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Publication Date

2023-05-03

Environmental Journalism in the Narrative Format

SPECIES CONSERVATION STORYTELLING

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Abstract:

I define myself as an environmental narrative journalist who specializes in topics related to wildlife and species conservation. I consider the following three pieces to be the best examples of who I am as a writer thus far.

“The Western Joshua Tree’s Future Could Rest on Landmark Climate Case” was published in *Earth Island Journal* in April 2022. It is 1,650 words. The story looks at the scientific and legal implications of listing the Western Joshua Tree as endangered under the California Endangered Species Act. As a writer, I believe this piece represents me as a writer because it takes a critical look at an iconic species conservation law and how it is used at the state level versus the federal level, and what the challenges and benefits are to saving an iconic species. Additionally, this article challenged me to write about science in an intriguing way to describe the tree’s tedious reproductive process. As an environmental journalist, I believe strongly that science needs to be sprinkled into every piece.

(URL: [https://www.earthisland.org/journal/index.php/articles/entry/the-western-joshua-trees-future-could-rest-on-landmark-climate-case.](https://www.earthisland.org/journal/index.php/articles/entry/the-western-joshua-trees-future-could-rest-on-landmark-climate-case))

“Saving Species Using Soundscapes” was published in the *Berkeley Science Review* in April 2022. It is 1,224 words. This piece explores the new research one herpetologist is conducting on the intersection of soundscapes and conservation. While science heavy and technical, this piece challenged me as a writer to understand and relay how environmental science interacts with many other fields — like the study of sound waves. I believe I explained these concepts well in this article while still keeping the larger ideas about species conservation at the center of the story.

(URL: [https://berkeleysciencereview.com/article/2022/05/01/saving-species-using-soundscapes.](https://berkeleysciencereview.com/article/2022/05/01/saving-species-using-soundscapes))

“Can the Northern Summer Steelhead be Saved Time” was published online at *Sierra Magazine* in March 2023. It is 1,288 words. This piece looks at the California Endangered Species Act through a critical lens using a critically endangered fish — the summer run steelhead trout. The trout waited four years to see an official day in court, while their population numbers continued to fall. I used characters like Scott Greacen, the lawyer who petitioned to list the species, and Samantha Kannry, the scientist who has monitored the species since the early 2000s, to tell the fish’s story. This article challenged me to deeply develop human characters in my writing and connect them to the species I was writing about in order to evoke emotions in readers; I traveled to Eureka, CA to meet with Greacen and Kannry and spend time with them. I believe the emotions of passion and frustration come through well in this piece.

(URL: <https://www.sierraclub.org/sierra/can-northern-california-summer-steelhead-be-saved-time>)

Saving Species using Soundscapes

By: Krissy Waite

As a child, Becca Brunner's idea of a good time was copying encyclopedia entries on animals into her notebook. She had no idea back then that "ecologist" was a possible career choice. She was always fascinated by animals, but one particular kind was especially exciting to her.

"I've always loved frogs," she said. "If you didn't know what to get me as a gift when I was a kid, you got me something frog related."

Now 34, Brunner is a herpetologist (an expert in frogs and amphibians) and a PhD candidate at the University of California, Berkeley in the Department of Environmental Science, Policy, & Management.

Brunner's research is based in Ecuador, where she studies local frog populations to determine which traits cause frogs to thrive or struggle when faced with habitat disturbances. Specifically, she examines if forest fragmentation due to agriculture is a barrier to frog breeding. In order to avoid inbreeding, frog populations must introduce new genes from other populations to increase their genetic diversity. Genetic diversity is important because it proves a greater chance for resilient traits to develop—traits that may help an individual avoid predators or obtain food more effectively, for example.

One way Brunner determines if frogs are traveling to breed is by examining mitochondrial DNA, which is found in the mitochondria and is inherited from an individual's mother. This kind of DNA is commonly used in population genetics studies because it has a high variability and is less likely to have genetic changes due to natural selection. Using this genetic information, she can determine how closely-related various frog populations are in a given area. If the data shows that frogs from geographically distinct populations are related, then the members of those populations must be traveling across the intervening distance to breed with one another and exchange genes. Distances that frogs travel to breed vary, even within one species; for example, the common toad may travel anywhere from 5 meters to 5 kilometers to breed.

"If you are small, traveling even a few meters takes energy," Brunner said.

Using population genetics to understand a species and its behavior is not a new technique. However, Brunner has expanded on this traditional method of analysis and taken her research to a new level by using an additional source of information: soundwaves.

"I'm totally going into a new territory here," Brunner said.

Most male frogs use mating calls to attract a female. The calls are coded with information about the male frog's health and vitality; for example, a bigger frog usually makes lower frequency calls. The female will hear and interpret the call and pick a mate, usually choosing the biggest male she can find.

But there is another important aspect to whether a male frog is successful in calling a mate: the environmental soundscape. In ecology, a soundscape is defined as all the sounds that come from an ecosystem. Each landscape has unique physical structures that influence the way soundwaves travel through the environment. A higher-frequency call needs a denser environment to travel, because high-frequency sound is more susceptible to attenuation (the weakening of a signal or current over a distance). Additionally, having more objects for a soundwave to bounce off of may help the higher-frequency wave amplify itself through positive (or constructive) interference, in which a soundwave bounces off an object in a way that produces a new wave that mimics the original soundwave. This is beneficial for a frog's mating call because the peaks and valleys of both soundwaves line up in sync, making the peaks and valleys bigger and making the sound louder.

Because of this, a wide-open, empty space like a crop field may be the death of a mating call. Over time, this could potentially lead to the death of entire populations—or even entire species—by promoting inbreeding.

However, in some cases, a frog's call may evolve to adapt to the unique soundscape of its natural habitat. Brunner's work uses one potential example, Orejuela's glass frog, that lives by loud waterfalls in Ecuador and Colombia. It has an unusually high-pitched call compared to its large body size; at three inches long, it is roughly double the size of most glass frog species. Brunner said its call probably evolved to be heard over the sound of the rushing water of the falls, which is generally of a lower frequency than the calls of many frogs. She suggested that the existence of this frog is evidence that traits can evolve due to the soundscape of a species' environment.

Brunner suggests that over time, if there were glass frogs with low-pitched calls that lived near waterfalls, they either died out because they were unable to call to each other and find mates, or they moved away from the falls in order to find better reproductive success. Either outcome would reinforce the preference among frogs with high-pitched calls for living near waterfalls, and potentially lead to new species of frogs specialized for different acoustic habitats.

This hypothesis is incredibly difficult to test, but the fact that large body size and high call pitch do not necessarily correlate may be evidence of a frog species adapting in response to its acoustic environment. In nature, it is uncommon to find frog species that prefer to live near waterfalls because the environment is usually too loud for them to call to one another, and is also difficult to move around due to the force of the water. This is why Brunner has spent time studying the delicate, see-through Orejuela's glass frog: It may be a unique example that illustrates a more general strategy for how frogs can adapt to the challenges posed by their habitat's soundscape.

“That is a super exciting concept to me, that the sound [of a habitat] can actually affect breeding biology,” Brunner said. “My hypothesis was that maybe we don't find these frog species in agricultural areas, especially pastures, because the sound environment is too different.” Brunner is still analyzing the data she has collected and is hoping to have a draft of her findings prepared this month.

Brunner hopes her research will be applicable to real-world conservation management plans. She suggests that farmers could utilize crops that are more ideal for amplifying the soundwaves produced by calling frogs. Current crops in Ecuador include palm oil, corn, bananas and wheat, which are often monocropped (a farming strategy where a single crop is grown every year on the same plot). The agricultural structure Brunner suggests would resemble a forest: fruits and vegetables for personal sustenance, and coffee and cacao as cash crops, grown underneath native trees. This would help the soundscape of the crop field better mimic the natural acoustic habitat of frogs.

“[Local farmers are] just trying to make ends meet,” she said. “I would love to also have these results turn into something that is a win for biodiversity and local people.”

Brunner’s studies address a key question in conservation and ecology: Why do we find species where we find them, especially in this age of human habitat disturbance? By studying population genetics and changing soundscapes, she hopes to develop a better understanding of how frog breeding patterns are impacted by deforestation. If her hypotheses prove correct, her work may shed new light on how best to improve agricultural practices to help frogs and humans coexist.

The Western Joshua Tree’s Future Could Rest on Landmark Climate Case

Without legal protection, the iconic trees could vanish from California by 2100.

By: Krissy Waite

The iconic western Joshua tree may become one of the first species listed as threatened primarily due to climate change under the [California Endangered Species Act \(CESA\)](#), potentially making it a landmark case in how species may qualify for legal protection in the future. If no action is taken to mitigate threats to the ancient species, recent climate models predict that the trees [may vanish from the state by 2100](#).

Climate change is causing a domino effect of stressors such as fire, predation, and drought that are affecting the trees’ ability to successfully reproduce, adding to the threat posed by habitat loss. Advocates hope to prevent this extinction by listing the tree as threatened under state and federal endangered species protection laws, which would then legally require state and government agencies to make an effort to protect it from climate change. For now, the western Joshua tree (*Yucca brevifolia brevifolia*) is considered a candidate species, but a legal process is underway that will ultimately decide its fate.

“This is a species that’s prehistoric,” Jennifer Schwartz, a staff attorney at the nonprofit WildEarth Guardians said. “Joshua trees have been around for two-and-a-half million years and we’ve kind of managed to threaten it with extinction in the span of one-and-a-half human lifetimes.”

Aware of this threat, the Center for Biological Diversity (CBD) [petitioned the state of California](#) in October 2019 to list the western Joshua tree as threatened under CESA. California’s Fish and Wildlife Commission transferred the petition to the Department of Fish and Wildlife (CDFW), which then conducted a review of the petition and decided that listing the western

Joshua tree may be warranted. The Commission then voted in September 2020 to move forward, making the tree a candidate for CESA.

Schwartz said plants can be easier than animals to list under the ESA because they are typically endemic to a small region, making it easier to identify a species' critical habitat. However, Joshua trees cover a large range, making identifying their critical habitat more difficult.

According to Schwartz, "the models show [that] so much of that [area] is going to be lost. Even if we started taking immediate action on climate change, populations will be lost."

Brendan Cummings, CBD's conservation director who wrote the petition, said that even though the western Joshua tree has a large range, he believes legal protection is attainable.

"I believe that it can be saved and that protection under the California Endangered Species Act will help save the species," Cummings said.

Protecting the Joshua tree through the legal system did not always seem practical. In 2019, the conservation group WildEarth Guardians had submitted another petition to the US Fish and Wildlife Service (FWS) to list both western and eastern species of Joshua tree as threatened under the ESA. After a year-long review process by the FWS, the tree was denied federal protection.

The FWS findings acknowledged that both species of Joshua tree face stressors, but ultimately concluded that it did not find the threats to be large enough in scale. It also noted that the trees still occupy their historical range.

WildEarth Guardians challenged the decision, and in September 2021, a United States District Court ruled that the FWS had violated the law when it failed to list both species of Joshua tree under the federal ESA. The court found the agency ignored the available science listed in the petition when making its decision, which it described as "arbitrary and capricious." The FWS now must reconsider its previous decision.

Cummings decided to focus on the western species for the CBD petition because its range is primarily in California, with a small portion of it in Nevada. While the two Joshua tree species vary slightly in shape, size, and genetics, the main defining factor between the two is that they have different pollinating moths.

For Cummings, the recognition from the FWS in 2019 that the Joshua tree is two separate species changed the game. As a single species, the Joshua tree spanned four states and over 12 million acres of both public and private land, which made it a less-than-perfect candidate for protection under either federal or state law. The eastern Joshua tree is mostly found in Mojave National Preserve, which means it is protected under federal law, whereas 40 percent of the western species' range is on private land, putting it at risk from development.

Models cited in Cummings' petition also predict the western Joshua tree will mostly, if not totally, cease to exist in California by the end of the century, perhaps surviving only in the

northeastern edges of its range. To be listed as a threatened or endangered species in California, the species only has to be imperiled in California, even if it exists in other states. This is another reason why Cummings wanted it listed under the state ESA.

“All those things came together, and it felt like the right time to make a go at protecting them,” Cummings said.

Todd Esque, a research ecologist at the US Geological Survey who studies the life cycle of Joshua trees, said the climatic threats to them mainly stem from the tedious and complex nature of its reproductive process.

Joshua trees are able to reproduce sexually, via pollinators, and asexually through their roots, which will produce genetically identical ‘resprouts.’ Resprouts can grow rapidly. According to Esque, a resprout can reach a reproduction life cycle within a couple of decades, whereas from a seed this takes about 70 years.

To successfully reproduce from a seed takes a combination of effort from moths and rodents, as well as pure luck. Esque explained that for a seed to grow, there has to be a year where the trees all are in bloom in order to be pollinated by yucca moths. This happens once every few years. The same year the trees are blooming, yucca moths also must have a healthy and active year. The effects of climate change on the moths are unclear.

If the Joshua tree is pollinated, the tree drops its seed-filled fruit to the ground. Squirrels then collect the seeds and store them away across the desert. In order to begin growing, the seed must be stored at about two centimeters underground.

If the seed is lucky, the squirrel will store the seed at the right depth and forget about it. “The more we study them, the more we find it’s incredible that they can ever make it, and yet, they’re out there ... so far,” Esque said.

Then, the weather has to provide enough rain within 18 months of the seed being planted, or else it may rot. Rainfall is scarce in the desert under normal conditions, with one wet year often followed by several dry years. [Thanks to climate change](#), these cyclical droughts are intensifying in length. Increasing incidence of wildfire poses an added threat.

“Just like when a human is burned, if a large part of our bodies are burned, it’s almost nearly always fatal,” Esque said.

When a Joshua tree is burned, it loses all the water in its tissue and essentially dehydrates. This puts the tree at a greater risk for infection. However, Esque’s research found that there is some hope for Joshua trees after a fire because of their vast, sprawling underground root systems. As long as there is enough rainfall after a fire, the tree’s roots can still generate resprouts. But after a fire, Joshua trees also face greater risk of predation. With fewer food options, predators like rabbits, insects, and rodents devour Joshua tree resprouts.

Cummings said he believes that if the western Joshua tree is listed as threatened under CESA, it could be one of the most impactful listings in its history not just because it would be the first due to climate change, but because it would change how CESA is enforced and land is used, especially in the desert. He added that the tree is impossible for developers to ignore, hide, or remove illegally due to its large size, making it easier to monitor the species.

“You can’t hide a Joshua tree,” Cummings said. “We can literally see them from space. ... we know if you illegally removed one without a permit.”

Due to the trees’ candidacy status, they are temporarily protected while the CDFW prepares a review of the case. While a ruling on a permanent listing was originally expected in October 2021, the California Fish and Wildlife Commission has been waiting on the review by the CDFW, which was granted a six-month extension. The CDFW submitted the [status report](#) last week, recommending against listing.

“California wildlife officials just proposed open season on Joshua trees,” Cummings said in a press release. “Before state protections took effect, developers were bulldozing these beautiful, fragile trees by the thousands to build roads, warehouses, power plants, strip malls and vacation rentals. If Joshua trees are to have any hope of surviving in a warming world, we have to stop the widespread killing of them.”

The Fish and Wildlife Commission will vote on whether the western Joshua tree will be listed as threatened under state law in June. The commission’s final vote will determine if the tree is officially added to the CESA. As a listed species, it would be illegal for any part or product of the western Joshua to be, “taken” (i.e., killed), possessed, purchased, or sold without a state approved permit, [according to the California F.W.S.](#)

Cummings believes the commission will vote to list the tree as threatened because the members are supposed to vote solely based on the science.

“If they vote no,” Cummings said, “we’re pretty confident a court would overturn it.”

Can the Northern California Summer Steelhead Be Saved in Time?

A report lists the status of the fish as “critical”

By: Krissy Waite

Researchers have come to dire conclusions about California’s native fish: Almost half of the salmonids are likely to be extinct in the next 50 years, including over half of anadromous species—fish that migrate up freshwater rivers from the ocean to spawn. This is according to the [State of the Salmonids II report](#), which reviewed the status of California’s 32 salmon, trout, and steelhead fish species.

One fish in particular, though, is declining more rapidly: The Northern California Summer Steelhead trout. In barely a decade, the time since the first *SOS* report was released, the species had escalated from a high to critical level of concern and their population numbers had

plummeted to less than 1,000 adults. While the fish are genetically poised to adapt to warming environments, they could cease to exist by 2050 without intervention and habitat restoration on the Eel River.

In 2018, Friends of The Eel River, a nonprofit in Eureka, CA, filed an official petition to list the Summer Run Steelhead Trout under the California Endangered Species Act (CESA). [According to the CA Department of Fish and Wildlife](#), the CESA process takes a minimum of two years, but there is no legal timeframe by which the entire process must be completed. Recent listings have taken around four years. Conservation experts worry that with added pressures from climate change, endangered species like the Northern California Summer Steelhead don't have years to wait for regulation. Now, advocates have taken a crisis management approach to the CESA, putting resources into species that show the most promise in surviving the future.

[The Northern California Steelhead once claimed a range](#) that spanned from Humboldt County to Mendocino County, but only a few watersheds support summer steelhead now: Redwood Creek and the Mad, Eel, and Mattole rivers. On the Eel River, they can be found in the mainstem, upper mainstem, North, Middle, and South forks. Their journey is long: In the beginning of summer, immature fish enter the river from the Pacific and travel upstream, often resting in deep, cool pools along the way to their estuary. When winter rains come in December to February, they spawn. Mature adults migrate back to sea around March. Juveniles leave their tributaries in the spring, taking time to grow and feed.

According to Scott Greacen, the conservation director for Friends of The Eel River, the fish would be more accurately named freshwater salmon. Like their relatives Chinook and Coho—which the Steelhead Trout are more closely related to than Sockeye—Summer Steelhead often migrate back to the same estuaries they were born into to spawn. Getting this trout listed under CESA wasn't always plausible. Up until recently, winter- and summer-run Steelhead were considered genetically similar. The idea that the descendants of the winter run could become summer run led to the belief that Winter Steelhead would sustain the Summer Steelhead species if population levels get too low. This was the argument the California Department of Fish and Wildlife made against listing them in previous years.

But summer populations have declined in past years faster than winter run. Fish biologist Samantha Kannry has done yearly population surveys—a three-day hike up and over boulders and through rough terrain—in the Van Duzen, a large tributary off of the Eel river, for the past 10 years. She agrees: population levels are alarmingly low and have been steadily decreasing. This past year, she surveyed a population of around 350 adults in the Middle Fork of the Eel, which is still considered the largest population in the watershed. A healthy population number would be in the thousands per area. “They’ll be gone pretty quickly in our lifetimes,” she said. “Summer Steelhead are on the verge of extirpation...and most people don’t even know they’re here.”

Researchers at UC Davis [discovered a specific gene](#) related to run timing—if a fish begins the freshwater journey in the summer, fall, or winter—that suggested Summer Steelhead are genetically unique. This gene only evolved once in the species’ entire genetic history, meaning the genetic variant that causes the summer run time is unlikely to appear again if lost. The fear

that thousands of years of unique genetic history will be gone forever is part of the reason advocates are determined to save this fish.

The Summer Run Steelhead trout are the athletes of the salmonids—[a class of long, bony cold-water fish](#) that includes salmon, trout, and chars. They swim faster, jump higher, and travel further—dispersing essential nutrients along the way—than their relatives. They are also incredibly adaptable; they utilize smaller bodies of water that salmon steer clear of and “zoom around,” as Greacen put it, all over the watershed in search of resources during the winter months.

According to Greacen, one of the co-benefits of getting the summer steelhead listed under CESA could be the removal of [two pre-ESA](#) dams on the Eel River. The Scott Dam is currently the end of the line for migrating fish, and that’s only if they managed to make it over the Cape Horn Dam fish ladder at the Lake Van Arsdale reservoir miles before. Both dams are part of the Potter Valley Project, a hydroelectric project that diverts water from the Eel into the Russian River owned by PG&E, the largest utility in California.

The habitat behind Scott Dam is some of the best for Summer Run Steelhead Trout, which prefer bodies of water with large boulders, woody debris, and deep, undercut banks essential for hiding from predators. The California Department of Fish and Wildlife review of the species even [acknowledged that Scott Dam blocks about 290 miles of freshwater habitat](#) and states that “removal of Scott Dam provides potential for repopulation of summer steelhead in the upper Eel River basin.” In the [Fish and Game Commission’s statement](#), Scott Dam is cited as a major threat.

In 2019, PG&E decided not to renew the Potter Valley Project’s license with the Federal Energy Regulatory Commission. They also halted attempts to sell it. A coalition of stakeholders developed the [Two-Basin Solution](#): a project that would meet the needs of water users while also restoring habitat for fish, but they were unable to raise the funds needed to buy the license. The Potter Valley Project license remains up in the air, but Greacen believes the Summer Run Steelhead listing will help expedite a decision to decommission the dams. “We are in a race against time,” he said, saying the dams would ideally be gone within five years.

Greacen asserts that a federal ESA listing would also add another level of pressure in the dam-removal argument. But the time concern remains: Federal ESA listing [takes an average of 12 years](#), and the fight for dam removal is ongoing.

Kannry cited how with some species, there was a clear action needed. For Bald Eagles, it was banning DDT; for Spotted Owls, it was limiting timber harvesting. “But with the steelhead, it’s just... everything,” she said.

For Caltrout’s Patrick Samuel, it’s deeper than ecological importance and speaks to a sense of societal responsibility. “I think when a species goes extinct, it’s a part of our shared human history and culture that goes with it,” he said.

Greacen, who has been in the field for decades, is careful to use the word “hope” when it comes to saving this species through CESA, as it can lead to passiveness. But he does see CESA as a way to bring public awareness and help move along the legal process.

“I love the world and I hate what has happened to it,” he said. “What drives me... It’s not hope. It’s an absolute refusal to let it happen without fighting back.”

Source List:

“Saving Species using Soundscapes”

- Becca Brunner, Herpetologist and PhD Candidate

“The Western Joshua Tree’s Future Could Rest on Landmark Climate Case”

- Brenden Cummings, Conservation Director at The Center for Biological Diversity
- Jennifer Schwartz, attorney at WildEarth Guardians
- California Endangered Species Act
- Fish and Game Commission member
- “Past and ongoing shifts in Joshua tree distribution support future modeled range contraction,” [Research Paper](#) published in Ecological Applications
- Todd Esque, research ecologist at the US Geological Survey

“Can the Northern California Summer Steelhead Be Saved in Time?”

- Samantha Kannry, Fish Biologist
- Scott Greacen, Conservation Director at Friends of the Eel River
- Alicia Hamann, Executive Director at Friends of the Eel River
- Patrick Samuel at CalTrout
- Russell Marlow, CalTrout Senior Project Manager
- Craig Tucker, consultant to the Karuk Tribe
- Gabriel Rossi, Postdoctoral Researcher at UC Berkeley and California Trout Coastal River Ecologist
- Dan Silver, Executive Director of the Endangered Habitats League
- Jeff Miller, Senior Conservation Advocate at the Center for Biological Diversity
- California Endangered Species Act