips to Costa Rica with groups of students to study the natural history of salamanders and other organisms in their native habitats.

Necturus, from Eastern North America, is the sister genus to *Proteus* in the family Proteidae, but the two differ in striking ways. Lila and Stan want to learn details of how they differ, including the macromutation called a chromosome translocation, which they think has great implications for the specialized troglomorphic adaptations in *Proteus*. What are the reproductive consequences of such a translocation and what are the possible selective advantages of the translocation in ancestral *Proteus*? Stay tuned!

[Thanks to Reida and Chuck Kimmel for interviewing the speakers and writing this introduction.]

Bees of Western Gas Stations

by August Jackson

Sandstone doesn’t erode so much as it disembodies and returns to a shiftless, formless state on the flatlands of the Colorado Plateau. On this narrow and geologically ephemeral ledge beneath one cliff and atop another, pink sand settles into something close to stone through the quietude of desert winter. Our feet leave uneven and wavering marks as we break the crusted earth; stress fractures stretch forward from one step to the next, creating riverine canyons in miniature. This terrain records its visitors and it appears there haven’t been any of our size in some time on this plot of unclaimed—at least unregarded—desert wasteland along a two-lane state highway spreading out south and west from the overflow parking lot of a Chevron quietly awaiting tourist season.

Early in our seven-hour journey back to Phoenix, it is a pageant of southwestern prickly poppies (*Argemone pleiacantha*) that pulls us off the highway. The large white flowers, with petals like crinkled tissue paper, are striking against the red earth and appear too delicate for their surroundings.

As if aware of this, they’ve armored themselves extensively with prickles that cover every bit of the plant other than the flower corolla itself, converging on a notion borne by their cactus neighbors. In several of the flowers, a flurry of activity is underway as bees not much larger than a grain of rice scabble at the *Argemone* anthers, methodically packing pollen into nectar-moistened, honey-colored masses on their hind legs.

Aptly named *Perdita* after the Latin for “lost,” these tiny bees (fairy bees as they’re commonly known)



Pygoperdita sp. Photo credit: A. Jackson

belong to a remarkably diverse genus, with over 600 species found predominantly in the deserts of Mexico and the American Southwest, including a number that are undescribed. While some species range as far north as Canada and a handful make it into the Willamette Valley, their range appears to be limited at least somewhat by a peculiar behavior that stands in stark contrast with that of most other bees—they construct their underground nest cells without any

additional lining to protect them from the elements. In wetter climates, this leaves their larvae susceptible to drowning in winter rains or the intrusion of pathogenic fungi. As small as they are—with the majority of species ranging only from two to seven millimeters in length—their capacity for intentional dispersal is severely limited, and most individuals spend their entire lives within ten meters of their natal nesting site.

The majority of *Perdita* species are floral specialists, meaning that they strictly feed their young on pollen collected from a specific group of plants—either one genus or a few closely related genera. These floral associations can aid in identification, which is especially useful when there are so many species. These particular prickly poppy bees belong to the *Perdita californica* species group in the subgenus *Pygoperdita*—the prefix *pygo* meaning “tail,” in reference to the modified seventh abdominal segment in males. Many of the *Pygoperdita* specialize either on mariposa lilies in the genus *Calochortus* or various poppy genera. Whether there is some physical or chemical similarity in mariposa and poppy pollen that makes for a more ready transition between the two food sources is unknown.

Perdita in the broad sense are wonderfully odd and exquisitely beautiful animals, often darkly metallic and liberally adorned with pale markings of whites, yellows, and oranges that demarcate different plates on their relatively hairless exoskeletons, imbuing them with an intangible quality that lends some of them the appearance of blown glass. It is in this context that these *Pygoperdita* on the edge of a gas station parking lot are particularly remarkable in appearance, incorporating rusty sandstone reds, poppy anther yellows, metallic olive greens, and cream dashes that fade into milky blues the color of the Little Colorado River. They also appear to be an undescribed species.

In the early 1990's, Terry Griswold of the USDA Bee Lab in Logan, Utah described three new species in the *Perdita californica* group, including two poppy specialists and one species found on the Colorado

Plateau only an hour's drive from our location. Based upon a shared set of derived morphological traits, these three species belong to a subgroup typified by *Perdita argemones* (unsurprisingly a specialist of poppies in the genus *Argemone*), and it appears that our little gas station bee does too. However, this bee does not match well with any currently recognized species. This is not particularly odd given the diversity of the genus (for comparison, there are nearly 500 species of *Perdita* in the Southwest and about 800 species of bees in all genera in the Eastern United States), the ease with which they are overlooked, and the high degree of endemism, with many species restricted to very small regions—fitting for a bee that may never fly further than the length of your living room. The convergence of these factors means that many species are rarely seen and may be described from only a handful of specimens so that what appears to be a new species could simply be hitherto unencountered intraspecific variation. It is complicated, and given the economic insignificance of these bees there is not much of a push to know more about them.

I know that for three short weeks of their adult life-span outside of the nest, these bees feed in poppies, meet in poppies, mate in poppies, and facilitate the mating of poppies, all at the edge of our comprehension and entirely out of sight of the millions of tourists passing through to the neatly packaged nature experiences in the National Parks to the north and west. I also know not to be surprised to find something unusual so close to pavement. In July of last year I found and identified five bee species that were either new records for the state of Oregon or had been recorded at no more than two sites. Every one of them was found in a roadside ditch or cutbank, just at the periphery of our daily lives. One could see this as an indication of their vulnerability, but perhaps it is more accurately illustrative of both their resilience and their predilection for the sort of periodic disturbance that reinvigorates the seedbank and opens up new sites for nesting. They get along fairly well in our cultural ejecta, providing hope that lost bees can be found before they're lost for good.

A Naturalist's September Manifesto—20th Anniversary by David Wagner

Preface—May 2021

Twenty years ago, while we were camped in the Three Sisters Wilderness, the World Trade Towers were brought down by terrorists. My daughter and I were blissfully unaware of the event, not noticing there were no airplanes flying overhead. We were

enjoying the total freedom of mind and spirit that wilderness solitude brings.

That event changed my life; it changed all our lives. The world has not stopped changing, each change seeming more significant than the previous. Since that time climate change has brought on multiple environmental disasters and seems unstoppable. Recently we have experienced an attempted violent authoritarian overthrow of our democratic republic. The worst pandemic in human

memory has gripped the entire world and will not end soon.

Contemplating the 20th anniversary of that week in September brought me back to this essay written for the first issue of the 2001-2002 Nature Trails. I was beginning another term as President of the Eugene Natural History Society. I had just read the first scientific article about human population peak that was based on definable parameters. I find that what I wrote in 2001 still rings true today. The future is liable to have the continuing misery I predicted as world population peak approaches. And I still believe in the possibilities of the outlook I described.

A Naturalist's Manifesto—September 2001 Original

This is the time of the year when the aroma of lightly fermented blackberries is carried on a warm breeze down by the Delta ponds where we walk in the evening. That smell identifies the season, late summer in the southern Willamette Valley, when our account of fine days is well stocked. This is the best time of the year to go up into the mountains. The likelihood of sunny weather is most reliable, the mosquitoes and tourists are gone, the snow banks have withdrawn from all trails and camp spots, the mornings are crisp, and the days are lively from dawn to dusk.

This is the time of the year for me to take long hikes in the wilderness. This year the plan is to spend five days with my daughter in the Three Sisters Wilderness in the vicinity of Linton meadows. It's a place where I feel truly alive, where what I do as a human being is right at the frontier of my consciousness. It's a place where I can sit quietly for hours, listening to the birds and watching the shadows move around the rocks and hummocks of grasses and dwarf pines. It's a place where I can think about natural history and what it means to be a student of natural history.

This year I will think about an article published recently in *Nature* magazine that offered the best guess as to the maximum population of the earth and when that maximum would be reached. This was something of a new idea to me. All my conservationist fears have been based on the notion that human population growth is an endless, runaway process that won't end until the earth is destroyed. It's not a rational thought but this is how I really thought. The pessimist in me said that population control was futile even though all of us conservationists know that unchecked population growth is the root of environmental degradation and so we have fervently supported Zero Population Growth organizations. We don't have to wait for

overpopulation, it's already here for those who like the freedom to roam a wild countryside.

The reality is that the earth will survive the maximum human population level and then the population will decrease. What happens to the earth after that is still anybody's guess because the available resources left in those future times and how they are allocated can't be predicted beyond the bounds of a huge error range.

The maximum population of the earth will be around nine billion people. That number will be reached around the year 2070. I won't live to see it but will likely live halfway there from now. I'll anticipate it and could be a part of shaping what it will be like then. This gives me a perspective that will help me decide how to live the remaining years of my life, to contemplate what is worth doing and what might be a wishful waste of time.

Nine billion people won't overrun the earth nor destroy it. But most of those nine billion will have a miserable existence unless we (we the people, the governments of the world) pay attention to fair distribution of what's important for a quality life. As a citizen of this country, I'm prone to define a quality life in terms of life, liberty, and the pursuit of happiness.

Natural history comes in when I try to imagine the pursuit of happiness for the greatest number of that nine billion. Some pursuits will fail. Enjoying life by entertaining ourselves with internal combustion machines has always been limited to a very few, and it will be fewer in the future. Playing with motorcycles, power boats, jet skis, snowmobiles, and jeeps are activities too expensive in natural resources to be sustained for long as simple pleasurable pursuits. Humanistic enterprises will increase in strength. The arts will thrive as will spiritual pursuits. The role of natural history is what interests me here.

I like to imagine a future where most people enjoy just being alive in an environment full of life of all kinds. Walking over the hill and down in the valley, learning the wildflowers, listening to the bird calls, watching the butterflies, tracing the constellations moving across the sky at night, drawing a spider—these are the activities of people filling their lives with natural history.

So now, I think that my conservation efforts, my teaching efforts, should be directed toward maintaining the resources that will provide future naturalists with the opportunity to enrich their lives with the study of natural history. I'll strive to protect the untouched forests and stop worrying about every new weed that shows up in town. And with involvement in organizations like the Eugene Natural

History Society, I'll do my best to help people enjoy nature, learn to love it, and work to conserve it along with me.

Postscript

The Guardian, 15 July 2020: "The world's population will peak at 9.7 billion in 2064 and decline to 8.8 billion by the end of the century, according to research led by the University of Washington in the US and published in the *Lancet*."

Spring Potluck: 2 p.m., 13 June, at the Kimmel's, 30306 Fox Hollow. You are welcome if you are two weeks past your final COVID vaccination. Bring a dish and beverage to share. If you need directions, contact Reida at rkimmel@uoregon.edu or call 541-345-4919.

Events of Interest in the Community

McKenzie River Trust <https://mckenzieriver.org/events/#event-listings> (541) 345-2799

Saturday, 15 May, 9 to 11:30 a.m. Green Island Ambassadors Training. Help connect people to conservation! We're opening the gates to Green Island every second Saturday from March through December 2021. Visitors will be welcome to enjoy all that this 1,100-acre conservation area has to offer. To help facilitate a positive experience, McKenzie River Trust is looking for Volunteer ambassadors to help guests feel welcome and oriented to the site. As an ambassador, you will receive on-the-ground training and orientation to Green Island. We'll prepare you with the tools to help make this special conservation area more accessible to everyone in our community. Join us! Register online.

Wednesdays, 19 and 26 May, 9 to 11:30 a.m. Watershed Wednesdays at Green Island. Each week we'll take on a different stewardship project.

Thursday, 20 May, 7 to 8 p.m. HabiChats! Climate Change & Future Flooding in the Columbia River Basin. From historic examples like the Heppner flood of 1903 and Vanport flood of 1948 to recent flooding of the Willamette and Umatilla Rivers in 2019 and 2020, it is clear that flooding remains a potent threat. By the end of the century, floods throughout the Columbia River basin are likely to increase in size, and flood seasons are likely to expand for some catchments, according to a new study by Oregon State University and University of Washington researchers. Laura Queen, the lead author, will share these recent findings, with a focus on the dramatic changes projected along the Willamette River and its upper tributaries. To register, go to <https://mckenzieriver.org/event/climate-change/>

Lane County Audubon Society lanecountyaudubon.org or 541-485-BIRD

Tuesday, 25 May, 7 p.m. Hawaiian Birds with Rick Ahrens. Now is your chance to vicariously see and appreciate some of the birds of Hawai'i. Rick Ahrens will be presenting his unique view of these birds. Join us for a bird's-eye perspective of this legendary paradise. For instructions on joining this Zoom meeting, go to lanecountyaudubon.org

Mt. Pisgah Arboretum

For MPA activities go to <https://mountpisgaharboretum.com/festivals-events/> or call 541-747-3817

Tuesdays, 18 and 25 May, 1 to 3:30 p.m. Arboretum Exploration ages 5–8. Explore Mt. Pisgah Tuesday afternoons. Learn about the many surprising and amazing animals and plants living right here with games, stories, and journaling activities. For children 5–8, \$15 per session. Allowing for the uncertainty of a return to in-person schooling, you can sign up for each session individually. That way, your student can participate one day per month or weekly as your schedule allows. Arboretum Members: get one session free when you sign up for four sessions at a time with a 25% discount. Masks and temperature checks are required for all participants. Ten students max. Sign up here:

<https://www.signupgenius.com/go/60B044EACAF2AA6F49-spring4>

Thursday, 20 May, 1 to 3:30 p.m. Arboretum Exploration ages 8–11 Explore Mt. Pisgah Thursday afternoons. Ditto above. Sign up here: <https://www.signupgenius.com/go/60B044EACAF2AA6F49-spring5>

University of Oregon's Museum of Natural and Cultural History <https://mnch.uoregon.edu/museum-home>

The museum is open to the public! Our new hours and timed ticketing system ensure a safe and enjoyable visit for every guest. [Learn more](#). Reservations are recommended. [Reserve your tickets online](#) or contact us at 541-346-3024 or mnchticketing@uoregon.edu.

Thursday, 20 May, 6 p.m. Live on Zoom, Drawing from the Deep: A PaleoArt Workshop with Ray Troll. Join renowned artist [Ray Troll](#) and museum paleontologist Edward Davis for a fun-filled evening of science and art! You'll dive into the natural history of **Oregon's colossal spike-toothed salmon**, learn about Ray's artistic process during a live drawing session, then draw your own spike-toothed salmon as Edward and Ray answer your questions. **Free for members!** Preregistration is required. [Register now](#) to secure your spot. The workshop will be hosted on [Zoom](#), and participants will receive a link after registration. Questions? Email lmw@uoregon.edu or call 541-346-3030.

Native Plant Society of Oregon, Emerald Chapter <https://emerald.npsoregon.org/>

Saturday, 12 June, 10 a.m. to noon. Ed Alverson will lead a walk in Kinney Park, a 20-acre natural area near Spencer Creek with a great deal of habitat diversity, including wet prairie and ponderosa pine woodland. We will explore the park's late spring

flora and examine the recovery of wet prairie following a woody vegetation clearing project. Meet at the intersection of Playway and Restwell Roads, off Gimple Hill Road. In response to public health concerns, group size will be restricted according to County guidelines. Attendees must preregister, wear a mask, keep socially distant along the trail, and attend only if they are free of symptoms. All trips will proceed rain or shine, so please dress for the weather. Sign up [here](#)

Nearby Nature <https://www.nearbynature.org/>

Tuesday, 8 June, 10 a.m. to 12:30 p.m. Green Start Play Day: A Bug's Life. Kids 5 and under only, with an adult, can enjoy another self-led outdoor nature exploration in our Learnscape. This month investigate the wonderful world of insects and other bug friends! Rain or shine! Preregister to reserve your time slot; only three families max can be in the Learnscape at once, with social distancing guidelines in place. Members free, non-members \$7/family. FMI or to preregister: 541-687-9699 or nearbynature.org.

Friends of Buford Park and Mt. Pisgah <https://www.bufordpark.org/>

Because people and nature need each other, the Park is OPEN during the coronavirus/COVID-19 pandemic. Please refer to [Lane County](#) for instructions about the park and updates.

WREN (Willamette Resources and Educational Network)

No WREN activities that fit into this month's calendar. This is a good organization. Keep track of them this summer and fall.

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*. Our web address:

<http://eugenenaturalhistorysociety.org/>

MEMBERSHIP FORM

Name _____

Address _____

City _____ State & Zip _____ Phone _____

E-mail (if you want to receive announcements) _____

I (we) prefer electronic copies of *NT* rather than paper copies. ___ Yes ___ No

If yes, email address (if different from the one above): _____

ANNUAL DUES:	Family	\$25.00
	Individual	15.00
	Life Membership	300.00
	Contribution	_____

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

Make checks payable to:

Eugene Natural History Society

P.O. Box 5494, Eugene, OR 97405

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2020–2021 Speakers and Topics

21 May Stanley Sessions and
Lilijana Bizjak-Mali

**Hopeful Salamonders: Linking Sex Chromosomes to Cave Adaptations in the
European Blind Cave Salamander, *Proteus anguinus***

2021-2022 Speakers and Topics

17 Sept. Julia Clark

Dinosaur Colors and Vocalizations (this will be a Zoom meeting)

15 Oct. Laura Prugh

Wildlife Ecology

19 Nov. TBA

10 Dec. Paul Bannick

Snowy Owls (cosponsored with Lane County Audubon Society)

21 Jan. TBA

18 Feb. Michael Nelson

Fire Ecology and Report Following the 2020 Fires

18 Mar. Pat O’Grady

Archaeology

15 Apr. Lauren Ponisio

Bees and Wildfire

20 May Lauren Hallett

Siskiyou Plant Communities



Olm salamander (*Proteus anguinus*) Photo courtesy D. Dalessi

Last year we postponed our annual business meeting from May to September due to the pandemic. This year we will go back to our normal schedule. The annual business meeting will occur at the beginning of this month’s Zoom meeting.