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Endangered Species Bulletin

Summer 2011 Volume 36, No. 2

Achieving Recovery and Preventing Extinction

Editor's Note

This will be the final edition of the *Endangered Species Bulletin* in its current format. Starting this fall, the publication will appear exclusively online at *www.fws.gov/endangered/news/bulletin.html*, and will be updated bimonthly. Each edition will include an in-depth feature article coupled with several supporting articles, a live endangered and threatened species news feed, plus other new and social media offerings.

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You can also call us at 703-358-2171.

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The Bulletin welcomes manuscripts on a wide range of topics related to endangered species. Please send an inquiry before drafting the article.

Connect with us! The Endangered Species Program is now on *Facebook www.facebook.com/USFWSEndangeredSpecies*. Visit our page—we think you will "like" it. Follow us on *Twitter www.twitter.com/USFWSEndsp* to keep up with the latest endangered species news and information.

◂ **On the cover**: The U.S. Fish and Wildlife Service and its conservation partners involved in the 30-year long Tennessee purple coneflower (*Echinacea tennesseensis*) recovery effort have reason to celebrate. In August 2011, the Service proposed to recognize the wildflower's recovery by removing it from the federal list of endangered and threatened species. ©2011 Daniel W Reed, *www.2bnTheWild.com*

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Recovering Endangered and Threatened Species

What Recovery Entails

by Debby Crouse

Kemp's ridleys display one of the most unique synchronized nesting habits in the natural world—females will come ashore in large groups and nest.

Photo courtesy of Gladys Porter Zoo

At first glance, someone reading the Endangered Species Act (ESA) may miss the recovery section altogether – Section 4(f), which directs the development and implementation of recovery plans for the conservation and survival of listed species, with little further guidance regarding the contents or implementation of these plans. All of this fits into two thirds of a page in a law that is 45 pages in length.

By delving deeper, one will realize the fundamental focus of the ESA is the recovery of endangered and threatened species. Most other sections within the ESA simply provide mechanisms to facilitate recovery. Indeed, the primary purpose of the ESA, as stated by Congress is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may become conserved, [and] to provide a program for the conservation of such . . . species."

So how do we achieve recovery, and how do all of the other aspects of the ESA fit in? This edition of the *Endangered Species Bulletin* outlines the recovery process from beginning to end.

We begin with an article describing the purpose of recovery plans and their role in strategically guiding the recovery program for any given species. Recovery plans provide direction for effectively achieving recovery. They also serve as outreach documents to those who are not directly involved with a species' recovery, but have an interest in the implementation of a recovery plan and how that plan might affect them. Therefore, plans must build a logic train between the current status of a species, the reasons for its endangered or threatened status, and why we believe a particular strategy and suite of recovery actions serves as the most efficient and effective way to recover the species. The Ash Meadows National Wildlife Refuge article later in the edition describes a recovery program guided by a relatively uncommon ecosystem-based recovery plan addressing a suite

of species impacted by the same threats in a small area.

The U.S. Fish and Wildlife Service (Service) and the National Marine Fisheries Service (NMFS) have been charged with determining whether to list species, reclassify them, or delist them–the Service for terrestrial and freshwater aquatic species, and NMFS for most marine species. These determinations are based on an analysis of various factors, commonly referred to as threats. Each listed species has a unique combination of biological attributes and threats (e.g., loss of habitat) that has led to its endangered or threatened status. Analyzing a species' inherent vulnerabilities and how, when, and where various threats may affect the species helps us craft the most effective strategy for recovery. This is exemplified by the article on the threatened southwest Alaskan distinct population segment (DPS) of the northern sea otter (*Enhydra lutris kenyoni*), which demonstrates how such a threats assessment led to identifying the most important threats to the DPS and a targeted recovery program for the otters.

Species recovery has its challenges. The article on the threatened bull trout (*Salvelinus confluentus*) in the Lemhi Basin illustrates how we can address uncertainty when making management decisions for endangered and threatened species, and therefore overcome various challenges to species recovery despite the uncertainties. Building adaptive management into a recovery program allows us to use the best tools currently available as we continue to learn more about a species and its management needs. A suite of additional articles highlight the diversity of situations and obstacles we encounter during the recovery process and how our biologists rise to these challenges.

Still, even the best of plans will not lead to recovery if they are not implemented. However, neither the Service nor NMFS have the resources, authorities, or the skills necessary to fully execute most recovery plans. We rely on our partnerships with other programs within the Service, NMFS, other Federal agencies, States, Tribes, private landowners, conservation organization, and industry to help implement many of the actions outlined in recovery plans. Several articles in this edition illuminate a few of the various partnerships and 'tools' that have helped facilitate implementation of most recovery plans.

Usually, it is up to the lead recovery biologist to engage conservation partners and coordinate their overall actions into a cohesive, strategic whole. This, however, is only one, and sometimes a minor, part of what they do. So what does it take to be a successful recovery biologist? Here, one of our recent Recovery Champion award winners gives us a glimpse of what it can be like to take on that role.

Once a recovery plan has been implemented, how do we determine a species has recovered to the point that it can be delisted, and how do we ensure the species' status does not deteriorate again once ESA protections are removed? The tale of the Lake Erie watersnake (*Nerodia sipedon insularum*) illustrates the entire process from recovery planning through implementation to delisting and subsequent 'post-delisting' monitoring.

We are constantly seeking ways to improve coordination throughout the Endangered Species Program to enhance the efficiency and effectiveness of species recovery. We see periodic threats assessments as an activity needed throughout a species' tenure under the ESA. A shared framework and database for the latest species' information and threats assessment will ensure a common understanding of a species' status and issues, giving us a jump start on species' management and recovery throughout the program. Another project underway is the updating of the NMFS/FWS joint recovery planning guidance to address ways to make plans more flexible and user-friendly for our recovery biologists, conservation partners, and other stakeholders, to help them identify opportunities to make more meaningful contributions to recovery.

The Black-footed Ferret Recovery Program is celebrating two major milestones this year: the 30th Anniversary of the species rediscovery and the 20th Anniversary of their successful return to the wild. *Ryan Hagerty, USFWS*

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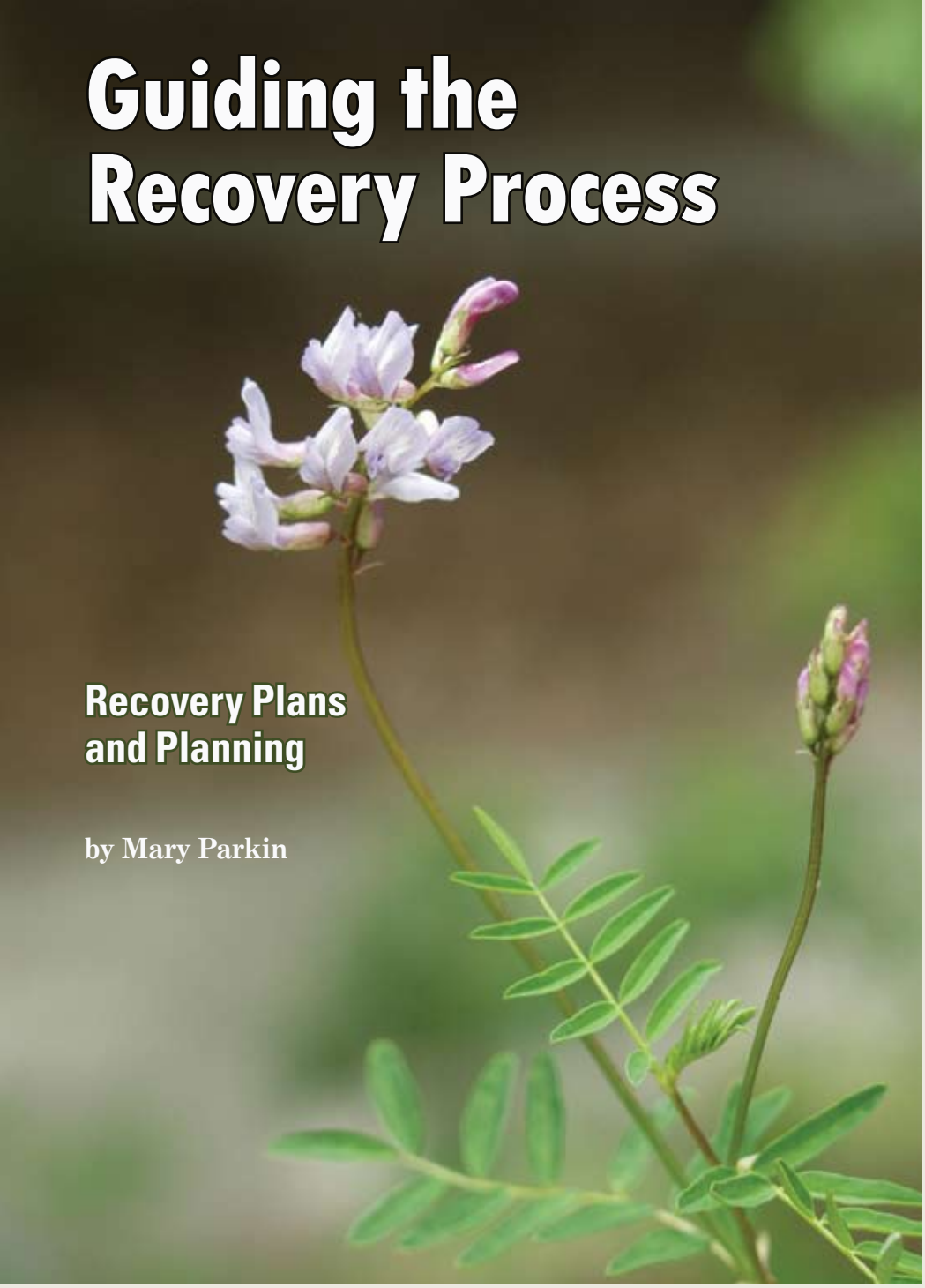
Guiding the Recovery Process

Recovery Plans and Planning

by Mary Parkin



Jesup's milk-vetch, an extremely rare member of the bean family, occurs only at three sites along a 15-mile stretch of the Connecticut River in New Hampshire and Vermont. *©Lisa Mattei, New England Wild Flower Society*

In 1989, as the newly minted Recovery Coordinator for the U.S. Fish and Wildlife Service's Northeast Region, my first encounter with a recovery plan was for the endangered Jesup's milk-vetch (*Astragalus robbinsii* var. *jesupi*). With the 1988 Endangered Species Act (ESA) amendments and a few recovery plan examples in hand, I worked alongside the Service's lead biologist and a contract botanist to create a document that would do justice to the issues facing this rare plant.

Our efforts resulted in a plan with a wildly ambitious set of recovery criteria and wish-list of actions. I still recall, though, the stimulating discussions, the careful analysis, and the many questions asked as we attempted to chart an effective course of action. To this day, the plan, however outdated, continues to provide the underpinning for valuable recovery activities.

As reflected in the language of the ESA – and particularly in its 1988 amendments – Congress envisioned recovery plans as conservation guides pertaining to virtually every listed species, with the dual purpose of ensuring effective action and accountability to the public (which is kept informed of recovery progress through biennial recovery reports to Congress and other reporting mechanisms). Appreciation of the need for sound recovery plans has evolved over the years; now, more than ever, we understand that recovery is a complex process requiring a focused strategy based upon good information, clear goals, and specific proposals.

Recovery plans have followed this evolution of understanding ever since 1976, when the first plan for the Columbia white-tailed deer (*Odocoileus virginianus leucurus*) was produced. The recently approved St. Andrew beach mouse (*Peromyscus polionotus peninsularis*) plan, for example, is different from early plans in many ways. Most notably, its recommendations stem from a systematic threats assessment that quantifies specific dangers to the species, whereas early recovery plans included general descriptions of threats and focused primarily on population targets. As well as more fully responding to threats, current plans tend to call for more rigorous scientific analyses and treatment of uncertainties, more explicit recovery strategies, and increased monitoring. Biologists embarking on recovery planning efforts today also follow updated guidance on the minimum requirements of a plan, including site-specific management actions; objective, measurable delisting criteria; and time/cost estimates for achieving recovery.

Piping plovers are the beneficiaries of an extensive recovery cooperator network. Federal and state agencies, state municipal beach managers, and non-governmental organizations focus a considerable amount of attention on the research, monitoring, protection, and management of these small shorebirds. *©Jim Fenton*

Despite these advances, it's reasonable to ask how much inherent value recovery plans add to the actual recovery process. Some see a tension between the "thinking" and "doing" phases of recovery, contending that planning diverts attention and funding from on-the-ground actions. It's also fair to say, however, that planning is essential for designing effective restoration activities. Recovery plans force us to envision what success looks like and to lay out a clear path for achieving that vision.

Species can benefit from individual planning endeavors in several specific ways. There is often a "bounce" in visibility and recovery momentum during the planning effort. For example, through the process of revising its recovery plan, the threatened Chittenango ovate amber snail (*Succinea chittenangoensis*) gained an invigorated recovery team and funding for long-delayed actions. Partnerships are typically enhanced, as exemplified by collaboration of multiple entities for the recovery of piping plovers (*Charadrius melodus*). Planning allows us to identify critical information gaps that need to be filled in order to make better recovery decisions and prevent inadvertent impacts to species. Taking the time to develop a plan also allows us to step back and reflect on present and future challenges to recovery, such as the emergent threat of white-nose syndrome, a rapidly spreading fungal disease that is putting Indiana bat (*Myotis sodalis*) and other bat species at great risk. Finally, good planning makes it more likely that approved recovery actions – among all possible actions – will have tangible benefits for the listed species, and the plan document allows us to convey this confidence to others. In this sense, recovery plans serve an essential function as outreach materials for both partners and the general public. Laying out a clear case for a particular recovery strategy and the associated recovery criteria and actions heightens that prospect that others will understand their role in and be motivated to contribute to the recovery process.

For species on the initial endangered species list, the "Class of 1967," recovery actions were implemented on a species-by-species basis. Now, however, half of our approved recovery plans are designed to address multiple species that occupy shared habitats or face similar threats. As of June 2011, 1,100 species were included in a total of 552 approved plans. Among others, multi-species recovery plans have been prepared for the Holmgren's milk-vetch (*Astragalus holmgreniorum*) and the Shivwits milk-vetch (*Astragalus ampullarioides*), found in Utah and Arizona, for several freshwater mussel species, and for a host of Hawaiian plants and animals. When species are co-listed because of shared habitats, biological traits, or threats, a plan may consolidate strategies and actions. Ecosystem-based plans can also prove useful, particularly if all of the covered species are endemic to that ecosystem. As a guiding principle, all recovery plans should steer recovery in the most efficacious way possible.

Our ultimate goal of restoring endangered and threatened species to long-term viability in the wild has been well-served through the traditional recovery planning process. But as times are changing, so are the approaches to recovery planning. In years to come, recovery plans will be even more practical and dynamic, more attuned to new technologies, and more responsive to scientific advances. Recovery is, by definition, an optimistic, forward-looking venture, and as we continue to hone our planning tools and skills, we'll be ever more able to guide species to a secure future.

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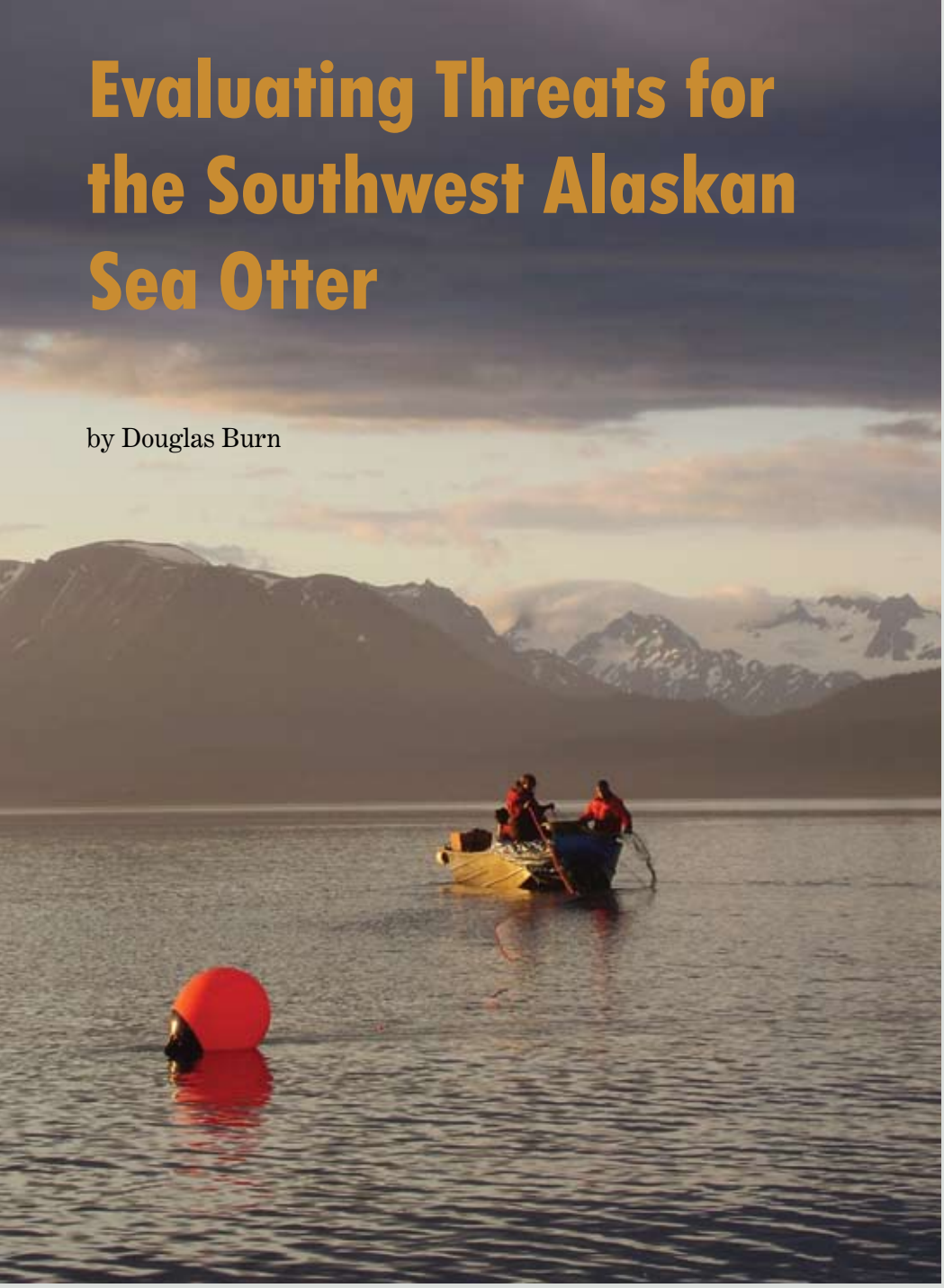
Evaluating Threats for the Southwest Alaskan Sea Otter

by Douglas Burn



Biologists lay out tangle nets to capture sea otters in Alaska. *USFWS*

Species become endangered or threatened due to one or more factors, commonly referred to as threats. Usually, these threats are primarily human-induced. Threats affecting a species' abundance, range, reproductive capability, and/or their genetic diversity make them more vulnerable to other threats or natural events, such as hurricanes or climate change. Recent recovery plans incorporate an explicit "threats assessment" to identify various threats, evaluate their impacts on the species, and rank their relative contribution to the species' endangered or threatened status. This makes for a more effective recovery strategy, which focuses on abating threats in order of their priority. It also facilitates a better understanding by potential conservation partners and other stakeholders of how and why we identify a particular strategy and a prioritized suite of recovery actions to most effectively achieve recovery of the species. In turn, potential partners more readily see how they can contribute to the species' recovery.

Depending on the specificity of the information available, threats assessments can range from more a qualitative assessment based on the studied opinion of a number of experts on the species' issues, to a quantitative and detailed assessment based on empirical data. In either case, the added value of explicitly analyzing threats is the clarification of areas of uncertainty, pointing to needed research in order to refine our understanding of a species' threats and their relative impacts. The threats assessment developed for the 2010 draft recovery plan for the southwest Alaskan distinct population segment (DPS) of the northern sea otter (*Enhydra lutris kenyoni*) illustrates such an assessment and how it has facilitated development of a recovery strategy and plan for otters.

The DPS was listed as threatened in 2005 after survey information indicated that the otters had declined in abundance by more than 50 percent since the mid-1980s. The cause of the overall decline is not known with certainty, but the weight of evidence points to increased predation, most likely by the killer whale (*Orcinus orca*), as the most likely cause. Other threats considered in the recovery plan include infectious disease, contaminants, oil spills, food limitation, disturbance, bycatch in fisheries, subsistence harvest, and loss of habitat.

The recovery team began by identifying six ranking criteria for each threat:

- Potential impact—the amount of effect the threat could have on the population in an area where the threat occurs;

- Geographical scope—the geographical extent of the threat across the management unit being considered;

- Likelihood—the likelihood that the threat will occur within the next 10 years;

- Level of confidence—the degree of confidence in the assessment of the previous three factors;

- Importance to recovery—an overall assessment of how much the threat could affect recovery; and

- Management potential—an estimate of the likelihood that the threat could be managed to reduce or eliminate its impact.

The importance of each of these factors was ranked with one of three categories, such as "low/moderate/high" or "not likely/somewhat likely/very likely." For example, the threat of oil spills could have a "high" potential impact on sea otters because they rely on a dense and well-maintained coat of fur as insulation from the cold waters where they occurs, and crude oil reduces the insulative capability of otter fur. However, the likelihood of occurrence over a wide geographic scope was determined "not likely" because large oil spills are a relatively rare occurrence. In this type of analysis, important threats with high management potential indicate areas where recovery actions may be the most successful.

After ranking all the threats for each of the five geographic management units within the DPS, the recovery team integrated all this information to create a summary ranking (low/moderate/high importance) for each threat. It was determined that most of the threats were of low importance, with only predation ranking as high importance. The recovery plan includes a narrative description of each threat, which describes the rationale behind the summary ranking.

A mother and pup sea otter caught in a research net. Adult sea otters are radio-tagged and tracked for up to two years. *USFWS*

The team also developed a Recovery Action Plan that details an exhaustive list of actions that could be taken to help recover the DPS. The list of actions was partially informed by the outcome of the threats analysis describe above. In addition, the assignment of priorities in the Recovery Implementation Schedule was also based on the importance of each threat.

To be effective, recovery plans must identify and prioritize among multiple threats according to the risk they pose to the species sustainability. Variations of this more explicit and transparent approach to analyzing threats have also been used in other recent plans such as that for the St. Andrew beach mouse (*Peromyscus polionotus peninsularis*), the northwest Atlantic population of the loggerhead sea turtle (*Caretta caretta*), and the Kemp's ridley sea turtle (*Lepidochelys kempii*), and have contributed to more effective recovery planning. As with all aspects of the recovery process, threats assessments should be reviewed and updated appropriately as new information becomes available. They can also be used to determine whether a species is ready for delisting, or if the recovery plan is in need of revision.

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The Role of Safe Harbor Agreements in the Recovery of Listed Species in California

by Richard Kuyper

Because the majority of land within the United States is privately owned, and the range of many listed species are found partially or even entirely on private lands, it is necessary for the U.S. Fish and Wildlife Service to work successfully with private landowners to contribute to the recovery of listed species. In California, safe harbor agreements are fostering relationships with private land owners and playing a significant role in recovery of listed species.

In a nutshell, safe harbor agreements are agreements between the Service and landowners who agree to carry out management activities on their lands that provide a net conservation benefit to a listed species (e.g., contribute to recovery). In return for their contributions to species recovery, landowners are authorized to return the property to baseline conditions at the end of the agreement. Baseline condition refers to the amount of listed species habitat that existed on the landowner's property prior to entering into the

The California tiger salamander is one of the species benefiting from the Safe Harbor program. *John Cleckler, USFWS*

Landowners participating in the Safe Harbor program work to create and conserve suitable breeding habitat for both the California tiger salamander and California red-legged frog. *Photos by James Jones, East Bay Municipal Utility District*

agreement. Although temporary in nature, many of the conservation measures and management actions that are implemented in a safe harbor agreement come directly from recovery plans for the covered species. These beneficial actions continue for the duration of the agreement, typically providing a net conservation benefit to the covered species for decades.

The Service's Sacramento Fish and Wildlife Office works with a variety of conservation partners to implement safe harbor agreements that are providing significant conservation for listed species, such as the California red-legged frog (*Rana draytonii*) and the California tiger salamander (*Ambystoma californiense*).

In northern California, many California red-legged frog and California tiger salamander populations occupy small artificial water impoundments, or stock ponds, created by cattle ranchers for the purpose of providing water for their cattle. These stock ponds also serve as ideal breeding habitat for red-legged frogs and tiger salamanders, where they lay egg masses on emergent vegetation. The stock ponds hold water long enough into the dry California summer for the larvae to metamorphose into adults and disperse to upland areas. In some areas of northern California, these stock ponds make up some of the last remaining breeding habitat for these listed species. Most of these ponds were installed decades ago and can require expensive maintenance to address eroding dams or siltation, where the stock ponds are filled in with sediment over time and are no longer able to hold water. Many ranchers are fearful of listed species inhabiting their property, so they abandon the ponds in favor of less expensive options, such as off-stream water tanks and troughs that do not provide habitat for the listed amphibians.

The Service's Sacramento Fish and Wildlife Office partnered with the Alameda County Resource Conservation District, the U.S Department of Agriculture's Natural Resources Conservation Service, and the Environmental Defense Fund to implement a programmatic safe harbor agreement to enroll landowners who want to maintain their stock ponds and surrounding uplands as habitat for the California red-legged frog and California tiger salamander. The Alameda Resource Conservation

"The ranchers we work with are proud of the land stewardship they provide. The safe harbor demonstrates to them that the Fish and Wildlife Service sees and values that stewardship," says Pete Van Horn, program administrator for the Alameda County Resource Conservation District. "These projects wouldn't happen without this real sense of partnership."

District holds the programmatic safe harbor permit. To date, they have enrolled eight ranches, with over 10,000 acres (4,047 hectares) of habitat being managed for the two listed amphibians.

"The ranchers we work with are proud of the land stewardship they provide. The safe harbor demonstrates to them that the Fish and Wildlife Service sees and values that stewardship," says Pete Van Horn, program administrator for the Alameda County Resource Conservation District. "These projects wouldn't happen without this real sense of partnership."

Recently, the Sacramento Fish and Wildlife Office partnered again with the Environmental Defense Fund to develop a safe harbor agreement to benefit the California red-legged frog and the California tiger salamander. This agreement was not with ranchers, but rather the East Bay Municipal Utility District, which provides water and power to the east San Francisco Bay area, including cities such as Oakland and Berkeley. This safe harbor agreement creates and conserves suitable breeding and dispersal habitat for these species within almost 20,000 acres (8,000 hectares) of enrolled lands. The Utility District works to remove non-native bullfrogs and predatory fish from their stock ponds, and conducts habitat enhancement at the ponds by creating a diversity of habitats in each pond—each component targeting a life-phase for the frogs and salamanders. These voluntary management activities help ensure the ponds remain suitable breeding habitat for the two listed amphibians.

Currently, the Utility District has known occurrences of California tiger salamander on their lands and known occurrences of the California red-legged frog on private lands adjacent to the Utility District's lands. The Utility District is hopeful that red-legged frogs will disperse to stock ponds on their property and utilize the stock ponds for breeding. However, they also wanted assurances that the listed species on

California tiger salamander larvae. *USFWS*

The federally threatened California red-legged frog now has a more secure future because of the voluntary management activities of landowners in California.
Flo Gardipee, USFWS

their land would not limit their ability to carry out their hydropower and water delivery obligations. The safe harbor agreement was a natural fit because the Utility District is now able to manage habitat on their lands to benefit the federally-listed species covered under the agreement without the fear of additional regulatory restrictions.

"Through this agreement, land managers have the ability to accomplish the District's goal of good stewardship of its lands," says Jose Setka, Supervising Fisheries and Wildlife Biologist for East Bay Municipal Utility District. "We have already discovered new California tiger salamander populations in new areas during monitoring required in the agreement." These new habitats will be added to the existing protected areas within the Utility District's lands.

Together, these two safe harbor agreements have resulted in the protection and management of over 30,000 acres of aquatic and upland habitat for the California red-legged frog and the California tiger salamander. Although these agreements are temporary in nature, they both provide protection and beneficial management for the two listed amphibians for the 30-year duration of the agreements. At the end of the agreement, a landowner is authorized to return their property to baseline conditions, but it is likely that many landowners will renew their safe harbor agreements with the Service and continue providing a net conservation benefit for listed species for many more decades to come.

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What Does It Take to be a Successful Recovery Biologist?

by Judy Jacobs

With a wingspan of over 7 feet (2 meters), the short-tailed albatross is the largest of three albatross species found in the North Pacific Ocean. It was also once the most numerous. *Photo courtesy of the Yamashina Institute*

When this question was posed to me, a single word popped into my mind. But first, let me say a bit about myself. I began my career with the U.S. Fish and Wildlife Service in the Endangered Species Program in 1981, and I've stayed with the program ever since. The work provides not only a sense of moral satisfaction, but also, importantly for me, it is never dull. Each species has its unique set of biological traits and challenges. Figuring out how to recover each endangered species is like solving a new puzzle. So, the word that popped into my head: creativity. That's the aspect of recovery I enjoy the most.

Of course, partnership skills are also essential for species recovery. The most creative and well-written recovery plan would do no good if people aren't willing to implement it. Negotiation skills and the ability to listen are definitely needed. Two other qualities required for a recovery biologist are persistence and a talent for being an entrepreneur. A species is listed under the Endangered Species Act only after other conservation efforts have failed; if we give up, there's no other safety net. It takes talent to find conservation partners and funding sources, and to convince them about the value of their involvement in the species' recovery.

But back to creativity, and its close cousin, flexibility. Imagine recovering an endangered species as climbing a mountain. If a team member or partner suggests an alternate pathway to the summit, or if we run into a brick wall in the path we're on, can we be creative and flexible enough to find another way, while progressing ever upwards?

Creative problem solving has come in very handy in recovery actions for the short-tailed albatross (*Phoebastria albatrus*), or STAL for short. This bird nests primarily in Japan but forages extensively in the waters off Alaska. The largest and once the most abundant of the three albatross species in the north Pacific, STAL were decimated by feather hunters during the late 1800s, and was thought to be extinct by the turn of the 20th century. Like the dodo, STAL nested on remote islands and had no fear of predators. In fact, the Japanese name for STAL, *ahoudori*, means "stupid bird." Unlike the dodo, however, albatrosses are powerful fliers, and their young remain

at sea for 5 to 8 years before returning to breed. In the mid-20th century, a few short-tails began showing up on the Japanese island of Torishima, one of the former breeding colonies. The Japanese were quick to realize what they had nearly lost, so they designated both the island and STAL as national treasures. But there was one slight problem: Torishima is an active volcano and could blow at any time! And just to spice things up, the *ahoudori* chose to nest on an unstable outwash slope. A landslide actually buried several chicks there in 2010. One other smaller STAL colony does exist, but it's on an island claimed by Japan, China, and Taiwan, so visiting there is politically infeasible.

The Short-Tailed Albatross Recovery Team (START) agreed that establishing at least one additional breeding colony within part of the bird's former range would be required for recovery. The best way to do this, we thought, would be to move young (one-month-old) chicks and rear them to fledging at the new location, in hopes that they would return there to breed. STAL chicks take about 4 months from hatching to fledging, so we'd have to plan on at least a 3-month rearing period. We had no experience in raising baby albatrosses, so we looked for someone who did. Our best bet was researchers at the northern royal albatross colony at Taiaroa Head, New Zealand. Biologists there occasionally rear orphaned chicks or provide additional food to chicks that have lost one parent. In 2006, we acquired funding and arranged for our Japanese partners at the Yamashina Institute for Ornithology (who would be the main chick-rearers) to go to the Taiaroa Head colony for training. Unfortunately (for us, not the chicks), there were no orphaned chicks or other supplemental feeding needs at Taiaroa Head that year. Here was a brick wall in our path, or at least a one-year delay, with no guarantee that there would be an opportunity the next year either.

Was there another path to consider? I put out a few feelers within the Service. Could we possibly work at the big Laysan albatross colony on Midway Atoll National Wildlife Refuge in the northwestern Hawaiian Islands? This proved not to be possible. However, the refuge biologist at Midway, John Klavitter, indicated that he could "spare" 10 Laysan chicks for rearing elsewhere. By a stroke of luck, Laysan albatrosses are reclaiming part of their former range on the island of Kaua'i. At Kilauea Point NWR, refuge biologist Brenda Zaun agreed to host the chick-rearing experiment. Although only four of the 10 chicks fledged, we learned to become much better albatross foster-parents, and our partners became much more engaged in the effort.

We've just finished our fourth year of STAL chick translocation at our new selected colony site, Mukojima Island, Japan, and have successfully fledged all the chicks (55 so far). We are encouraged to see some 2008 and 2009 fledglings returning to the new colony and even practicing courtship dancing!

So, my advice to recovery biologists is this: Don't be stopped by, or keep knocking your head into, those brick walls. Sit back, turn on your creative juices, and find another pathway up the hill. Your persistence will pay off!

Fish and Wildlife Service biologist Judy Jacobs (left) and Junko Obata of the Yamashina Institute for Ornithology (right) feed a translocated short-tailed albatross chick. *Photo courtesy of the Yamashina Institute*

Judy Jacobs, a wildlife biologist in the Service's Alaska Regional Office, can be reached at judy_jacobs@fws.gov or 907-271-2768.

Editor's note: In 2006, Judy was honored by the Service as a Recovery Champion for her work with the short-tailed albatross. In 2010, the Yamashina Institute for Ornithology also received recognition as a Recovery Champion for its work on this species. For more information, visit http://www.fws.gov/endangered/what-we-do/recovery-champions/index.html.

"Is it a Colony Yet?"

Short-tailed Albatross Translocation Project Update

by Judy Jacobs

Endangered Species Bulletin readers may recall an article in the Spring 2009 edition (*http://www.fws.gov/endangered/bulletin/2009/bulletin_spring2009-all.pdf*) describing efforts of the Service and the Yamashina Institute for Ornithology to learn how to rear albatross chicks, with the ultimate goal of establishing a breeding colony of the endangered short-tailed albatross (STAL) on a safe (non-volcanic) and accessible island. The article ended with our first-year (2008) attempt to rear STAL chicks on Mukojima, an island in the Bonin chain selected for the new colony site.

The month-old STAL chicks moved to Mukojima in February 2008 were reared successfully. After more than three months of daily feeding, all 10 chicks fledged. The post-fledging movements of five of these chicks, followed by satellite telemetry, were comparable to those of five parent-reared chicks fledged from Torishima. Given the success of our 2008 results, we decided to move 15 STAL chicks to Mukojima each year in 2009, 2010, and 2011. Ironically, just 10 days after the 2010 translocation, heavy rains on Torishima caused a landslide that killed at least two chicks at the donor colony and partially buried several others.

The good news is that all of the chicks moved to Mukojima in 2009 through 2011 fledged successfully, bringing the total number of chicks fledged from Mukojima to 55! Satellite tracking shows that the translocated fledglings appear to be surviving as well, or possibly even better, than their Torishima age-mates.

So the bottom line: Are the Mukojima birds a colony yet? No. The short-tailed albatross is a long-lived bird that does not reach breeding maturity until five or six years of age. However, we've seen some early signs that are very encouraging.

In mid-April 2009, two subadult short-tailed albatrosses visited Mukojima (apparently attracted by decoys, the presence of translocated chicks, and playbacks of STAL vocalizations recorded at the Torishima colony). These subadults practiced their courtship dancing on Mukojima, a good sign that they might return to nest there in future years. Later that April, a subadult "visited" one of the older translocated chicks that was close to fledging.

In 2010 and 2011, subadult STAL have again been seen numerous times on Mukojima. Also, some of the young STAL that fledged in 2008 were spotted briefly back on Torishima, but they subsequently spent more time and exhibited courtship behavior on Mukojima. This indicates that the birds are behaving just like albatrosses should, flying extensively and recognizing their own species. Best of all, they seem to recognize Mukojima as a place where they might breed in the future!!

With these early paybacks on our extensive investments, we are excited to continue the translocation work for one more year, ultimately fledging (if all goes well) a total of 70 STAL from the new colony site. We have good reason to hope that our dream of creating a safe breeding colony for STAL will become a reality.

A translocated albatross chick still sporting remnant down on its head. Feathers will cover this chick's head prior to fledging in the coming days. *Greg Balogh, USFWS*

(Opposite page top): Biologists of the Yamashina Institute prepare a short-tailed albatross chick for its helicopter trip from Torishima to its new home on Mukojima Island. *Kiyoaki Ozaki, Yamashina Institute*

(Opposite page bottom): Short-tailed albatross chicks arrive at the new colony site on Mukojima Island. *Photo courtesy of the Yamashina Institute*

Lupine and Cows

A Private Lands Success Story

by Kate Norman

Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*) is kind of a rock star among plants. It is a showy member of the pea family, with flowers that range from purple to brown in color, palmately compound leaves (i.e. leaflets are arranged like fingers on a hand), and a scent that has been compared to either grape soda or dirty socks. Not only is this lupine a rare species, it is also the primary host plant for the endangered Fender's blue butterfly (*Icaricia icarioides fender*), a celebrity in its own right.

Both Kincaid's lupine and Fender's blue butterfly rely predominantly on prairie habitat. The prairies of the Pacific Northwest are some of the rarest ecosystems in North America. Prior to European settlement, the valleys were frequently burned by the native people living in the area. When Europeans moved in, they adopted a protocol of fire suppression. Today, less than one percent of the historic prairies still exist. Most of the habitat has been converted to agriculture or urban development, but even areas that have been left alone have rarely survived intact. Without fire or some form of disturbance, the prairies are overrun with woody species and invasive weeds.

Kincaid's lupine is a long-lived perennial that is found mainly in the Willamette Valley, Oregon, where it occupies native grassland habitats.
Kate Norman, USFWS

Compounding the decline of the prairie ecosystem is the reality that most of this species' populations are found on private property. Plant species on private property have little protection under the Endangered Species Act. Unlike the case with animal species, the law has no prohibitions on the "take" of listed plants, unless the take occurs while state laws are being violated. Landowners are free to manage their threatened or endangered plant populations as they see fit.

So, with all of these factors, how is it that Kincaid's lupine has become, quite literally, a "poster child" for rare species management?

We have achieved success with this species and we're moving towards recovery and delisting. But this success has not resulted from any all-powerful authority. Progress has been achieved almost entirely through voluntary conservation by our partners and private landowners.

One of the greatest examples of how this species has been taken to heart can be found two hours north of Portland, Oregon, near the northern extent of the species' range. On an organic dairy farm in Boistfort Valley, Washington, surrounded by the foothills of the coast range, Kincaid's lupine thrives among a herd of cows.

It Began with Critical Habitat

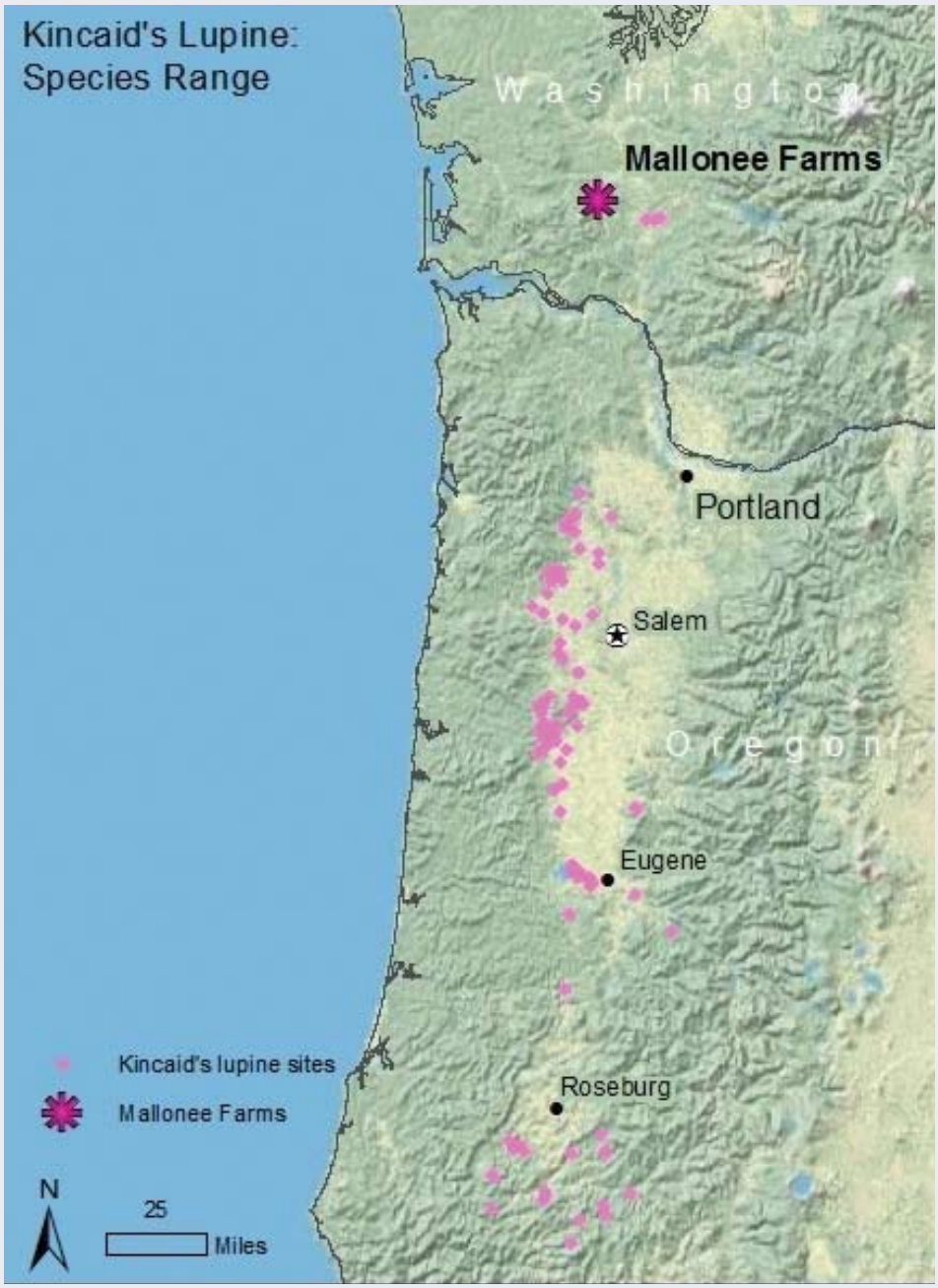
Ted Thomas, an ecologist with the U.S. Fish and Wildlife Service's

Washington State Fish and Wildlife Office, says "critical habitat is where it all began." Several historical reports of Kincaid's lupine were documented in this area by the Washington Natural Heritage Program. Six years ago, these locations were included in a proposed designation of critical habitat for this species. Ted called the landowners to engage them in a discussion about this tool—what it is, what it isn't, and what options are available for pursuing an exclusion. Critical habitat is designated in areas that possess habitat features that are necessary for a species' survival. In some cases, an area may be excluded from critical habitat if it is determined that the benefits of exclusion outweigh the benefits of inclusion. Mary and John Mallonee were listening. With Ted's help, and with guidance from Marty Cheney of the Natural Resource Conservation Service and Joe Arnett of the Washington Department of Natural Resources, the Mallonees created a grazing and management plan. The plan ensures that they can graze their cattle during certain times of the year and rotate their herds regularly while providing habitat for the lupine. During the comment period for the proposed critical habitat, the Mallonees submitted their management plan, which allowed them to be excluded from the final designation.

Bessie Helps the Lupine

The Mallonees' story doesn't end there. The first year after the grazing plan was put in place, they invited a group of 40 biologists out to see the site and prove to the nonbelievers that grazing was compatible with maintaining Kincaid's lupine. In fact, that lupine was not only surviving but expanding.

Private landowners play a key role in conservation of threatened and endangered species. Where species occur on federal, state, or local government property, agency contacts are invaluable. But many species occur predominantly or exclusively on private property. In these cases, the only way to achieve recovery is by working with the landowners and supporting them in managing their habitat.



The northern limit of Kincaid's lupine is Lewis County, Washington, and it occurs as far south as Douglas County, Oregon. The Mallonee Farm is located in the northern extent of the species' range.
Kate Norman, USFWS

John and Mary Mallonee. *Rebecca Dare, Washington Native Plant Society*

"The Mallonees have an interesting story because their use of the land creates perfect conditions for lupine," explains Joe Arnett. As organic farmers, they don't use herbicides that could kill or harm the lupines. The absence of herbicide use is likely the reason why Kincaid's lupine is still found on this site while it is absent from neighboring fields.

The grazing practices have also been beneficial. "[The Mallonees] are managing by stubble heights of the forage, the animals aren't out there when the ground is really wet, and, since there's plenty of palatable forage, they have no reason to want to eat the lupine," says Marty Cheney. As Maynard Mallonee, son of the lupine property owners explains, "We call it the field of dreams theory. We maintain the property and the plants are going to thrive as long as we provide them what they want, a safe, friendly habitat."

The thriving populations of Kincaid's lupine have drawn interest from federal, state, and other biologists. The Native Plant Society has visited on field trips, local school groups have been invited to the site, and every year the Mallonees, in conjunction with their dairy co-op, Organic Valley, host a Lupine Pasture Walk. In its fourth year in 2010, the Mallonees had over 130 participants.

Mary and John open up their pasture to showcase not only the Kincaid's lupine, but other native wet and upland prairie plants that are found on the farm, including the mule ear (*Wyethia angustifolia*), camas (*Camassia quamash*), pale larkspur (*Delphinium pavonaceum*), and thin leaved peavine (*Lathyrus holochlorus*). Their three children, Maynard Mallonee, Jodi Mallonee, and Diana Frampton, all help to prepare for this event. The lupine pasture day now includes a presentation by Joe Arnett on Kincaid's lupine biology, lunch provided by Organic Valley, a botany bike ride, a hands-on soil lesson, and, of course, a walk through the lupine pasture with botanists from the state and federal conservation partners.

Word of Mouth

"The Mallonees are the ultimate family conservationists; they're genuinely concerned about their stewardship of their land and the health of their land is demonstrated by the robust

lupine population," says Ted Thomas. Although the Mallonees were more receptive to the idea of conserving Kincaid's lupine than some other landowners, they have shared their positive experience with neighbors and friends who didn't understand their interest in the plant. Mary remembers people telling her how terrible it could be to have a listed species, but she feels very differently about the work they've done and the relationships they've created. "Every time we walk in this pasture with Joe or Marty and other conservation people, we learn something new, every single time… It's been a wonderful experience."

John and Mary Mallonee have one of the healthiest Kincaid's lupine populations in existence. Their commitment to the species and to sharing their success has encouraged other landowners to talk to Joe, Ted, and Marty. The Mallonees have also done a great deal towards educating others about this rare species by opening up their property and showcasing the lupine. By managing their grazing, the Mallonees have discovered how cows can be a lupine's best friend and how protecting and managing for a listed species doesn't have to cost landowners their livelihoods. If you'd like to learn more about the Mallonee Farm or the Annual Lupine Pasture Walk, please visit malloneefarms.com.

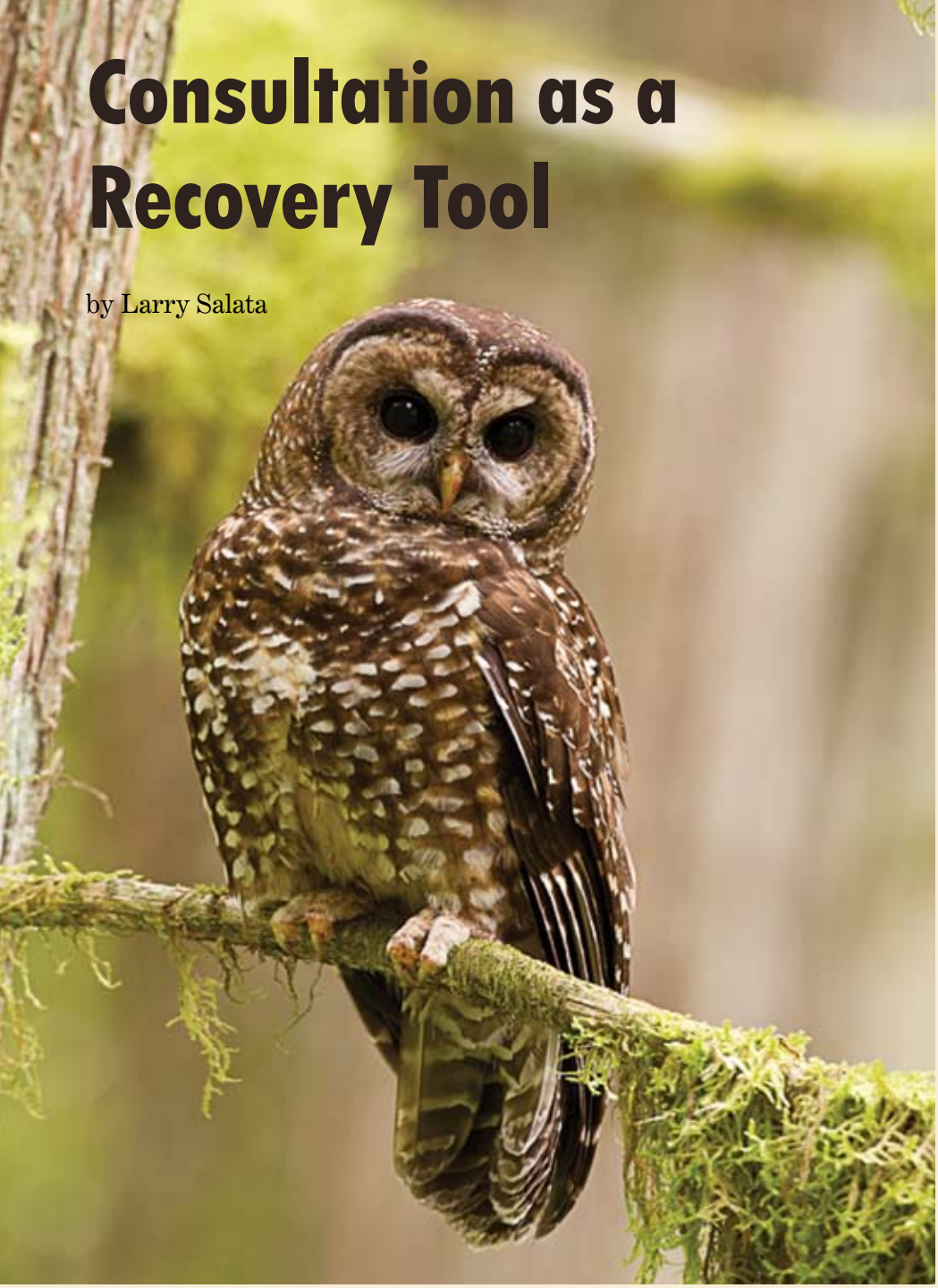
"The Mallonees are the ultimate family conservationists; they're genuinely concerned about their stewardship of their land and the health of their land is demonstrated by the robust lupine population," says Ted Thomas.

Kate Norman, who until recently worked on Kinkaid's lupine as a botanist in the Service's Oregon Fish and Wildlife Office, is now with the endangered species recovery branch in the Arlington, Virginia, national headquarters office. Kate can be reached at kate_norman@fws.gov or 703-358-1871.

Joe Arnett (center) from Washington Natural Heritage Program shows a group of lupine pasture walk attendees Kincaid's lupine. *Ted Thomas, USFWS*

Consultation as a Recovery Tool

by Larry Salata



The U.S. Forest Service and the Bureau of Land Management adopted the Northwest Forest Plan in 1994 to end the impasse over management of Federal forest lands in the Pacific Northwest within the range of the northern spotted owl. *©Jared Hobbs, hobbsphotos.com*

The purpose of the Endangered Species Act (ESA) is to conserve endangered and threatened species and the ecosystems upon which they depend. The consultation provisions in section 7 of the ESA play a significant role in achieving that objective by directing federal agencies to carry out programs to conserve listed species, and to ensure their actions do not jeopardize these species or result in the destruction or adverse modification of critical habitat.

Section 7 consultation involves coordination between federal agencies and the U.S. Fish and Wildlife Service or the National Marine Fisheries Service prior to carrying out, funding, or otherwise authorizing federal actions that may affect listed species or critical habitat. Adequate consideration of listed species in planning and implementing federal actions is fundamental to complying with the conservation purposes of the ESA.

The U.S. Supreme Court's 1978 decision in Tennessee Valley Authority v. Hill, a well-known case involving the construction of a dam on the Tennessee River that was likely to inundate occupied critical habitat of the endangered snail darter (*Percina tanasi*), affirmed the preeminent role of the ESA and section 7 in shaping federal actions to conserve listed species: "The plain intent of Congress in enacting this statute was to halt and reverse the trend toward species extinction, whatever the cost…the legislative history undergirding section 7 reveals an explicit congressional decision to require agencies to afford first priority to the declared national policy of saving endangered species." Accordingly, federal agencies are encouraged to integrate conservation programs into their activities to promote the recovery of listed species.

Several noteworthy examples of such integration resulting from ESA section 7 consultations involve federal agency activities in the Pacific Northwest, California, and Indiana.

In response to the requirements of section 7, the U.S. Forest Service and the Bureau of Land Management adopted the Pacific Northwest Forest Plan in 1994 as part of their land management responsibilities. Under the plan, large blocks of reserves are being managed for older forest habitat over an approximately 24 million-acre (9.7 million-hectare) area to address the conservation needs of the threatened northern spotted owl (*Strix occidentalis caurina*) and a multitude of other listed and non-listed species.

On San Clemente Island in southern California, the Navy has successfully

integrated conservation programs into its military mission. It has invested millions of dollars to eradicate feral goats and pigs that were causing significant damage to the habitat of native species, some of which are found nowhere else in the world. The Navy also funds ongoing research, monitoring, and habitat restoration activities on the island. Many listed species and listing candidates that occur on San Clemente Island have benefitted greatly from these conservation actions. Foremost among these recovery efforts is a world-class captive propagation and reintroduction program for the endangered San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*). From a low of five pairs in the wild in 1988, the shrike population increased to 82 pairs by 2009, and extinction has been averted.

For more than 30 years, the Marine Corps has funded intensive management and monitoring of the endangered California least tern (*Sterna antillarum browni*) and the least Bell's vireo (*Vireo bellii pusillus*) while carrying out its military training mission at Camp Pendleton in northern San Diego County, California. In the case of the vireo, those efforts began about five years before it was listed. As a result of these conservation actions, Camp Pendleton is home to about one-quarter of all California least terns and over one-third of all least Bell's vireos. The Marine Corps is also managing regionally significant populations of several other listed species on the Base.

At Klamath Lake in northern California, the Bureau of Reclamation operates a major water storage and delivery project for agricultural use. In conjunction with project operations, the Bureau has installed a fish screen on a major diversion canal, built a fish ladder to restore upstream movement of endangered shortnose and Lost River suckers (*Chasmistes brevirostris* and *Deltistes luxatus*, respectively) into Klamath Lake, and removed a dam on an upstream tributary to facilitate sucker spawning. Since 2002, the Bureau has funded research on the status of these fish and the factors affecting their survival. Both species have also benefitted from extensive habitat restoration funded by the Bureau.

In 1997, endangered Indiana bats (*Myotis sodalis*) were first documented on the Army's Camp Atterbury Joint Maneuver Training Center in Indiana. At least three maternity colonies are now known to occur on this 33,000-acre (13,350-hectare) installation, giving it one of the highest concentrations of maternity colonies known across the bat's range. The Center is a very active facility, but its development has not precluded the Army from integrating Indiana bat conservation into the military mission. The Army and the Fish and Wildlife Service have cooperated to ensure that new training areas (e.g., a tank range) were developed in ways that avoid or minimize adverse impacts on Indiana bats. The Army has set aside some of the best habitat on the Center as Indiana bat management zones that are off limits to incompatible uses. The Army also has an active Indiana bat monitoring and research program on the Center.

These examples are just a few out of tens of thousands of cases nationwide where compliance with section 7 has facilitated federal conservation of listed species to varying degrees. The Fish and Wildlife Service continues to work on enhancing the effectiveness of section 7 consultations as a recovery tool by encouraging federal agencies to integrate conservation actions into their activities. In 2006, the Service initiated a national effort to establish a web-based system for the development of "conservation frameworks" that describe the needs of listed species. The intent of these frameworks is to help federal agencies determine the best management practices to consider as part of their proposed actions to promote species recovery. This tool and other types of such integration are likely to further strengthen the role of the Service's consultation program in species recovery.

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The Army and the U.S. Fish and Wildlife Service have cooperated to ensure that development activities on Camp Atterbury Joint Maneuver Training Center in Indiana —an extremely active military facility—does not adversely impact the federally endangered Indiana bat. *Andrew King, USFWS*

Decision-making in the Face of Uncertainty

Restoring Fish Passage in the Lemhi Basin

by Andrew J. Tyre

The path to recovery for a listed species can be filled with risk and uncertainty. For example, which restoration actions will yield the greatest improvement for the least cost? Adaptive management, a special type of structured decision-making, is one approach to making wise choices in spite of scientific uncertainty. In a simplified way, it can be described as learning while doing, by planning management actions so the results of current actions provide information to refine such actions in the future.

The bull trout (*Salvelinus confluentus*) is a stream-living fish in the salmon family distributed in drainages of the northwestern United States. The decline of bull trout populations throughout their range, in concert with a number of other

threats, led to listing the species as threatened throughout its entire range in 1998.

Bull trout depend on habitat with the "4 Cs"—clean, cold, complex, and connected. Measuring clean, cold, and complex (in the sense of a diversity of physical structures in the stream) is relatively straightforward. However, determining whether streams are connected or not, and how important connectivity is for the future of bull trout, is more of a challenge.

Connectivity matters because bull trout populations have two distinct life history forms: resident and migratory. Both spawn in small headwater streams, typically from August through November. While resident forms complete their life history entirely within headwater streams,

migratory forms live in headwater streams for 1 to 3 years during their juvenile stage before migrating downstream into larger, more productive waters where their growth rates are greater. As a result, migratory adults are much larger and more fecund than their resident counterparts. Although migratory bull trout generally return to their natal streams to spawn, the migratory individuals are important for recolonizing streams that have lost their bull trout populations.

In the Lemhi River drainage of eastern Idaho, the U.S. Fish and Wildlife Service, in partnership with the State of Idaho and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service, is working to address the conservation needs of bull trout and other salmonids. In particular, the agencies are working to restore necessary water flows at appropriate times of year in key sections of the Lemhi watershed to allow bull trout access to headwater streams. Restoring fish passage will allow migratory adults to reenter streams where bull trout populations are currently restricted to the resident form, as well as streams not currently inhabited by the species.

Reestablishing connectivity of isolated populations involves some risk. Another member of the salmon family, the non-native brook trout (*Salvelinus fontinalis*), has been introduced into the Northwest, and it generally occurs in warmer streams than bull trout populations. However, in streams where both species now occur, the bull trout has been observed shifting toward colder stream reaches at higher elevations (where their populations are less productive). Additionally, hybridization between brook trout and bull trout is known to occur, apparently resulting in hybrids that are either sterile or have very low fecundity. Reestablishing connectivity of isolated bull trout populations could allow brook trout to invade areas occupied by resident populations of bull trout. This would potentially reduce both the availability of good bull trout habitat and bull trout productivity through hybridization.

However, due to a dearth of resources we are unable to restore fish passage to every headwater stream in the Lemhi Basin. Boiled down to the essentials, we must choose between addressing this problem in streams that currently have resident bull trout, and those that do not. These choices must be made before the scientific uncertainties are resolved; indeed, given the magnitude of the task and the difficulty of monitoring bull trout, agency managers may never know for certain the exact nature of the risks involved.

In 2005, a group of Fish and Wildlife Service biologists gathered at the National Conservation Training Center, together with scientists from universities and the U.S. Geological Survey, to see if this problem could be addressed by using adaptive management.

Considering what is unknown about bull trout biology, the scientists addressed two distinct questions. First, do brook trout have a negative effect on bull trout, and second, will the migratory form of bull trout return to occupied streams immediately? Combining the two potential answers to each of these two questions yielded four different possibilities. The effects of different choices on the persistence of bull trout were analyzed for each case. In all four cases, the best choice is to restore connectivity to a stream that is currently occupied by resident bull trout. The interesting outcome of the analysis is that the substantial scientific uncertainty does not affect the decision. Even if managers were certain about which hypothesis is correct, it would not change their decision. However, determining which streams to restore depends on the number of streams that are both occupied and connected, so monitoring is crucial to making the best decisions.

The analysis of fish passage restoration in the Lemhi Basin is just one example of how management decisions can be made despite uncertainty about threats to a species. The methods of structured decision-making and adaptive management are not specific to bull trout. Decisions about how to restore other species could benefit from the same type of approach.

Andrew Tyre, an associate professor of wildlife population biology at the University of Nebraska-Lincoln, can be reached at atyre2@unl.edu or 402-472-4054.

Though there is some risk involved in restoring water flows in the Lemhi watershed, reestablishing connectivity of isolated populations is seen as critical for bull trout recovery. *Photos by Joel Sartore, National Geographic Stock with Wade Fredenberg*

A Slithering Success Story

by Megan Seymour

The Lake Erie watersnake, a harmless, non-venomous reptile once threatened with extinction, has rebounded to the point that the Service proposed removing it from the list of federally threatened and endangered species in June 2010. *Kristin Stanford*

Who would have thought that a few small islands in Lake Erie, a feisty snake, and a group of dedicated folks could come up with a conservation message that reached the nation and contributed to the biological diversity of the Midwest? This is the story of the Lake Erie watersnake.

It started many years ago. French explorers in the 1700s noted an abundance of serpents and named the western Lake Erie islands the "Islands of the Snakes." Accounts from the late 1800s described watersnakes "sunning themselves in heaps, knots, and snarls." In the early 1900s, when this subspecies was described scientifically as the Lake Erie watersnake (*Nerodia sipedon insularum*), it could still be found in large numbers.

It is unique for many reasons, not the least of which is its very limited distribution; it occurs primarily on U.S. and Canadian islands and adjacent waters in western Lake Erie. It prefers rocky shorelines, hiding under large limestone rocks within shoreline vegetation, or within the cracks and crevices of docks, "riprap" erosion control, and other human-made structures. These are also the areas where summer island residents and tourists want to be. Though non-venomous, the snakes are large, moody, and smelly enough to attract few defenders. Between the modification of shoreline habitats, the destruction of inland hibernation sites, and eradication efforts, the Lake Erie watersnake population declined precipitously. In 1999, it was listed as a threatened species under the Endangered Species Act (ESA), and I became its recovery coordinator.

In 2002, as directed under Section 4(f) of the ESA, the U.S. Fish and Wildlife Service began developing a recovery plan for the watersnake. The recovery plan described a series of tasks designed to protect needed habitat and help people learn to coexist with the snake. These tasks included outreach and education programs, population monitoring, and research. The plan identified three objective, measurable recovery criteria—establishing multiple secure subpopulations, conserving habitat

distributed proportionally among the islands, and surveying public opinion. Once the plan was in place, I felt much more confident that a path to recovery existed, and all we had to do was implement it.

The earliest efforts to recover the Lake Erie watersnake focused on outreach to the local residents. A "Watersnakes Welcome Here" campaign conveyed the message that these creatures are harmless and part of the island environment. Hundreds of signs were printed and distributed to island landowners, a bi-annual newsletter was started, and Service biologists met with landowners who had "snake issues." Shortly thereafter, "The Snake Lady" arrived. Kristin Stanford, a graduate student from Northern Illinois University (NIU) studying under Dr. Richard King, was hired to conduct snake research and outreach, and she quickly became the spokeswoman for this misunderstood critter. Stanford embraced the snake and the islanders, both literally and figuratively, grabbing snakes by the handfuls while chatting with local folks about the species' biology, life history, and ecological significance.

Stanford and Dr. King engaged volunteers to participate in annual counts of Lake Erie watersnakes for mark-recapture studies. Regional snake researchers, government officials, students, members of the media, and even island kids joined in each year. Reaching out to diverse stakeholders kept island residents engaged in the process. Stanford's efforts as the face of the public outreach campaign gained her trust among islanders and eventually a starring role on an episode of the Discovery Channel's TV series "Dirty Jobs." Viewed by millions of people across North America, it was one of the series' top-rated episodes. The research and outreach efforts of Dr. King and Stanford earned them the Service's 2010 Recovery Champion Award.

While Stanford brought the plight of the watersnake to a national audience, the watersnake's troubles brought the plight of Great Lakes islands biodiversity to the attention of many throughout the region as well. Ultimately, this has led to a multi-partner coalition amongst the Service, The Nature Conservancy, Nature Conservancy Canada, Ontario Ministry of Natural Resources, the University of Minnesota, the Northeast Midwest Institute, and USEPA Great Lakes National Program Office to identify and plan conservation actions for the biodiversity of Great Lakes Islands as a whole.

Environmental adventure campers help Kristin Stanford bag Lake Erie watersnakes for mark-recapture studies. *Tyler Lawson*

The Service and Ohio Department of Natural Resources (ODNR) funded NIU's outreach and monitoring efforts. The Service also contributed toward habitat protection by ODNR and a grass-roots conservation organization, Black Swamp Conservancy, Lake Erie Islands Chapter. Led by islander and dedicated conservationist Lisa Brohl, the Conservancy took on preservation of smaller island parcels, conservation easements, and even established a local park district. Many of the Conservancy's island properties are permanently protected habitat for Lake Erie watersnakes. In 2010, Brohl was awarded the ODNR Division of Wildlife's Wildlife Conservation Award for her work to protect the Lake Erie islands.

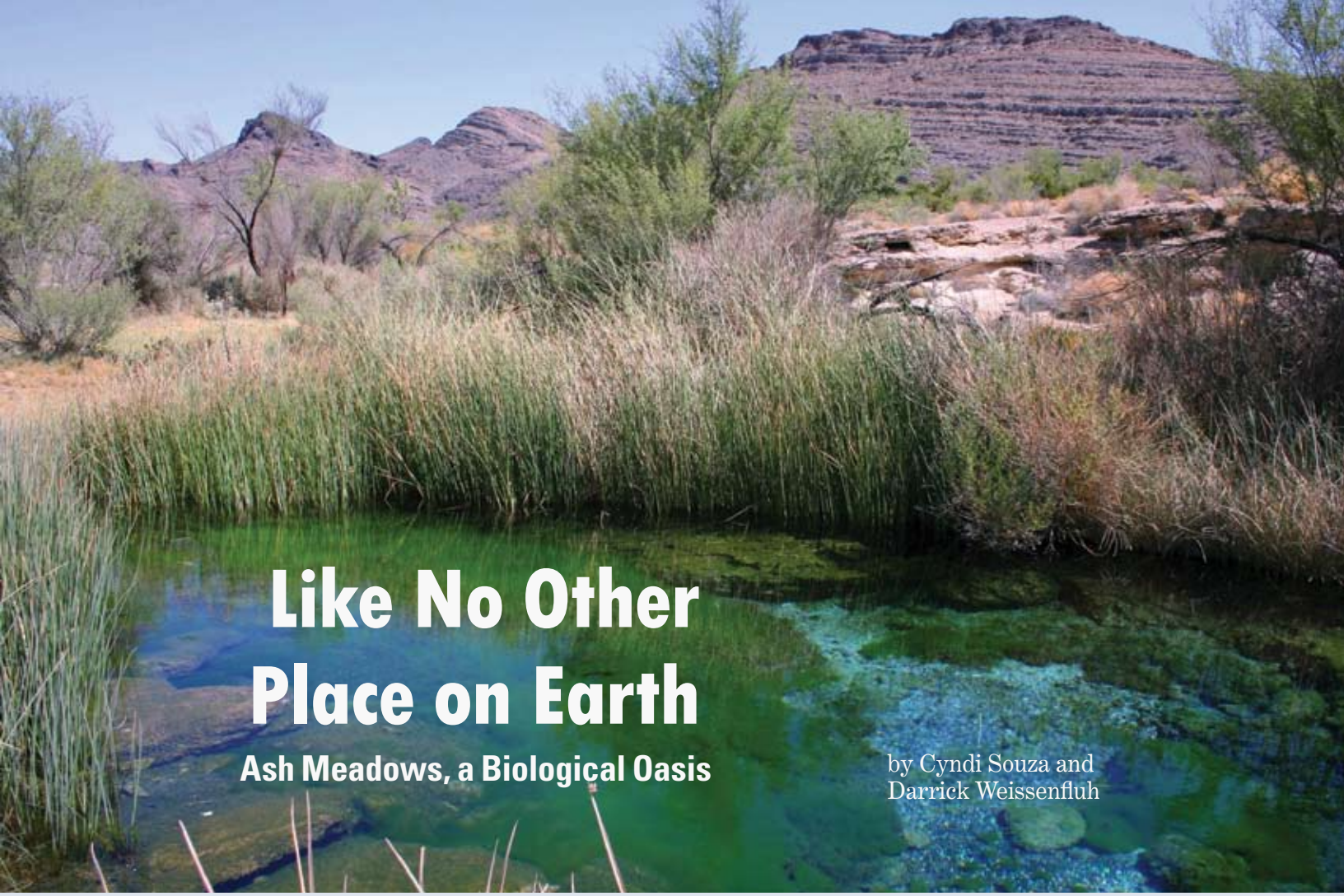
Since much of the watersnake's habitat occurs along the Great Lakes shoreline, impacts are regulated by the U.S. Army Corps of Engineers. The Service developed guidelines for when certain activities can occur and designs for creating snake habitat as part of shoreline construction projects (e.g., docks and erosion control structures). When there is no federal nexus, the Service works with private landowners to develop Habitat Conservation Plans that avoid and minimize impacts to the watersnake from private development.

Kristin Stanford checks a Lake Erie waternsake for a passive integrated transponder (PIT) tag with Mike Rowe of the Discovery Channel's show, "Dirty Jobs." PIT tags help biologists identify and track individual snakes. *Tyler Lawson*

Twelve years after listing, the watersnake population has increased approximately five-fold, 318 acres (128 hectares) of key shoreline habitat are protected, and the public is more tolerant of the harmless creatures. After analyzing the factors that led to its threatened status, we determined that it has recovered to the point that it no longer needs the protection of the ESA and proposed to remove the species from the endangered and threatened species list in June 2010. We are now moving forward with a final rule to delist the Lake Erie watersnake. While we believe it has recovered and no longer needs ESA protection, we have a duty under section 4(g) of the law to ensure that it will continue to thrive after delisting. Accordingly, the Service has developed a post-delisting monitoring plan that will continue the population monitoring of the past 12 years, evaluate the population status after each census, ensure that protected habitat remains suitable, and assess public attitudes and the need to conduct additional education and outreach. Over the next 5 years, we expect to demonstrate that the watersnake population is self-sustaining and secure.

Although the Lake Erie watersnake may no longer need ESA protection, its legacy as a conservation and recovery success story has benefitted the island environment that it depends on, as well as the Great Lakes Islands as a community. Thanks, you feisty little critter!

Megan Seymour, a wildlife biologist in the Service's Columbus, Ohio, office, can be reached at megan_seymour@fws.gov or 614-416-8993.



Like No Other Place on Earth

Ash Meadows, a Biological Oasis

by Cyndi Souza and Darrick Weissenfluh

King's Pool, a thermal spring that is part of the extensive wetland system within Ash Meadows NWR, is home to the Ash Meadows Amargosa pupfish.
Cyndi Souza, USFWS

Located in the middle of nowhere, according to most of our visitors, is Ash Meadows National Wildlife Refuge. An area just over 23,000 acres (9,300 hectares), it supports at least 26 species of plants and animals that cannot be found anywhere else on earth. In fact, the Ash Meadows ecosystem supports the highest concentration of endemic species in the continental United States. The refuge contains the largest oasis of springs within the Mojave Desert, which is the driest region in North America, and it was also one of the first sites in the nation to be designated as a Wetland of International Importance. Never heard of Ash Meadows? We know. Few people have, and you won't find it using your GPS.

As you leave the glitz and glamour of Las Vegas, the Nevada landscape becomes a dry, vast, and sparsely populated desert. This is not a place where you would ever expect to see rare flowers, hundreds of species of birds, and fish that swim in Caribbean-blue spring pools. Most tourists drive on past by the refuge entrance signs toward a more famous place, the nearby Death Valley National Park.

Prior to 1960, five endemic fishes were known to exist within the Ash Meadows ecosystem. Around that time, their unusual habitats began to be altered extensively by farming, mining, water diversion, artificial dams and channels, extensive removal of native vegetation, and the introduction of non-native aquatic species. These impacts are blamed for the extinction of the Ash Meadows poolfish (*Empetrichthys merriami*).

Receiving only a few inches of rain each year, the Ash Meadows ecosystem is supported by an aquifer of "fossil" water left behind from the Pleistocene epoch, a time when the region was wetter and crossed by interconnected lakes and rivers. One of its most famous surviving residents is the Devils Hole pupfish (*Cyprinodon diabolis*), which exists only in a single water-filled cavern, Devils Hole. This small fish was already endangered when corporate farming in the Ash Meadows area began to grow to massive proportions in 1967. Large-scale farming in such a dry area requires intensive pumping of ground water for

irrigation. As the aquifer was depleted, the water needed to support the Devils Hole pupfish began to decline. After a 1971 federal court injunction against over-pumping the aquifer, the U.S. Supreme Court guaranteed sufficient water levels for the Devils Hole pupfish permanently in a landmark 1976 ruling. But the decision applied only to the Devils Hole pupfish, since at the time it was the only Ash Meadows species listed as endangered. The ecosystem's other unique animals and plants went unprotected.

In the late 1970s, the landowner, Cappaert Enterprises, determined it no longer had enough water to continue large-scale farming, so it decided to sell the land. In 1980, a private company purchased the property with the intent to subdivide it into 34,000 residential lots. When development began, important habitats suffered further degradation and the aquifer was again threatened, along with the species that depended on it.

In 1982, the U.S. Fish and Wildlife Service published a temporary emergency rule listing two endemic fishes, the Ash Meadows Amargosa pupfish (*Cyprinodon nevadensis mionectes*) and the Ash Meadows speckled dace (*Rhinichthys osculus nevadensis*), as endangered species. This halted additional habitat damage for 240 days, allowing time to determine if final Endangered Species Act (ESA) protection was warranted. In 1983, both fish species received final ESA protection and The Nature Conservancy negotiated a purchase of the property. The following year, the Service purchased the land from the Conservancy to create Ash Meadows National Wildlife Refuge. A recovery plan for the area was developed in 1990 to restore habitats and recover the listed species, which by then included four endangered fishes, seven threatened and endangered plants, and a threatened aquatic insect, the Ash Meadows naucorid (*Ambrysus amargosus*).

Restoration and Recovery

Back in the 1930s, Ash Meadows speckled dace inhabited at least 13 springs in the area, but by 2009 only two viable populations remained. The Ash Meadows Amargosa pupfish and the Warm Springs pupfish (*Cyprinodon nevadensis pectoralis*) survived in most of their historic habitat but faced lingering threats. Even today, new threats have emerged from pumping and aquifer drawdown in the basin outside the boundary of Ash Meadows NWR.

All of the pupfish species, which reach about the size of your thumb, live for only one to three years. The males, a silvery- iridescent blue, can be seen darting among the algae. This behavior was originally mistaken for the kind of playfulness shown by puppies, hence the name pupfish. In reality, the males are guarding their small territories. But even this display of bravado is no match for invasive species such as western mosquitofish (*Gambusia affinis*), red swamp crayfish (*Procambarus clarkii*), and sailfin molly (*Poecilia latipinna*), which have became established in most springs and compete for the same resources needed by native species. Eradicating invasive species is challenging. Chemical treatments can be lethal to native invertebrates, and physical removal methods, such as netting, are time consuming with usually marginal success. A new plan for restoring the unique creatures of Ash Meadows was needed, so in 1995 biologists began working on an innovative strategy.

In the 1970s, prior to the establishment of Ash Meadows NWR, the springs located at Point of Rocks and King's Spring were excavated and developed for agricultural use. *C. H. Lostetter*

Because it is unlikely that invasive species can be eradicated from the ecosystem, the new management approach is to remove as many non-native fish as possible using traditional methods, such as trapping, while restoring habitats to conditions that favor native fish over non-natives. Focusing on the most numerous invasive species, sailfin molly and mosquitofish, biologists began extensive research on historical habitats, restoration processes, and fish behavior. Among the habitat characteristics they studied were water depth, velocity, and temperature at various sites in the system. The findings guided managers in choosing the designs for habitat restoration.

For example, if invasive species flourish in slower, cooler water, habitat improvements include measures to restore outflows that retain warmer temperatures with flow rates conducive to native species. The success of this strategy was validated in 2003, when the percentage of native species finally surpassed, by a large margin, the invasive species.

In 1997, habitat restoration began at Kings Pool Spring, an area severely affected by the former farming activities. Before the project, Ash Meadows Amargosa pupfish comprised only 23 percent of the spring's fish population, but they rose to 91 percent after the restoration. The entire process took 4 years. Since 2008, 10 populations of invasive aquatic species (e.g., red swamp crayfish) have been eradicated from six spring systems in Ash Meadows.

The Devils Hole pupfish is a truly unique species, with one of the smallest ranges of any vertebrate. This inch-long, iridescent blue fish makes its home in the 93 degree waters of Devils Hole, which is located within Ash Meadows National Wildlife Refuge. *Olin Feuerbacher*

Today, Tomorrow, and Beyond

Reestablishing a healthy ecosystem and historic populations of native species is challenging, but refuge managers have achieved substantial success. In 2010, four miles (6.5 kilometers) of the Fairbanks Spring outflow were rehabilitated to promote the restoration of Carson Slough, which was the largest wetland in southern Nevada before it was drained and mined for its peat. The habitat once again supports the endemic Fairbanks springsnail (*Pyrgulopsis fairbankensis*), the Ash Meadows Amargosa pupfish, and the previously extirpated Ash Meadows speckled dace. Speckled dace disappeared from the Fairbanks Spring system in the 1950s but were reintroduced in 2010. Post-project monitoring reveals that all three species are well established and reproducing.

The successful reestablishment of speckled dace into the Fairbanks system would not have been possible without numerous volunteers and partners. Funding was obtained by the Desert Fish Habitat Partnership, a group representing state and federal resource agencies, tribes, conservation organizations, and other interests. Habitat restoration continues at Ash Meadows NWR. There are plans to reintroduce Ash Meadows speckled dace into other spring systems the fish once occupied.

The desert fish of Ash Meadows are not the only native species benefitting from habitat restoration; many trees and other plants are beginning to flourish. The area also is frequented by a wide diversity of migratory birds. At least 239 bird species have been recorded in Ash Meadows, in addition to 27 mammals, more than 20 reptiles, five amphibians, and more than 330 flowers and shrubs.

Given the high rate of endemism in the Ash Meadows area, it is not surprising that species may still be discovered. In 2009, we learned of two new species of bees that may be unique to Ash Meadows. One can only imagine the fate of these and other unusual creatures if conservation efforts to protect endangered species had not been successful.

For detailed information on habitat restoration as a means to control non-native species, refer to an article by Scoppettone, et al., "Habitat Restoration as a Means of Controlling Non-Native Fish in a Mojave Desert Oasis," published in the June 2005 edition of *Restoration Ecology* (Vol. 13, No. 2, pp. 247-256).

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Saving the Emerald-eyed Dragon

The Strategic Habitat Conservation Approach

by Darin Simpkins and Catherine Carnes

The U.S. Fish and Wildlife Service and its partners have embarked on a new era in conservation through the enhanced application of scientific principals and the implementation of adaptive management across large landscapes. Though many conservation biology techniques are well understood, less is known about expected population responses to site-specific management actions and large-scale ecological process, such as climate change. Biologists must know specifically what conservation actions are needed, where they are best applied, and how many resources will be required to achieve recovery objectives. The Service calls its new approach to addressing these challenges Strategic Habitat Conservation (SHC).

Hine's emerald dragonfly larvae. *USFWS*

The Service recently joined with The Nature Conservancy, University of South Dakota, U.S. Forest Service, and Wisconsin Department of Natural Resources to implement SHC for the endangered Hine's emerald dragonfly (*Somatochlora hineana*). Signature features of the Hine's emerald dragonfly include its large size (about 3 inches or 7.5 centimeters), large green eyes, and two creamy yellow stripes on its thorax. It is the only dragonfly protected by the Endangered Species Act. The current range of this emerald-eyed dragon is concentrated around the Great Lakes Basin, mostly at select locations in Illinois, Michigan, Wisconsin, and Ontario. It is also found in the Ozark Mountains area of Missouri. The species apparently no longer occurs in Ohio and Indiana. A single specimen is known from Alabama.

The Hine's emerald dragonfly breeds during an approximately six-week period from mid-June through mid-August in shallow, slow-flowing marshes and sedge meadows with thin marl or muck type soils underlain by dolomite bedrock and fed by calcareous groundwater seeps. Eggs are laid in shallow water and hatch the following spring. Hatched larvae inhabit wetlands, especially small spring-fed streamlet channels that flow through the wetlands, for three to five years. The larvae retreat into crayfish burrows in or near the streamlet channels, using them for refuge during times of drought or to overwinter. Mature larvae crawl out of the water onto emergent plants, where they emerge as tenerals (or juvenile dragonflies) and soon mature

into adults with the species' distinctive bright green eyes. Adults forage on aerial prey, including small dipterans (flies), near shrubs and forest edges and over meadows, narrow roads, fields, and lakes near potential breeding sites. Males defend the feeding and mating territories, which are adjacent to aquatic habitats, whereas females generally feed over larger areas until they are ready to mate or lay eggs.

Today, many of the wetland habitats used by the Hine's emerald dragonfly have been mined for limestone. Accelerating residential, agricultural, commercial, and recreational development has reduced the availability and connectivity of breeding, nursery, and feeding habitat. In response, various management activities across the species' range are focused on conserving groundwater supplies, controlling invasive species, and restoring habitat.

We are still learning about the status, distribution, and structure of Hine's emerald dragonfly populations, and about how landscape features and processes relate to dragonfly populations and habitats. The goal of the SHC project is to develop a scalable, landscape-based decision tool that can be used for guiding management actions. Project objectives are to 1) develop and validate landscape-based relationships in order to predict the distribution and occurrence of Hine's emerald dragonflies; 2) assess the size, structure, and genetics of populations across a broad geographical range; 3) evaluate interrelationships among landscape features, microhabitats, and population characteristics; 4) assess the relative importance of habitat characteristics in predicting presence and abundance; 5) apply relationships between habitat and population characteristics to model the potential for areas to support Hine's emerald dragonfly; and 6) evaluate the impacts of climate change on landscape characteristics and management actions, such as efforts to control invasive plant species. Results of this project will be used by managers to identify expected population responses to specific habitat conservation actions, set habitat restoration and protection objectives, and understand why certain actions may be effective in some areas but not others.

The Hine's emerald dragonfly SHC project began this year. It is receiving funding and technical assistance from the Service's Coastal Program – Great Lakes, Partners for Fish and Wildlife Program, and Endangered Species Program, as well as a Great Lakes Restoration Initiative grant from the Environmental Protection Agency. We look forward to learning how to better manage and protect this emerald eyed-dragon of our wetlands.

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Historically, the Hine's emerald dragonfly was found in Alabama, Indiana, and Ohio and probably has been extirpated in those states. Today the dragonfly can only be found in Illinois, Michigan, Missouri and Wisconsin. *Photos by Paul Burton*

Taking Pride in Conservation

Landowners Restore Rare Species in Texas

by Chris Best

(Left to right) Partners for Fish and Wildlife biologist Tim Schumann and landowners Don and Brenda Kirchoff search for native plant seeds along the San Antonio River, Texas. *Chris Best, USFWS*

Is it possible, some people may ask, to protect endangered species in Texas, a state where 95 percent of the land is privately owned? Increasingly, Texas landowners are providing an answer by voluntarily taking steps to conserve endangered plants and animals on their land. Recently, I interviewed members of four Texas families to find out what motivated their sense of stewardship.

One November morning, I joined a small flotilla of canoes and kayaks that drifted down the San Antonio River. Ancient bald cypress trees, still draped in mist, towered over the river banks. An alligator as long as my canoe plunged languidly into a murky pool. Soon, the quiet river became a series of whitewater rapids and tumbled over sandstone ledges. As we traversed the riparian corridor, a narrow green ribbon winding through agricultural plains, we saw glimpses of the pre-settlement landscape. We were there to collect seeds from remnant patches of grasses and forbs for a savanna restoration project on the nearby Kirchoff Farm.

In 2008, Don, Scott, Susan, and Brenda Kirchoff inherited their parents' 200-acre (80-hectare) farm in Wilson County. As a memorial to their parents' conservation ethic, they decided to restore the land to its pre-settlement condition, a subtropical savanna of native grasses and shrubs. Don acknowledges that their land may be too small and isolated to support endangered species, but he hopes it will have great educational value and inspire others to restore habitat. Ultimately, many small habitats might coalesce into an ecological corridor along the San Antonio River.

David Bamburger is a businessman who became a conservationist in 1969 when he purchased 5,500 acres (2,225 ha) of over-grazed rangeland west of Austin. Inspired by the delicate beauty of the Texas snowbells (*Styrax platanifolius* ssp. *texanus*), an endangered shrub adorned with bright white flowers, David took on its recovery as a personal goal. He went from ranch to ranch promoting the species' conservation, but it took seven years to overcome the mistrust many landowners have of government agencies.

With $35,000 of his own savings and a $17,000 grant from the National Fish and Wildlife Foundation, David established an extensive cooperative program to survey private ranches, collect seeds, propagate, and reintroduce Texas snowbells on private lands, including his own ranch. His efforts inspired others to join the cause, including Steve Fulton, whose research on Texas snowbells earned him a master's degree from Texas State University, San Marcos. Currently, 24 landowners voluntarily manage

Texas snowbells populations scattered over 130,000 acres (about 52,610 ha) of private land. David has also reintroduced more than 800 surviving snowbells plants into the wild. Now 82, he says he will "retire" after the thousandth of the reintroduced snowbells survives for at least two years in the wild.

Dr. Ashley McAllen traces his family's Texas heritage to 1797, when his ancestors received part of the Llano Grande Land Grant in what is now Hidalgo County. In 1998, Ashley and his brother Geoffrey acquired land in Bandera County where the Sabinal River slices a canyon through the rugged limestone ridges of the Edwards Plateau. The McAllens raise a few cows there, in deference to family tradition, but they believe the real value of the property lies in its recreational use, natural beauty, and biodiversity. Ashley requested a rare plant survey from the U.S. Fish and Wildlife Service and the Texas Parks and Wildlife Department, and was delighted when Dr. Dana Price and I discovered a small population of the endangered Tobusch fishhook cactus (*Sclerocactus brevihamatus* ssp. *tobuschii*) there in March 2007. He and his children periodically monitor the population, and they became alarmed when they discovered rodents were nibbling their cactuses. They decided to design and install screen cages that effectively protect the cactus clusters. Ashley stated that his positive experiences show that landowners have nothing to fear and much to gain from working with government conservation agencies.

Dr. Ashley McAllen protects Tobusch fishhook cactus on his ranch in Bandera County, Texas. *Photos by Chris Best, USFWS*

I met Kathy Corbett at her family's ranch in Willacy County, where dense, subtropical shrubland borders La Sal Vieja, a natural salt lake. While much of the surrounding land has been cleared, most of the Corbett's 4,200-acre (1,700-ha) tract remains intact. Rare plants and animals, including the ocelot (*Leopardus pardalis*) and jaguarundi (*Herpailurus yagouaroundi*), two endangered cat species, persist there. In the 1980s, Kathy's husband Michael set aside concerns about the Endangered Species Act and allowed a fellow Texas "Aggie," Mike Tewes, to capture and study ocelots there for his doctoral dissertation. In 2003, Bill Carr, a botanist for The Nature Conservancy, discovered a third endangered species there—the largest known population of Tamaulipan kidneypetal (*Ayenia limitaris*).

Although Michael Corbett passed away in December 2008, his feelings for the land live on in the journal he kept to record the ranch's natural history. Kathy read for me the dedication to his journal: "For the love I have for my wife, Kathie and my daughter, Katie, and for the affection I have for this ranch, for this land, for its abundant wildlife, for the salt lake, for the incredible miles of scenic views, for this special habitat of huge, old ebonies, comas and the large areas of wild olive trees growing on our hills, for the large collection of Indian artifacts, the presence of the endangered ocelot and the rare Ayenia plants, all give me great pride that we made a good effort for conservation and financial gain to work together and have a ranch that we, the Corbett and Green families, could all be proud of."

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Mussels on the Move

by Angela Boyer

In August 2010, a major northern riffleshell (*Epioblasma torulosa rangiana*) translocation project took place in Big Darby Creek within the Prairie Oaks Metro Park of Franklin County, Ohio. Nearly 1,500 adult mussels were released at three locations in the creek, which has been designated as a State and National Scenic River. Big Darby Creek is noted for its tremendous diversity and abundance of both aquatic and terrestrial plants and animals, including 43 species of freshwater mussels.

The northern riffleshell is an endangered freshwater mussel that makes its home in streams with a sand or gravel substrate, and it prefers riffles and runs. Prior to 1800, this species was widespread throughout both the Ohio River and Maumee River drainages. It could be found in Illinois, Indiana, Kentucky, Michigan, Ohio, Pennsylvania, and West Virginia. Its range also extended into western Ontario, Canada. Unfortunately, populations have declined dramatically because of reduced habitat quality.

Like many freshwater mussels, the northern riffleshell is sensitive to silt, agricultural run-off, other forms of water pollution, stream channelization, the conversion of free-flowing stream habitat to impoundments, and competition from the non-native zebra mussel (*Dreissena polymorpha*). The decline of the northern riffleshell is not unique; nearly 70 percent of the nation's freshwater mussel species are considered endangered, threatened, or of special concern.

These aquatic gems are important indicators of water quality. Because of the rapid population decline and habitat fragmentation, augmenting riffleshell numbers is essential to the species' recovery. For last year's big translocation project, northern riffleshell mussels were collected from the Allegheny River by U.S. Fish and Wildlife Service and Pennsylvania Fish and Boat Commission biologists. The mussels were transported to the Columbus Zoo and Aquarium mussel facility, where they were briefly quarantined and fitted with passive integrated transponder (PIT) tags. These tags will allow biologists to locate individual mussels in the future and determine the conditions most conducive for long-term survival and reproduction success.

The Columbus Zoo and Aquarium, Ohio State University, Ohio Department of Natural Resources Division of Wildlife, Franklin County Metroparks, and Darby Creek Association all took part in this translocation project. A similar translocation of 1,700 northern riffleshells took place in 2008 at Battelle-Darby Creek Metro Park, just a few miles downstream of Prairie Oaks Metro Park. It remains the largest single release of any federally listed species in the state of Ohio.

A large number of these rare mussels became available for both of these projects as a result of a proposed bridge replacement project in the Allegheny River in Pennsylvania. The bridge project requires the translocation of approximately 200,000 endangered northern riffleshells over the next several years.

When the bridge replacement project was first proposed, a northern riffleshell augmentation and reintroduction plan was already being developed in Ohio, and a captive propagation facility was in place at the Columbus Zoo and Aquarium in cooperation with Ohio State University.

The northern riffleshell is an endangered freshwater mussel that was historically found in the Ohio River and Maumee River drainages. *Angela Boyer, USFWS*

These releases are the first steps to reintroducing and augmenting populations with mussels displaced by the bridge replacement project. Biologists hope that focusing augmentation efforts in areas of Ohio already surrounded by protected uplands in the Big Darby Creek watershed will improve the northern riffleshell's chances for recovery. The information gained from these efforts will also aid future mussel restoration efforts in Ohio and other states in the Midwest.

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(Top): In August 2010, nearly 1,500 northern riffleshell mussels were released at three locations within Big Darby Creek in Ohio. *Angela Boyer, USFWS*
(Bottom): Divers and snorkelers from the U.S. Fish and Wildlife Service and Pennsylvania Fish and Boat Commission collect northern riffleshell mussels from the Allegheny River in Pennsylvania for translocation into Big Darby Creek. *USFWS*

The Return of the "Watchman of the Gorge"

by Mima Falk, Jan Busco, Lori Makarick, and Allyson Mathis

Like many rare plants with very specific habitat requirements, sentry milk-vetch is threatened by habitat loss, climate change, and drought.

Jan Busco, Grand Canyon National Park

One of our nation's rarest plants, the sentry milk-vetch (*Astragalus cremnophylax* var. *cremnophylax*), occurs only in Grand Canyon National Park, where it is known from three locations along the South Rim. This tiny member of the pea family with minute pale purple flowers favors a very specific type of habitat on the canyon edge within shallow depressions in the highly porous Kaibab Limestone. It was scientifically described in 1948 by Rupert Barneby, who gave it the evocative Latin name *cremnophylax*, meaning "watchman of the gorge."

The sentry milk-vetch was listed in 1990 as endangered due to its small population size, very narrow range, and threats posed by recreational activity near the only colony known at the time (Maricopa Point). The Park is one of the recovery partners for this species and has been enthusiastic in conservation actions, taking action even before the recovery plan was completed in 2006. The population at Maricopa Point, for example, was fenced for its protection in 1990. In 2008, the Park followed up by removing the Maricopa Point parking lot to provide additional habitat for the species. The area is being restored with various native plants, and a portion has been set aside for a pilot project to test reintroduction methods for the sentry milk-vetch.

In 2009, with funding from the U.S. Fish and Wildlife Service and in partnership with the Grand Canyon Association, the Park constructed a 200-square-foot (18-sq-meter) passive solar greenhouse that houses an *ex situ* (off site) population of sentry milk-vetch. Botanists collected seeds from the natural populations but took care to leave some in place for germination in the wild. In 2010-2011, they collected another 2,660 seeds. The park now has an *ex situ* bank of more than 3,000 seeds that will be used to support reintroduction trials.

The Park is also focused on conserving the existing populations and continuing the search for others. It has monitored

the Maricopa Point population regularly since the 1990s and makes yearly visits to assess other populations at Lollipop Point and Grandview. More than 1,000 additional plants were discovered on limestone platforms below the populations on the canyon rim during 2010 spring-summer surveys. We are excited about this find and hope that staff with rock climbing skills and no fear of heights will find additional populations below the rim.

The Service provided additional funds in 2009 to investigate the plant's ecological characteristics. Park staff and dedicated volunteers from the Student Conservation Association studied and documented the species' pollinators (two species of small, native bees and a native species of hoverfly), documented the presence of a natural seed bank at Maricopa Point, and examined the differences in germination and growth of sentry milk-vetch seedlings using tap water and reclaimed water. In July 2010, a mini-reintroduction effort at Maricopa Point was undertaken by planting five sentry milk-vetch plants. Eleven months later, all five plants are still alive! This bodes well for our summer 2011 pilot planting at Maricopa point.

Research scientists at the Arboretum at Flagstaff have also contributed to tasks outlined in the recovery plan. They have been studying the unique soil characteristics associated with the plant to inform our selection of future reintroduction sites. They are also examining the relationship of other plant species that grow in close proximity to sentry milk-vetch to determine if they play a role in promoting seedling germination and survival. Sentry milk-vetch is in the National Collection of the Center for Plant Conservation, of which the Arboretum at Flagstaff is a participating institution.

When the actions outlined in the Sentry Milk-vetch Recovery Plan have been accomplished, the species should be restored and ready for removal from Endangered Species Act protection. Recovery of the sentry milk-vetch will be achieved when there are eight viable populations of 1,000 individuals each growing in protected habitat. Each natural population must be stable or increasing for a 10-year period, and each planted population must be stable or increasing for a 30-year period. There will be many steps to take before recovery is realized, and the Park staff and volunteers, the research community, and the Service will continue to work together to restore "the watchman of the gorge."

Sentry milk-vetch in bloom. *Peter Rowlands, NPS*

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A Second Chance for the Foskett Spring Speckled Dace

Habitat Restoration and Reintroduction as Recovery Tools

by Paul Scheerer and Mark Terwilliger

Foskett speckled dace (*Rhinichthys osculus* ssp.). *Paul Scheerer, ODFW*

The Foskett Spring speckled dace (*Rhinichthys osculus* ssp.) is a small fish known from a single population inhabiting Foskett Spring in south-central Oregon. In 1985, it was listed under the Endangered Species Act as threatened, due to habitat loss and its restricted distribution.

Populations of the Foskett Spring speckled dace were probably distributed throughout prehistoric Coleman Lake in the Warner Basin. The Warner Basin includes portions of southeast Oregon, northern Nevada, and northern California. The dace became isolated in Foskett Spring as the lake began to dry nearly 10,000 years ago. The salt content of the lake water increased and the amount of freshwater habitat available to the dace was reduced to just a few spring systems.

Foskett Spring is a natural system that rises from a springhead pool, flows through a narrow brook into a series of shallow marshes, and then disappears into the soil of the normally dry Coleman Lake.

In 1979, 100 dace from Foskett Spring were introduced into Dace Spring by the U.S. Bureau of Land Management (BLM)—located just half a mile south of Foskett Spring—in an attempt to establish a second population. This attempt failed, however, due to a lack of suitable spawning habitat.

In 1987, BLM acquired, through exchange, a 160-acre (65-hectare) parcel of land containing both Foskett and Dace springs. Both sites were fenced to exclude livestock, thereby minimizing habitat disturbance.

The Oregon Department of Fish and Wildlife's (ODFW) Native Fish Investigations Project then began monitoring the Foskett Spring population on a biannual basis. Its biologists found the population to be healthy and near the carrying capacity of about 3,000 adults. ODFW also documented multiple age-classes and the presence of young-of-the-year fish, which suggested successful recruitment.

However, the population has fallen by approximately 90 percent since 1997. We attribute this decline to a substantial reduction of open water habitat due to encroachment by macrophytes, plants that grow in or near the water. ODFW has worked with the U.S. Fish and Wildlife Service to increase the quantity of open water habitat at Foskett Spring and create an additional population of the fish at Dace Spring.

In 2009, a collaborative project between the Service, BLM, and ODFW was implemented to complete a restoration

Paul Scheerer, a fish and wildlife biologist with the Oregon Department of Fish and Wildlife, introduces Foskett Dace into Dace Spring. *David Banks, ODFW*

project at Dace Spring and create two permanent pools. The following year, 50 dace from Foskett Spring were transferred into these new pools.

ODFW biologists will monitor both the donor and the introduced populations to obtain population estimates, describe the population size structures, and look for evidence of recruitment. Once we are confident that the introduced population is well established, and have documented successful spawning and increasing abundance, ODFW will plan a similar habitat restoration project for Foskett Spring. Ideally, this will result in a stable or increasing population and contribute towards recovery.

One of the two spring-fed ponds constructed at Dace Springs in 2009. *Paul Scheerer, ODFW*

In 2009, the Service completed a 5-year status review for the Foskett Spring speckled dace. Among the recommendations in the review was the collection of demographic information on age structure, age at reproduction, and longevity. In partnership with Oregon State University, ODFW initiated a project in 2010 to gather this information. Validation is the first step in assessing the age structure of a population. In this case, validation involves verifying that growth patterns on ageing structures of individual fish are discernable and deposited annually. Examples of fish ageing structures include scales, otoliths (ear bones), and rays of the pectoral fins.

Annular growth rings, or annuli, are typically deposited on hard structures of the fish, much like annular rings form in trees. In the summer, rapid growth creates widely spaced rings, but the rings become more closely spaced when growth slows down for the winter. In springs, where water temperatures are fairly constant, these differences in fish growth may not be as evident.

In 2010, ODFW biologists marked all of the dace introduced into Dace Spring by exposing them to the antibiotic oxytetracycline (OTC) for six hours. When OTC is incorporated into the dace's hard structures, it forms marks that are visible under ultraviolet light.

ODFW will sample 50 dace to characterize the annual growth patterns since the time of their initial marking. This will allow biologists to validate growth patterns and assign accurate ages. If the patterns are regular and discernable, samples will be collected again in 2012 to describe the age structure, the age and size at reproduction, and the longevity of individuals. This information will be critical to assess the health of these populations and their responses to habitat restoration.

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Editor's note: In 2006, Paul Scheerer was recognized by the Service as a Recovery Champion for his work on the Foskett Spring speckled dace and a variety of Oregon's other endangered and threatened fish species.

Never Giving Up

Work Continues on Mexican Wolf Recovery

by Sarah E. Rinkevich, Wally Murphy, and Sherry Barrett

Minimizing wolf depredations and gaining rancher tolerance of wolves is one of the greatest challenges the Service faces in its efforts to recover the Mexican gray wolf. *Jim Clark, USFWS*

The Mexican wolf (*Canis lupus baileyi*), long recognized as a subspecies of gray wolf, historically inhabited the southwestern United States and Mexico. A government predator extermination program in the late 1800s and early to mid-1900s reduced the Mexican wolf population so much that, by 1970, it was considered extinct in the wild. Fortunately, a few wolves were found in Mexico. They were captured and brought to the U.S. in 1981 to begin a captive breeding program for future reintroduction into the wild. The successful propagation effort has increased the captive population to about 300 Mexican wolves at 49 breeding facilities in the U.S. and Mexico.

In 1998, we began reintroducing Mexican wolves into the wild in Arizona and New Mexico, designating them as a "nonessential experimental population" under section 10(j) of the Endangered Species Act. Such designations are intended to promote support for reintroduction by allowing a greater degree of management flexibility. However, after more than 10 years of reintroduction, the wild population remains fragile. In December 2010, the wild population numbered approximately 50 wolves—half the number needed for our objective to establish a single population of at least 100 wolves pursuant to the 1982 Mexican Wolf Recovery Plan.

The effort to reestablish the Mexican wolf continues. With the black-footed ferret (*Mustela nigripes*) and the red wolf (*Canis rufus*), it is one of only three carnivores in North America to have been eliminated from the wild, bred in captivity, and reintroduced to the wild. Both the Mexican wolf reintroduction in the Southwest and the red wolf reintroduction in the Southeast relied fully on captive-bred animals. In contrast, the U.S. Fish and Wildlife Service's gray wolf programs in the Northern Rockies and Great Lakes states relied on the translocation of wild wolves and/or natural recolonization from adjacent source populations.

The progress of the Mexican wolf recovery program has been hindered by regulations associated with the section 10(j) population boundary. These regulations mandate that Mexican wolves remain in a confined portion of Arizona and New Mexico. Although no single threat is responsible for delaying progress in the reintroduction, the cumulative effects of illegal shooting, removal of wolves because of livestock

depredations, and reduced fitness due to inbreeding depression result in a consistently high level of wolf mortality.

As we struggle to increase the wolf population, we are also working to improve the overall Mexican wolf recovery program. A new recovery team was convened in February 2011 to develop recovery and delisting criteria. The Service's law enforcement officers continue to investigate and prosecute illegal shooting. With regard to the effects of inbreeding, a graduate student at the University of Arizona will investigate the purity of the initial population founders, the extent of inbreeding in the captive and wild populations, the current distribution of genetic variation from the original founders. The student will also examine how to minimize the frequency of mildly deleterious traits that lead to inbreeding depression. Minimizing wolf depredations and gaining rancher tolerance of wolves, however, remains one of the most demanding challenges we face.

Although recent public polling in Arizona and New Mexico shows that most respondents have positive feelings about wolves and support the reintroduction of the Mexican wolf to public land, much of the local ranching community feels otherwise. Ranchers are frustrated primarily because of wolf depredations on livestock. From 1998 to 2009, confirmed depredations by Mexican wolves included 139 cattle, 12 sheep, 3 horses, and 5 dogs. Barriers to the success of the Mexican wolf reintroduction project will continue unless the impacts of wolf depredations are addressed. A proposal is in the works to address this hurdle by providing ranchers and other livestock owners options for managing wolf-livestock interactions.

The Service's Southwest Region has developed what it is calling the "Mexican Wolf-Livestock Interdiction Fund." The objective is to generate funding for long-term financial support to livestock operators within the framework of Mexican wolf recovery. Under a cooperative agreement with the Service, a non-federal organization, the National Fish and Wildlife Foundation, will manage the fund. A Stakeholder Council consisting of local ranchers, county organizations, Native American Tribes, and conservation groups has been created to determine where, when, and how the interdiction funds are to be allocated. The Service will serve as a technical advisor to the council, which met for the first time in April 2011.

This multi-faceted program has three proposed funding avenues: (1) *Interdiction*, which will fund proactive measures that prevent wolf-livestock interactions from occurring such as using guard dogs, range riders, and pasture management; (2) *Incentives*, which will provide upfront payments for potential future livestock losses caused by Mexican wolves; and (3) *Compensation*, which will provide payments for confirmed livestock kills by wolves. The Stakeholder Council will establish guidelines for fulfilling compensation requests and managing payments. Financial support for the Interdiction Fund is still being raised, and the program is expected to eventually be funded by the annual interest generated by the Fund.

What does the Interdiction Fund mean to livestock owners? It means more options for management of wolf-livestock interaction to help keep ranchers on the land. What does the Fund mean for the Mexican wolf reintroduction program? We hope it will offer advances in wolf recovery in that wolves will not have to be translocated or removed if they depredate. The next steps for the Interdiction Fund will be to increase the funding available and assist the Stakeholder Interdiction Council in developing a long-term program that provides for the recovery of the Mexican wolf in the presence of livestock grazing.

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The "Mexican Wolf-Livestock Interdiction Fund" will provide ranchers and other livestock owners with options for managing wolf-livestock interactions. *USFWS*

A Secure Future for the Tennessee Purple Coneflower

by Mike Bender

Tennessee purple coneflower. *©2011 Daniel W Reed, www.2bnTheWild.com*

More than three decades of conservation and protection have paid off well for the Tennessee purple coneflower (*Echinacea tennesseensis*), a distinctive plant once in danger of extinction. On August 12, 2010, the U.S. Fish and Wildlife Service proposed to recognize the wildflower's recovery by removing it from the federal list of threatened and endangered species, and the final decision will be announced this summer.

An array of conservation partners have successfully increased the known number and distribution of populations while managing and protecting the habitat they need for long-term survival.

First collected in 1878, the Tennessee purple coneflower was not described as a distinct species until 1898. It then went unnoticed until it was rediscovered in the late 1960s in Davidson County and in the early 1970s in Wilson County. When first listed in 1979 as endangered, the Tennessee coneflower was found only as small populations in limestone barrens and cedar glades in Davidson, Rutherford, and Wilson counties.

In 1989, a revised recovery plan for Tennessee purple coneflower established a criterion for recovery and delisting. It required that the species exist in five secure or protected populations, consisting of at least three colonies each. There are now 19 secure colonies distributed among six populations, five of which contain three or more colonies. These 19 colonies account for approximately 83 percent of the species' total distribution.

This recovery success story is the result of conservation efforts by many partners who worked more than 30 years to protect and expand the Tennessee purple coneflower colonies. The Service's partners include the Tennessee Department of Environment and Conservation, the Tennessee Division of Forestry, The Nature Conservancy, the U.S. Army Corps of Engineers, the National Park Service, and various private landowners.

Many factors influenced the recovery, including discovering new colonies through surveys of suitable habitat;

researching the life history, genetics, and ecology of the species; and establishing new colonies from seed or nursery propagated plants.

The Tennessee Department of Environment and Conservation was instrumental in buying or securing habitat through other means to restore the species, as well as building fences to protect colonies from recreational vehicle damage, removing competing vegetation, and using prescribed burns to provide open habitat conditions that help this species thrive.

Tennessee purple coneflower is a member of the sunflower family in the genus Echinacea, which includes several purple coneflower species that are commercially marketed for ornamental and medicinal purposes. Purple coneflowers sold commercially are usually hybrids.

If Tennessee purple coneflower is removed from the list of threatened and endangered species, federal agencies will no longer need to consult with the Service to ensure any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of this species. But if the coneflower is delisted, the Service will work with Tennessee Department of Environment and Conservation to implement a post-delisting monitoring plan for at least five years to ensure that this unique wildflower has a secure long-term future.

Mike Bender recently retired after serving over 25 years as Editor of the Endangered Species Bulletin.

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