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PROJECT NUMBER NR-23-004

Story Telling Through Photographic Profiles of Species at Risk on Department of Defense Lands

René Parker / Select Engineering Services

March 26, 2024

Documenting Endangered/Threatened Species on Military Training Bases

Improved Ecosystem Monitoring Protocols/Tools/Processes on Military Installations

26 March 2024

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LIST OF ACRONYMS

DoD	Department of Defense
ESA	Endangered Species Act
OSD	Office of the Secretary of Defense
PARC	Partners in Amphibian and Reptile Conservation
PIF	Partners in Flight
SAR	Species at Risk
SES	Select Engineering Services
SHOBA	Shore Bombardment Area
SKR	Stephen's Kangaroo Rat
VSFB	Vandenberg Space Force Base

1.0 Introduction

Department of Defense (DoD) lands contain some of the most pristine examples of rare wildlife habitats remaining in the U.S., unchanged and untouched by encroachment of urban sprawl. DoD has made great strides in protecting Species at Risk (SAR). Prioritizing sound environmental stewardship is a priority that is balanced with supporting the military mission.

This project showcases the DoD conservation story by documenting years of successful collaboration between key management organizations. Outstanding examples of DoD stewardship are highlighted through world class photographs, individually outlining DoD efforts and species conservation status, and the critical role DoD has played in protecting these species.

1.1 Background

DoD agencies manage nearly 27 million acres of land that have been sheltered from development pressures and large-scale habitat loss. These installations have proven vital to the conservation and preservation of many rare plant and animal species by providing crucial habitat that may be their last refuges in rapidly urbanizing landscapes. DoD lands support more federally listed species than any other major federal agency, and harbor more imperiled species than lands managed by either the National Park Service or the U.S. Fish and Wildlife Service.

1.2 Scope

This project identified 10 SARs on DoD lands and conducted portrait style photoshoots of each species in coordination with the world renown National Geographic Photographer and founder of the Photo Ark, Joel Sartore. The project required working with DoD leadership, biologists, natural resource managers and partners to develop the conservation story surrounding each of the photographed species.

2.0 Technical Approach

The technical approach for this project was to identify species at risk on DoD lands that could be photographed, and their conservation story documented. There were discussions with installation wildlife biologists to determine what species could be safely captured and photographed. Photoshoots were then coordinated with the photographer. Each photoshoot ensured the safety of the species and that necessary permits/permit holders were in place.

3.0 Objectives

3.1 Identification of Species

Identification of species began with a review of the Office of the Secretary of Defense (OSD) Species at Risk which was broken down by military installation. Discussions with biologists assisted in further down selection based on the ability to photograph the species which included where the species was located and who held the permit to handle the species. A spreadsheet was developed that broke out species by military service, status, and location. Species were identified as either an OSD SAR priority, Legacy Project priority, DoD Partners in Flight (DoD PIF)

and/or DoD Partners in Amphibian and Reptile Conservation (DoD PARC) priority. DoD PARC provides a framework for DoD and the Military Services to effectively manage amphibians and reptiles on DoD lands by focusing on habitat and species management; inventory, research, and monitoring; and education, outreach, and training. DoD PIF works beyond installation boundaries to facilitate cooperative partnerships, determine the current status of bird populations, and prevent the listing of additional birds as threatened or endangered. The spreadsheet also indicated whether a species was in a remote location, whether a permit was needed, if there was a permit, the name and contact of the permit holder, notes, and dates of availability. The dates of availability were determined by when species would normally be captured or handled.

3.2 Species Research

Research on the species and discussions with installation biologists was conducted on species from the Department of the Navy, San Clemente Island Office, Naval Weapons Station Seal Beach Detachment Fallbrook, CA, and Vandenberg Space Force Base to gather data that included: Common Name, Scientific Name, Conservation Status, Geographic Location, Habitat, Diet, Threats and Benefits. Additional research was done to understand the species and its home on military installations. This information was used to document the species and its habitat on military lands.

3.3 Availability for Capture and Photos

Once the SARs were identified, it was necessary to identify when species were available for capture. From that data it was possible to see clusters of multiple species that might be available during a particular timeframe that could then be coordinated with the photographer's schedule.

Each location included scheduling, species availability, coordination with installation, base access, and site preparation (for photo shoot). At each location, a site was identified for the photo shoots to take place. Each location had a black and a white background set up. The black and white backgrounds are used to focus the attention on the species. The close-up photographs on black and white backgrounds are also a way to gain a different perspective on the species; looking at an insect at the same scale as an elephant alters the focus and highlights the uniqueness of each.

The capture and holding of the SAR were dependent upon the individual SAR and the parameters of the handling permit. There was a pre-photoshoot briefing regarding the SAR, to ensure the safety of the SAR.

There was also a post photo shoot de-briefing to document lessons learned and the teardown completed at the site.

4.0 Discussion

Five species were identified for documentation between San Clemente Island and Seal Beach Detachment Fallbrook. These were the San Clemente Loggerhead Shrike (Ludovicianus mearnsi), Island Night Lizard (Xantusia riversiana), Island Fox (Urocyon littoralis clementae). and Stephen's Kangaroo Rat (Dipodomys stephensi). The first four species are found on San Clemente Island and the fifth on Detachment Fallbrook. The San Clemente Bell's Sparrow (Artimisiospiza belli clementae) was not photographed because it was in the process of being

delisted and the permit holders had not renewed their permits which prevented the species from being captured.

4.1 San Clemente Island

The first location visited was San Clemente Island, which is controlled by the Navy and required travel by military airplane to access. Plans had been made previously to photograph the San Clemente Loggerhead Shrike, Island Night Lizard, Island Fox and San Clemente Bell's Sparrow. However, because the San Clemente Bell's Sparrow was in the process of being delisted the permit holders had not renewed their permits which prevented the species from being captured and photographed.

Human activities related to military readiness and training continue on San Clemente Island and are managed and directed by the U.S. Navy. Activities such as shore bombardment in the shore bombardment area (SHOBA), covert training, grenade and small arms practice, and other support activities continue in specified training areas on the island to augment military readiness and national security.

4.1.1 San Clemente Island Loggerhead Shrike

The San Clemente Island Loggerhead Shrike is a robin-sized songbird that hunts like a hawk. The Loggerhead Shrike has been called the "butcher bird" because of its tendency to impale their prey on thorns, to hold the prey in place while consuming it. (National Park Service 2016). Shrikes that live in proximity to training areas are at increased risk to disturbance or harm from training activities. The shrike was listed as endangered in 1977.

The San Clemente Loggerhead Shrike population was very close to extinction with as low as 14 individuals in 1998. (Warnock and Mader 1998). However, due to captive breeding and release programs, predator management and habitation protection, the shrike population has begun to rebound. In 2022, there were 20 pairs in the wild.

4.1.2 San Clemente Bell's Sparrow

The San Clemente Bell's Sparrow is restricted to San Clemente Island, California. Since 1976, the Navy has supported nearly annual monitoring of the San Clemente Bell's Sparrow population, including color banding to augment demographic analysis of the adult and juvenile population. Nest surveys have also been used to analyze habitat, ascertain nesting success, and examine potential causes of nesting failures and high juvenile mortality.

The San Clemente Bell's Sparrow was listed as threatened in 1977 and has been close to extinction, with a low of 38 individual adults reported in 1984. Since that time, the population has fluctuated. Some of this population fluctuation may be related to differences in survey methods and areas surveyed. The wild population can fluctuate annually in number and has low annual juvenile survivorship.

Some of the reasons for the decline of the Bell's Sparrow are the same as for the decline of the loggerhead shrike: reduced or unavailable food supply; habitat destruction by pigs, goats, and military activity; and competition with other birds, especially the white-crowned sparrow, house finch, and horned lark. Other problems are unique to the Bell's Sparrow. It appears to be unable

to effectively invade and use marginal habitat. Predation by cats, fox, kestrels and other raptors, harriers, and cowbirds may also threaten the Bell's Sparrow.

However due to the removal of the goats, and the return of shrubs the Bell's Sparrow began to return. The population has grown to more than 6,000 birds and has expanded from a range of 10,000 acres to 33,000 acres. This remarkable return of the Bell's Sparrow led to its delisting in January 2023.

4.1.3 San Clemente Night Lizard

The San Clemente Night Lizard is endemic to the California Channel Islands. This lizard is found in isolated portions of three of the Channel Islands—San Clemente, San Nicolas, and Santa Barbara.

The species represents an extreme pattern of lizard life-history characteristics, including slow growth, low reproductive effort, late maturation, long life span, and low predation. These life-history features magnify the importance of the potential of predation on lizard populations. The night lizard was listed as threatened in 1977 and delisted in 2014.

4.1.4 San Clemente Island Fox

The San Clemente Island Fox only lives on six of the eight Channel Islands off the coast of southern California. They are found nowhere else on Earth. Each island population is recognized as a separate endemic or unique subspecies. The island fox is one third smaller than its mainland ancestor the gray fox. Environmental and ecological factors such as overcrowding, reduction in predators, food limitations, and genetic variations could have contributed to the natural selection for a smaller size.

The island fox is currently not listed under federal Endangered Species Act (ESA) but is protected under a Candidate Conservation Agreement between the Navy and U.S. Fish and Wildlife Service.

4.2 Seal Beach Detachment Fallbrook

The second location to be visited was Seal Beach Detachment Fallbrook. Prior to arriving, plans had been made to capture the Stephen's Kangaroo Rat (SKR). Both photos and video were taken of the SKR.

Seal Beach Detachment Fallbrook is the primary West Coast supply point for Navy amphibious warfare ships and acts together with Naval Weapons Station Seal Beach to provide Navy ordnance storage, maintenance, and distribution for a majority of the U.S. Pacific Fleet. The base also provides storage and distribution of Marine Corps munitions and air-launched missile maintenance services for several major DoD weapons programs. Detachment Fallbrook is immediately adjacent to the eastern border of Marine Corps Camp Pendleton. Approximately 90% of the base is undeveloped natural landscape.

4.2.1 Stephen's Kangaroo Rat

The SKR is endemic to the Southern California region of the United States, primarily in western Riverside County. The species is listed as threatened under the federal Endangered Species Act. This is because the SKR's native home of Southern California's flat, sparsely vegetated

grasslands has been under intense pressure from urban and agricultural development. As a result of this loss of much of its habitat, the SKR can now only be found in small, fragmented patches that continue to be threatened where not protected by a preserve.

The SKR is a small rodent with a tail almost 1.5 times the length of its body, and spring-loaded hind legs (that give it its name) for bounding quickly across the arid landscape it inhabits. SKRs create burrows to sleep in by day and cache seeds for later use, acting as a keystone species by promoting soil health and reducing the impacts of invasive grass species.

These rodents can promote the growth of native plants and reduce the spread of invasive ones. They do this through their diet of seeds and burrowing. The SKR build complex burrows which increase soil fertility and water infiltration. These rodents also tend to store seeds in their burrow. Not all these seeds will be eaten, leading to more native plant growth.

4.3 Vandenberg Space Force Base

The last visit was to Vandenberg Space Force Base (VSFB), where six species were photographed. These species included the Tidewater Goby (Eucyclogobius newberryi), Lompoc Grasshopper (Trimerotropis occulens), Southwestern Pond Turtle (Actinemys pallida), Western Spadefoot Toad (Spea hammondii), Arguello Slender Salamander (Batrachoseps wakei), Buckwheat Blue Butterfly (Euphilotes spp.) (undescribed).

Vandenberg is a space launch base, launching spacecraft from the Western Range and also performs missile testing. It is located midway between San Francisco and Los Angeles California. Much of the base is rugged, mountainous, coastal, and undeveloped and home to numerous threatened or endangered species.

4.3.1 Tidewater Goby

The Tidewater Goby was listed as endangered in 1994 and had to be caught right before they were photographed. The goby needs an estuarine environment that exists in coastal lagoons, where fresh water meets the sea. Habitat desecration from development can push too much saltwater into the lagoons or expunge lagoons all together. Vandenberg's unspoiled coastline plays an important role in protecting these tiny fish because the lagoons are intact.

4.3.2 Lompoc Grasshopper

The Lompoc Grasshopper is also endangered. The search for the Lompoc Grasshopper became serious during a base-wide invertebrate survey in 2004-2005. Scientists collected a grasshopper species that was different than others seen across the base and that looked very similar to the Lompoc species, which was described in 1984 from mounted museum specimens collected in 1909 and 1938. In 2006, the Lompoc Grasshopper was discovered on VSFB, it had not been seen since 1938.

4.3.3 Western Spadefoot Toad

The Western Spadefoot Toad needs two distinct habitats to thrive – an aquatic area for breeding and raising tadpoles, and a drier terrestrial area for foraging and estivation – a type of summer hibernation for reptiles and amphibians. Vernal pools provide the aquatic component, and as they

dry up the spadefoot burrows into the ground and estivates until it rains again. As of 2023, the Western spadefoot toad remained under review for federal ESA listing.

4.3.4 Western Pond Turtle

In 2020, the Western Pond Turtle was divided into two species, the Northwestern Pond Turtle and the Southwestern Pond Turtle, which is the one that lives in and around Vandenberg. Both species were recommended for threatened status under the ESA in 2020.

4.3.5 Arguello Slender Salamander

The Arguello Slender Salamander is a relatively new species discovered in 2006 by Vandenberg-affiliated scientists. It lives in a very small area of the region – maybe 2 to 4 square miles – and spends most of its life underground. It needs to stay very moist, and recent droughts have not helped this species thrive. Right now, it is believed to exist solely at Vandenberg and neighboring properties, although biologists are hoping to find it in other areas of the Santa Barbara region. The Arguello Slender Salamander conservation status is currently undetermined.

4.3.6 Buckwheat Blue Butterfly

The Buckwheat Blue Butterfly conservation status is also undetermined, since it was discovered on VSFB and is undergoing genetic testing to confirm its species. It had originally been thought to be an endangered El Segundo Blue Butterfly.

The photos and species profiles are included in Story Maps that also include a story of the conservation efforts of these species. Three separate Story Maps developed for each of the locations visited. Base personnel were interviewed for each of the stories which provided a unique look into the hard work and dedication of those on the ground that support conservation efforts.

5.0 Conclusions

During this project there were three locations visited and 11 species documented and 10 photographed (the San Clemente Bell's Sparrow was not photographed due to delisting). The results are included in three Storymaps attached and the delivery of all high-resolution photographs and videos.

The Story Maps can be found at:

- U.S. Navy Making Endangered Species History https://arcg.is/1DSzCu0
- A Success Story the Stephens' Kanagroo Rat Recovery https://arcg.is/0qn5v1
- Saving Species, Supporting the Mission https://arcg.is/1jfXn

Documenting and photographing these species enable greater understanding of the critical work being undertaken by the DoD to conserve these species. A picture speaks a thousand words as the public can connect with each of the species and understand the role each species plays in the ecosystem.

6.0 Military Mission Benefits

DoD lands contain some of the best examples of pristine habitat left in the US, essentially becoming islands of diversity in a sea of development, and as a result, managers are experiencing an increased burden to protect species under duress. As DoD land managers strive to deal with the challenges of balancing land, water and air resources within a very high operational tempo, an understanding of the biological status of SAR species is critical. This project promotes coordination with multiple DoD partners and integrates relevant efforts at a cross-boundary, landscape, regional, and national scale. It highlights compatible land uses, including sustainment of military ranges and operating areas for future use, while simultaneously publicizing long-term stewardship of natural resources and the benefits there-of. By collaboratively managing habitats, DoD land managers can be assured that other federal agencies, and other land holders surrounding military lands are doing their part to manage for species that could affect mission and essential testing and training activities on DoD lands.

7.0 Recommendations

As stated above a picture speaks a thousand words and being able to capture the SARs located on DoD lands provides a look into just what is at stake. Each species represents the dedication and commitment to conservation while ensuring military mission is carried out. For future photoshoots, it is important to coordinate early with the installation biologist to align photoshoots with planned monitoring activities. This ensures that the right people with the right permits are available to support the photography session and protect the species. It is also important that the biologist/permit holder communicates any unique holding or limitations for each species. As important as the photographs is the documentation of the species and the conservation story. Connecting the photograph with the people responsible for its survival is critical to communicating the importance of the work.

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APPENDIX A - U.S. NAVY MAKING ENDANGERED SPECIES HISTORY STORY MAP

U.S. Navy Making Endangered Species History

Largest group delisting in the history of the Endangered Species Act

Department of Defense Legacy Resource Management Program- Project Number: NR-23-004
March 26, 2024

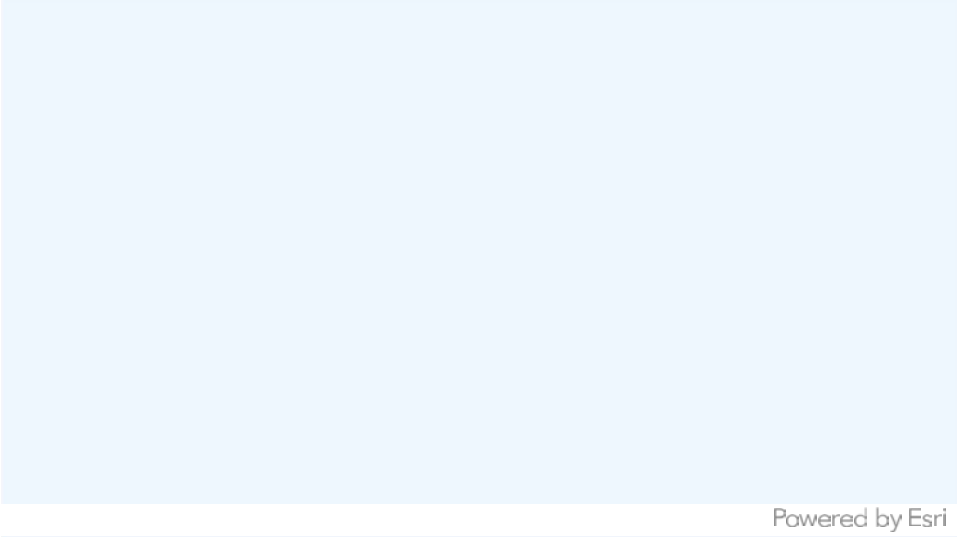
All photos were taken on San Clemente Island, by Joel Sartore, Joel Sartore Photography, with assistance from the dedicated Department of the Navy, Environmental staff of San Clemente Island.

In 2023, on San Clemente Island (SCI) off the California coast, the U.S. Navy quietly made Endangered Species Act (ESA) history when the U.S. Fish and Wildlife Service delisted five SCI species at once.

The San Clemente Bell's Sparrow (Artimisiospiza belli clementae), SCI Broom (lotus), SCI Paintbrush, SCI Bush-mallow, and SCI Larkspur were removed from federal listing in January 2023 because their populations have sufficiently recovered.

“It is the largest group delisting in the history of the Endangered Species Act,” said Melissa Booker, San Clemente Island’s wildlife biologist.

The natural resource management effort is admirable, made more impressive by the mission under which this effort was made. San Clemente Island, situated 41 miles off the Southern California coast, provides the only ship-to-shore, air-to-ground, and boots-on-the-ground live firing range in the Continental U.S. In civilian terms, that means it is a place where troops can practice storming beaches, dropping bombs, and firing weapons – sometimes all at once.



San Clemente Island

It’s important to manage the habitat not only for the endemic and protected plant and animal species, but also to maintain the landscape for essential training missions. The topography and habitats that occur on San Clemente – open grassland plateau, beaches, deep canyons, dense cactus, and scrublands – allow troops to train on a variety of terrains and conditions.

Yet, with all of this intensive military activity, biologists and botanists who work for the military and myriad other agencies and nonprofit groups have simultaneously engaged in decades of resource management resulting in the recovery of these five federally listed species that occur on SCI, and they continue to work to protect dozens of other endemics found nowhere else.

> The success of the act [ESA] relies on recovery, and doing it in areas where we have overlays of active missions," said Kim O'Connor, Conservation Program Manager for the Commander Pacific Fleet. "There's a lot of coordination. And frankly, it's really a passion for us. We care about the natural resources, and we care about the mission."
>
> *Kim O'Connor, Conservation Program Manager for the Commander Pacific Fleet*

The 1960 Sikes Act requires the Department of Defense to identify, monitor, and create recovery programs for the natural resources and ecosystems that occur on military-owned lands. At San Clemente Island, this mission means managing multiple unique ecosystems with a U.S. military mission that occurs nowhere else in the continental United States.

But a law can't create the kind of dedication needed for creating management plans and the cooperative relationships to successfully execute them. Such passion comes from within personnel who deeply care.

"Take the SCI Larkspur, for example. In 1979, it occurred in only two places on the island, and in one of those spots there was a single plant," O'Connor said. She thinks about her predecessor out there in the hot sun putting a fence around that single plant. It had to feel hopeless.

And the challenges at that time were huge. The island had been used for ranching from the 1850s until the Department of Defense acquired it in 1934. Decades of grazing had left it bare of most native vegetation and home to invasive grasses and thousands of free-roaming feral goats, among other habitat degradations.

However, once the last of the estimated 29,000 feral goats was removed from the island in 1991, the shrubs and plants began to recover, gradually bringing back the landscape that makes San Clemente Island unique among California's Channel Islands. As the southernmost island in the chain, it encompasses a hybrid of the Baja Peninsula's dry, desert habitat and the moist, more temperate habitat of islands farther north.

The island's native vegetation captures moisture from the fog and clouds that pass over the island almost daily. Pulling that moisture into the plants and soils below creates the habitat in which dozens of endemic species thrive. San Clemente has the highest endemism of flora and fauna in the California's islands.

"As the habitat improved and the endangered SCI Larkspur spread, Navy officials found themselves having to consult with natural resources management in more areas of the island before initiating training missions. That made everyone's tasks more complicated, but species recovery illustrates it's worth it to get to the other side,"O'Connor said.

Now there are more than 19,000 SCI Larkspur plants spread over 74 areas.

Among other successes are the San Clemente Bell's Sparrow, delisted in January 2023, and the SCI Night Lizard (Xantusia riversiana), delisted in 2014.

The San Clemente Bell's Sparrow was first recognized as a subspecies of the Sage Sparrow during the 1800s, and at that time called the San Clemente Sage Sparrow. A 2013 taxonomy update

for the Sage Sparrow split the species into two distinct birds – the Sage Sparrow and Bell's Sparrow, with San Clemente Bell's Sparrow, a unique subspecies.

The bird was listed as threatened in 1977, along with six other species of flora and fauna endemic to the island. By 1984, only 38 Bell's Sparrows existed on the island, and experts estimated it had a 96% chance of going extinct in 50 years, Melissa Booker said.

On the plus side, Bell's Sparrow is a very adaptable bird, and once the shrubs and other more vertical vegetation began to return after removal of the goats, the species' nesting success improved, Booker said. Biologists also revamped their monitoring program after realizing the bird was adapting to other parts of the island for foraging and nesting.

As a result, the Bell's Sparrow population has grown to more than 6,000 birds, and has expanded from a range of 10,000 acres to 33,000 acres, nearly the entire island.

SCI Night Lizard

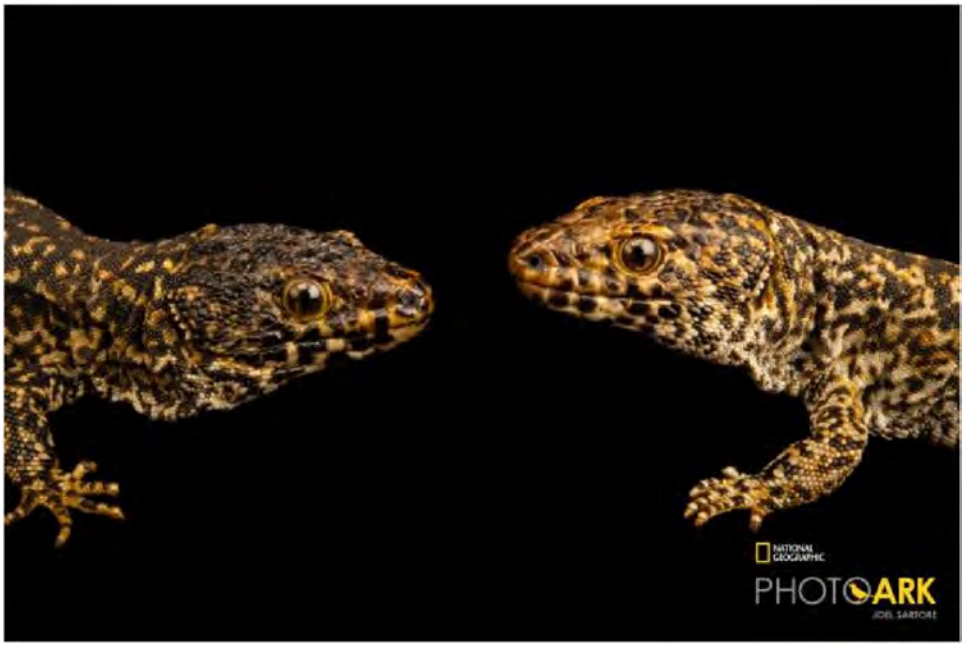
SCI Night Lizard

The SCI Night Lizard (*Xantusia riversiana reticulata*) is another endemic species that dodged the extinction bullet under the military's watch. This medium-sized lizard measures 5 to 8 inches from its snout to the tip of its tail and is widely dispersed over the island. It also occurs on Santa Barbara Island and San Nicolas Island, which also is managed by the military. But San Clemente Island provides about 90% of its range. At the time of its delisting

in 2014, there were an estimated 21.3 million night lizards on San Clemente, according to the Federal Register.

The SCI Night Lizard's name isn't totally accurate, Booker said. They are active during the day, but typically remain out of sight – under rocks or shrubbery – to avoid predators. They give birth to live young, and can live to be over 25 years old – a long time for a small reptile.

"You have to admire these lizards," Booker said. "They live over 25 years. And during drought or during fires, they go down into the ground and estivate (sleep). When the rains come, they are back.



SCI Night Lizard

And they have an interesting relationship with the Bell's Sparrow," Booker added. Remote cameras have shown the lizards climbing into the sparrow's nests, in search of food. So, while trying to protect the sparrow population, resource managers also had to respect the lizard's needs. In the end, the improved habitat helped the ecosystem balance itself, with animals that eat the lizard keeping its brazen nest forays at a reasonable level.

“Predator pressure is natural,” Booker said. “This is how it’s supposed to work.”

Still working their way to recovery and delisting on or around San Clemente Island are six marine mammal species, four species of sea turtle, two plant species, two bird species, and one shark species. Add to that, the fact that San Clemente Island has dozens of endemic species and subspecies, along with new species being discovered – such as a recently noted land snail that DNA testing suggests is an as-yet, unnamed new species.

Documenting this diversity is not only fascinating, it is important for the future," Booker said. "We are recovering habitat and sustaining the species we know to exist, but also looking to the future. It is my firm opinion that understanding our diversity and maintaining it will be paramount."

Melissa Booker, San Clemente Island’s wildlife biologist

Climate change is the biggest variable SCI scientists face. Weather trajectories are uncertain, and climate models for the Channel Islands aren’t perfect.

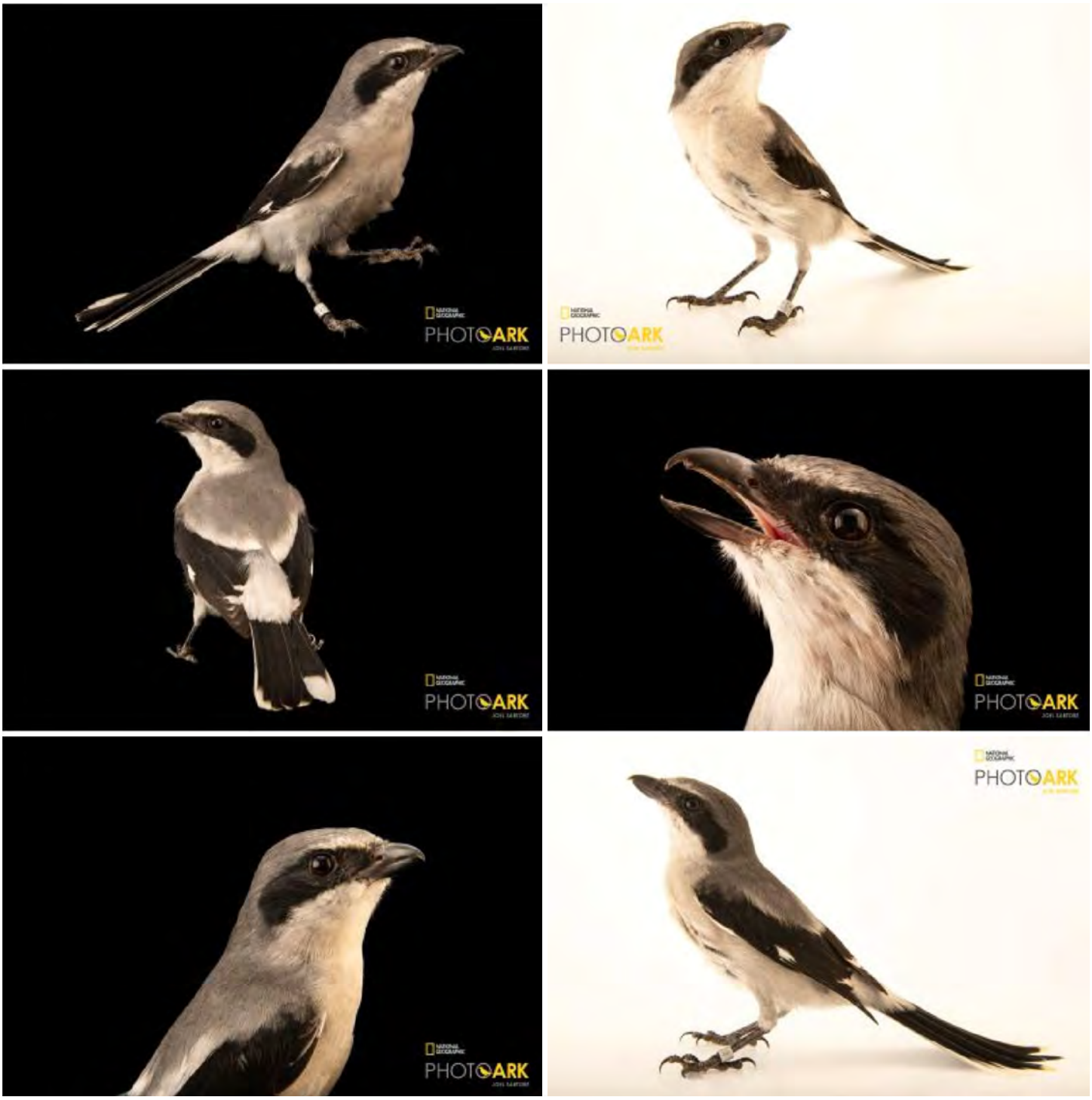
“There will be winners and losers that we cannot yet predict,” Booker said. “So if we can document our diversity now and manage to maximize maintaining diversity, we have hopes of keeping species that will survive under future scenarios.”

Booker and O’Connor both said they feel good about the work they have done so far, and are optimistic about the work ahead. They have strong partnerships with area nonprofit groups and the U.S. Fish and Wildlife Service, along with a deep commitment and financial support from the Defense Department. The Department put more than $6 million toward natural resource management under O’Connor’s purview in 2022.

In addition to the importance of the species outcomes, O'Connor said she hopes their efforts send a message to those lone scientists out there, struggling to fence off one plant or saving a single invertebrate. It may seem like a futile effort, but don't give up, she said.

"You don't know where it's going to go in 30 years," O'Connor said. "You will get to the other side."

San Clemente Loggerhead Shrike



San Clemente Loggerhead Shrike

The endangered San Clemente Loggerhead Shrike (Ludovicianus mearnsi) struggles to maintain its population, even though it is one of the tough guys of the bird world.

The Loggerhead Shrike is a songbird – a word that conjures images of colorful little feathered friends teetering on a branch, singing sweet songs.

But the shrike is the bully of the bird yard – an astute hunter often called “the butcherbird.” This 9-inch carnivore with gray feathers and a black mask munches on grasshoppers, crickets, beetles, lizards, mice, and even other birds.

Its infamy stems not so much from what it eats, but from how. The Loggerhead Shrike perches above the ground and drops on unwitting prey, breaking the neck of vertebrates with the “tomial tooth” on its beak. If the prey happens to be too large to take easily, the shrike will wrestle its quarry to a sharp twig, barbed-wire fence or other sharp object and impale it. In this way, the Loggerhead Shrike can cache a bird bigger than itself enabling them to dismember it for dinner or save it for later.

However, the Loggerhead Shrike subspecies endemic to California’s San Clemente Island (SCI) is facing a threat far too big to impale on a fence: the decades of habitat degradation that shrunk the population followed by repeated drought cycles that appear to be preventing recovery, led to it being listed as a federal endangered species in 1977.

More than 40 years later, it remains at the center of an aggressive program by the Navy’s Commander Pacific Fleet to help it recover. And this recovery must be done in concert with what the U.S. Navy needs to accomplish at San Clemente Island – training exercises that involve live fire. Lots of it.

> *It's the last Continental U.S. location where the Navy can engage in simultaneous live fire ship-to-shore, air-to-ground, and ground troop training. And it's the only place for the 3rd phase of Navy Seal training," said Melissa Booker, wildlife biologiest for SCI. "It has a unique role in the military."*
>
> *Melissa Booker, Wildlife Biologist, SCI*

San Clemente Island also has a unique ecosystem, she said. As the southernmost of California's eight Channel Islands, San Clemente Island is a hybrid of the arid Baja habitat and the more moist habitats of the islands found farther north. It has grassland, canyon woodland, dune, and scrub ecosystems.

Biodiversity thrives in the edges where different habitats meet, making San Clemente a 21-mile-long treasure trove of nearly 1,000 different species of plants and animals, including at least 47 species that are endemic – meaning they occur nowhere else.

It is not uncommon for U.S. military bases – because of their large land masses that are used for specific mission needs – to provide some of the last open wildlands in the United States. The presence of endemic species isn't a surprise, but because of their limited ranges, such species can become threatened or endangered without management plans that provide species protection while allowing the military to do its work.

Integrated Natural Resources Management Plans for military installations must result in no net loss of the military's mission on those lands. But that doesn't mean the species conservation needs are ignored.

Quite the contrary, San Clemente Island has shown that species can not only survive, but thrive alongside military missions.

The struggle with any species recovery on San Clemente Island is largely linked to vast habitat degradation caused by ranching and agricultural activity that occurred from the 1850s until 1934, when the Defense Department assumed ownership of the island. But the feral herbivore populations (pigs and goats) persisted after ranching ended. At the center of the problem was this large persisting population of feral goats that obliterated native vegetation, said Kim O'Connor, Conservation Program Manager for Commander Pacific Fleet. The island's endemic shrubs are important to the overall health of the ecosystem because they

capture and hold moisture from the frequent fog and low clouds that pass over the island and send that moisture into the soil. The military removed the last of the estimated 29,000 feral goats in 1991, and the ecosystem began to recover. “That’s not that long ago,” O’Connor said. “It’s pretty remarkable that 30 years later we have species being delisted."

Still, the SC Loggerhead Shrike is proving a challenge. Although the military worked to rid the island of feral goat and cat populations, partnered with mainland captive breeding programs to increase the wild bird population, and installed fuel breaks to protect habitat from fires caused by military activity, the shrike population still plummeted to just 7 pairs in 1998.

San Clemente Loggerhead Shrike

"Officials moved the captive breeding program to San Clemente Island," Booker said, so “the birds could be held in the same conditions in which they will be released.” Keeping it on-island also helped prevent the introduction of mainland diseases. They also improved methods of release, resulting in released birds surviving and recruiting into the wild population.

It seemed to work. By 2009, there were 82 pairs of Loggerhead Shrikes in the wild, and things were looking up.

Unfortunately, recent years of persistent drought have made conditions more difficult for the wild pairs to successfully raise their broods and survive, and the number of pairs in the wild dipped to just 20 in 2022, Booker said. Scientists believe that drought affects the shrike’s productivity and survival. Still, there is hope. Recovery is a marathon, not a sprint.

“We are very optimistic the rains this year will result in productivity increases and better survivorship,” Booker said. “The

key is when the rats come back."

Invasive black rats decline during drought, but increase in numbers when the rains come. The hope is that the Loggerhead Shrikes will be able to incubate their eggs and have their broods fledge before the rats return to raid nests. The shrikes have a better chance of success if they are "out the door first," she said. The Navy works to control the rats, especially where shrikes nest, but they cannot use poisons that would impact the shrikes themselves or other protected and endemic species like the Island Fox, so control is a challenge.

Shrikes have preferred the southwestern end of the island where ship-to-shore bombardment occurs. Once in the central portion of this bombardment buffer zone, they are now clustered on the southeast side, where there is a large, vegetated buffer region between the mainland-facing side and the bombardment area as well as along the eastern side, north of the shore bombardment area. The Navy's team of biologists releases birds outside of the bombardment area, to increase the population across the island, but shrikes, as it turns out like to nest near other shrikes. "If they see another (shrike), they'll set up relatively close," Booker said. "They cluster or what biologists call conspecific attraction."

Recovery is a long process that requires diligence, patience, communication, and persistence among many stakeholders. The biologists from the San Diego Zoo and Institute for Wildlife Studies actually live on-island to run the captive breeding program, and release and monitoring program, respectively.

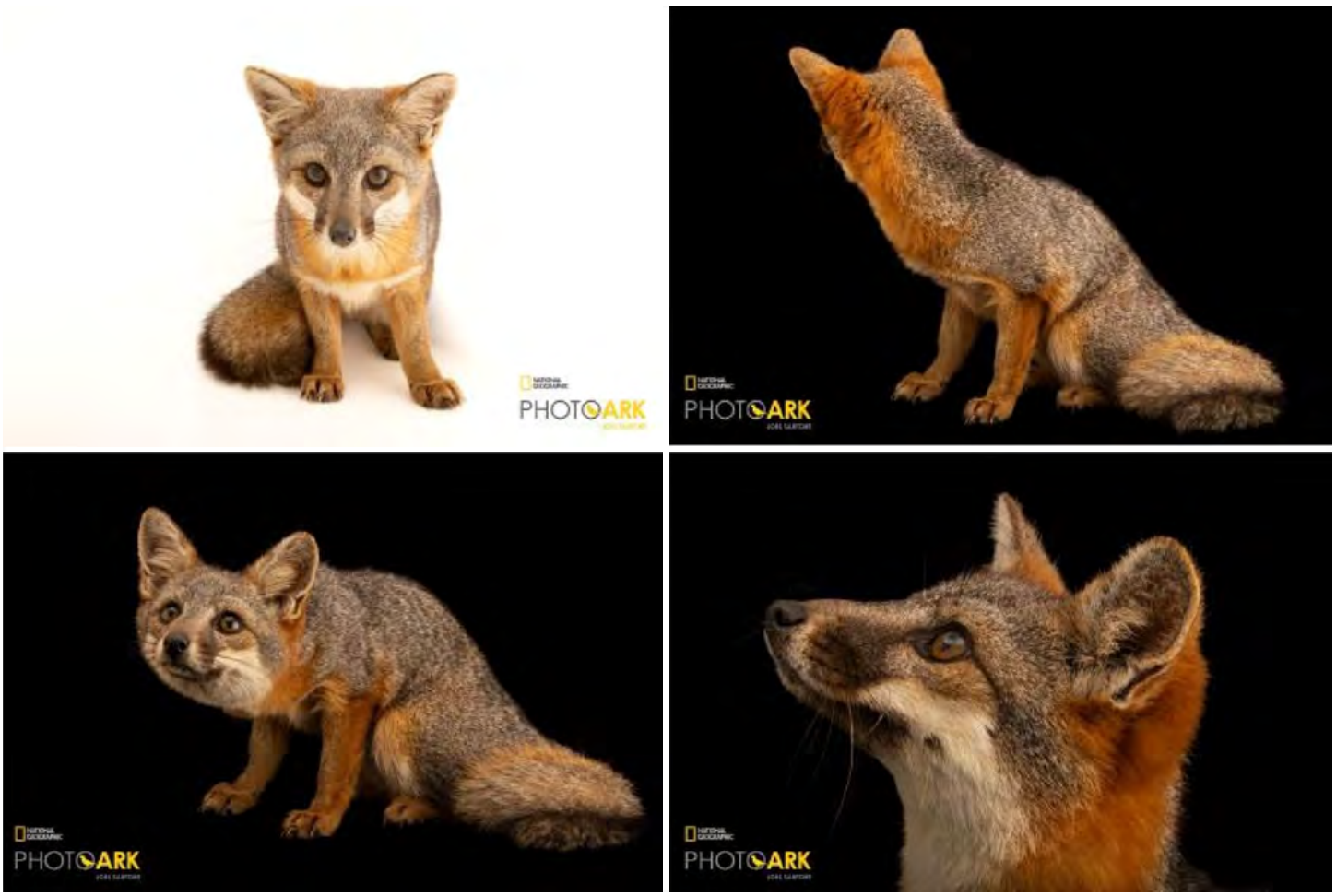
"People give up what most of us would consider a normal life to live out here," Booker said.

The Navy with the U.S. Fish and Wildlife Service direct the recovery program and are committed to its success. The Commander Pacific Fleet has invested at least $50 million in the shrike recovery effort so far, taking all feasible management

actions, Booker said. When the threat is drought, or extreme weather events, the road ahead is challenging. The Navy and biologists know how to remove non-native grazers, recover habitat, manage fire, raise and release birds, but we cannot control the weather. Still they are staying the course of the marathon.

“Some people work their whole lives to save species and don’t get there. We are lucky to have the resources we have, the DoD structure we have,” she said. “And I can’t say enough about our partners. I have always had tremendous respect and gratitude for the San Diego Zoo and Institute for Wildlife Studies.”

San Clemente Island Fox



San Clemente Island Fox

Biologists for the U.S. Navy monitor fox holes on the agency's San Clemente Island training facility, but maybe not the kind typically associated with military maneuvers.

These dens are home to actual foxes – specifically, the San Clemente Island Fox (Urocyon littoralis clementae), a species of concern that is covered under the Navy's Integrated Natural Resources Management Plan.

The San Clemente Island (SCI) Fox is a subspecies of the Island Fox that is endemic to six of California's eight Channel Islands. The fox is the largest native terrestrial mammal to all of the islands it inhabits, making it a keystone species – one whose existence is tied to the success or failure of other species in its ecosystem.

Fox populations on each of the six islands are considered separate subspecies that are endemic, or unique, to those islands, and two of those populations occur on military installations – San Clemente Island and San Nicolas Island.

In 2004, four of the six Island Fox subspecies experienced catastrophic population declines and were listed as federally endangered under the Endangered Species Act.

In what some may consider an unexpected turn, the two populations that were not in such peril are the ones found on San Clemente and San Nicolas. But it's not all that odd. Military installations typically have vast land masses that are used for specific missions, and as a result provide some of the last open wildlands in the United States.

The military is committed to protecting the endemic species on their lands by implementing management plans that provide protection while allowing the military to fulfill its mission. Such Integrated Natural Resources Management Plans must result in no net loss of the military's mission.

But that doesn't mean plant and animal species' conservation needs are ignored. Quite the contrary. The military is charged by law with not only protecting species and habitat, but also having plans to help threatened or endangered ones recover.

At the time of the 2004 listing, the SCI Fox constituted 45% of the total Island Fox population, and the San Nicolas Island Fox constituted 31%. That means 76% of the animal's population existed on lands owned and managed by the Navy, and they aren't considered threatened or endangered.

But the Navy isn't waiting for a federal listing. It considers the SCI Fox a species of concern due to its keystone species status and its decline on the other islands. It is far better to engage in protection before an animal is threatened or endangered.

As an omnivore, the SCI Island Fox diet consists of a variety of plants, insects, mammals, and birds, adapting to whatever is available.

At San Clemente, the fox occurs in its highest densities at the northern end of SCI and typically at its lowest densities at the southern end of the island. Dune habitats support the highest fox densities followed by grasslands and scrub habitats. The high densities of foxes at the northern end likely reflect their comfortable association with humans and adaptability, taking advantage of human food when they can get it.

As evidenced by the high fox densities at the northern end of SCI, the fox seems to do all right around human activity, and there is plenty on the island, Booker said. In addition to the troop live fire training areas, which are separated with large land buffers, there are greenhouses for growing endemic species, facilities for the San Clemente Loggerhead Shrike captive

San Clemente Island Fox

breeding program, and bunkhouses and living quarters for everyone. In addition to all of the military personnel, there can be as many as 40 biologists on the island at one time.

“There is a whole village of people who run the military ranges, galley, housing facilities, power plant, air field, port operations, etc., including the offshore areas,” Booker said. “It is the only Department of Navy fully staffed field station.”

San Clemente’s Integrated Natural Resources Management Plan used to divide the island into 18 management units, with boundaries that were set with roads, canyon rims, or manmade fire breaks. While these units were created primarily to serve to control the spread of wildfires, they also provide delineated areas by which biologists tracked such species as the SCI Fox.

However, over time it became clear that these delineated areas weren’t useful in getting accurate numbers because some species - like the SCI Fox – travel to various areas, Booker said. Fox monitoring has been redesigned three times in the past 17 years, each time leading to more accurate population estimates. The Navy uses adaptive management, science and lessons learned from past data to inform its wildlife management programs. This results in defensible data, better natural resources management, and often times long-term cost savings. The Navy has added disease monitoring to its fox management to ensure new threats don’t impact the fox and addresses and maintains a fox hospital, aka “foxpital” to treat injured animals. The fox program on SCI is comprehensive as well as adaptive.

Balancing the interests of various species doesn’t solely mean mitigating human interactions, but also those with other protected species in the ecosystem, Booker said. For example, the SCI Night Lizard, which was delisted due to recovery in 2014, will raid the nests of the San Clemente Bell’s Sparrow, which was delisted this year. And the SCI Fox will eat the SCI Night Lizard.

They are dependent on each other, and as long as humans don't interfere, will keep each other in check.

San Clemente Island Fox

"It is ecosystem balance. Prey and predators are requisite in virtually all natural systems," Booker said. "If foxes were lost from SCI due to disease or some epidemic event, then it is possible lizard numbers would increase to a point where the sparrows were under too much predation pressure and their numbers would drop. If foxes and lizards were both lost then sparrows would likely over-populate and eat themselves out of house and home or be more vulnerable to disease," she added. "It's nature's system of checks and balances."

SCI Species Profiles

San Clemente Loggerhead Shrike

Common Name: San Clemente Loggerhead Shrike

Scientific Name: Ludovicianus mearnsi

Status: Endangered

Habitat: Open areas for hunting, with sufficient vertebrate and invertebrate prey, but with adequate perches, and enough shrub cover nearby for nesting. They prefer open coastal sage scrub on terraces and canyon woodlands.

Diet: Shrikes are perch and wait search-type predators and their diet is related to prey abundance, detectability, and size rather than to a specific prey type.

Breeding: Clemente loggerhead shrike pairs commonly renest after their first nest, which enables pairs to often raise two broods.

Threats: Non-native predation by black rats can threaten nesting shrikes and juvenile shrikes. Extended and/or strong drought appear to limit shrike foraging resources and likely reduce over-winter survival.

Benefits: Eating insects and small rodents.

Island Night Lizard

Scientific Name: Xantusia riversiana

Common Name: Island Night Lizard

Status: Delisted in 2014 due to recovery (formerly ESA threatened)

Habitat: Island night lizards are found in all major habitats on San Clemente Island except sand dunes, which have scant

vegetative cover, no rock shelters, and unsuitable soils. They occur in high densities within habitats with soil cracks and crevices in and around rock outcrops and surface boulders as well as vegetative cover. These areas provide protection from predators and an underground retreat during times of drought or fire.

Diet: This lizard is a generalist consuming insects, spiders, scorpions, and plant material as well as vertebrate prey like bird nestlings and eggs when available.

Breeding: Low reproductive rate compared with other lizards, likely because they are so long-lived (up to 25 years). A female may not have her first brood until she is nearly five years old. Seasonal activity peaks in the spring when mating takes place, then continues at a lower level through the summer and fall. Island night lizards breed in April, and 2 - 9 young are born fully developed in September. Giving birth to live young (as opposed to laying eggs) is not common among reptiles.

Threats: The island night lizard has evolved a life history strategy emphasizing low reproductive potential and long life span – a pattern that is extremely sensitive to disturbance by habitat destruction and introduction of exotic species.

Benefits: Lizards are important prey items for the island fox and many bird species on SCI, including the loggerhead shrike. They form a critical link in the food web especially as they are well adapted to maintain their populations through various climatic conditions.

San Clemente Island Fox

Common Name: San Clemente Island Fox

Scientific Name: Urocyon littoralis clementae

Status: Not Listed under federal ESA, but protected under a Candidate Conservation Agreement between the Navy and U.S. Fish and Wildlife Service; listed under the California Endangered Species Act.

Habitat: Foxes occur within all habitats on San Clemente Island. They are found in higher densities toward the northern end of SCI within grassland and dune habitats and lower densities to the south within Maritime desert scrub – prickly pear phase habitat.

Diet: A study of San Clemente island fox food items documented beetles, beetle larva, deer mouse, snails, prickly pear fruit, and

lizard in descending order. When available foxes readily take mice. They have also been documented predating bird nests. A new study (using eDNA) found they are eating moths or butterflies probably in the form of caterpillars.

Breeding: Island foxes are generally monogamous (mate for life), and breed only once a year. Mating takes place at SCI earlier than other Channel Islands, starting as early as December, with pups born as early as mid-December (Valentine's Day is earliest known record) through March. Pairs produce, on average about two pups, in a "den" which may consist of an underground structure, cover underneath a dense shrub, or under a human-made structure. On SCI, foxes are more likely to den in canyons and drainages or some form of rock piles than other potential denning areas. Pups are blind and helpless with short dark brown hair and emerge from the den at about one month of age, much furrier but still considerably darker than adults.

Threats: Vehicular strikes (roadkill) is the primary known source of mortality for foxes at SCI; however, the population remains stable and resilient. The most likely threat to the population is potential disease introduction.

Benefits: The island fox predates rodents and as the only native mammalian meso-carnivore plays a role in ecosystem balance.

1934	U.S. DoD aquires San Clemente Island
1960	Sikes Act
1973	Endangered Species Act
1977	San Clemente Loggerhead Shrike listed as endangered
1977	San Clemente Bell's Sparrow listed as threatened **2023 Delisted**
1977	San Clemente Night Lizard listed as threatened **2014 Delisted**
2023	San Clemente Island Fox Species At Risk Species

DoD Legacy Resource Management Program

Photos and videos	Joel Sartore, Joel Sartore Photography

Content	Susan Snyder, Select Engineering Services
Production	René Parker and Aaron Bronson, Select Engineering Services
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APPENDIX B - A SUCCESS STORY THE STEPHENS' KANAGROO RAT RECOVERY STORY MAP

The Stephens' Kangaroo Rat Recovery

A Tale of Two Successful Missions

Department of Defense Legacy Resource Management Program Project Number: NR-23-004
March 26, 2024

All photos were taken on Naval Weapons Station Seal Beach Detachment Fallbrook, CA, by Joel Sartore, Joel Sartore Photography, with assistance from the dedicated Department of the Navy, Environmental staff.

A female Stephens' Kangaroo Rat, Dipodomys stephensi, from the Naval Weapons Station Seal Beach Detachment Fallbrook, CA.

Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, CA

The best thing that could have happened to the endangered Stephens' Kangaroo Rat (Dipodomys stephensi) just might be living near military explosives storage bunkers.

The kangaroo-hopping rodent is endemic to roughly 1,100 square miles in Southern California including areas of western Riverside County and northern San Diego County. In 1988, it was listed as endangered on the federal Endangered Species List as its population plummeted due to habitat loss from human development.

One of the animal's last remaining strongholds is the 9,000-acre Naval Weapons Station Seal Beach Detachment Fallbrook, at Fallbrook, Calif., where decades of carefully planned and persistent management and protection efforts have paid off. In February 2022, the Stephens' Kangaroo Rat was downlisted to threatened, due to a reduction of threats since listing and the implementation of conservation actions.

"They need a lot of open space and relatively low levels of development," said Christy Wolf, biologist at the Fallbrook detachment. "The good news is (military installations) also tend to need a lot of open space and have relatively low levels of development."

Female Stephens' Kangaroo Rat

But there is a lot to balance, she said. Natural resources management must support and integrate with the military's mission. There can be no net loss to the mission of the base.

Fallbrook's mission is maintenance, storage, and transportation of ordnance. Storage bunkers of ordnance need expansive buffers and few roads to travel among them. So about 90% of the base is undeveloped natural landscape.

But even with relatively low human activity, the area needs resource management in order to maintain the native species that live there.

"In this day and age, you can't manage land with a hands-off approach," Wolf said. "For starters, it's going to be taken over by invasives."

Fallbrook provides habitat for seven federally listed species, including the Stephens' Kangaroo Rat, the star of Fallbrook's most recent success story.

Female Stephens' Kangaroo Rat

This nocturnal little creature measures just over 11 inches long – about 7 inches of that being tail. Its role in the ecosystem is small but mighty. It digs complex burrows, which helps to aerate the soil, and it eats lots of seeds, which disperses native plants across the landscape in ways that wind or water can't. And for predators, Stephens' Kangaroo Rats are good eating. Rodents create a prey base.

Besides being important to the ecosystem, this animal has some unique adaptations, Wolf said. For example, it doesn't need to drink water, as other mammals do. It extracts moisture from the plants and seeds it eats, and its behavior and physiology help prevent water loss. Its kidneys are designed to concentrate this moisture so that every bit is extracted to keep the animal hydrated.

They can leap several feet into the air from a standing position and kick like a kangaroo. A quick internet search reveals videos of one of these diminutive creatures leaping away from a rattlesnake with seemingly no effort – giving the snake a swift kick in the snout as it escapes.

They are adapted to thrive in semi-arid to arid conditions along gently sloping, open, native grasslands and bare ground. Oddly, providing bare ground is one of the biggest challenges, Wolf said.

Situated between Los Angeles and San Diego, Fallbrook is surrounded on three sides by Camp Pendleton, which is run by the U.S. Marine Corps. But the region still has a fair amount of urban interface. Invasive plant seeds blow in from beyond its borders, adding to the constant battles Wolf already wages

against the non-native annual European grasses that already exist at Fallbrook.

Early California settlers wanted the lush green grasses of home, so they brought those seeds with them. Generations later, these grasses have a strong foothold across the formerly scrubby arid landscape that early human transplants considered barren and dead-looking.

One of the best ways to control these annual invaders is eliciting help from an unlikely partner – domestic cattle. In many parts of the West, generations of cattle grazing have decimated the tallgrass prairies and meadows on which native wildlife depend.

But at Fallbrook, Wolf said, cattle are used to keep the invasive grasses at bay. Reduced biomass and bare ground are beneficial for the Stephens' Kangaroo Rat, and leaves less fuel for wildfires, which plague Southern California.

“Cattle grazing supports the military’s mission by reducing fire risks,” Wolf said. “It’s a win-win.”

Female Stephens' Kangaroo Rat

Although Wolf is ultimately in charge of natural resource management at Fallbrook, she doesn’t work alone. She’s quick to point out the success of her program depends on a larger Navy team, Command leadership, and essential contract support, and requires close coordination with many stakeholders. Her management plans must pass muster not only with the U.S. Navy, but also the U.S. Fish and Wildlife Service that is charged with protection of listed species, along with other federal and state natural resources agencies.

“It is an effort that requires good relationships,” said Peter Beck, a biologist with the U.S. Fish and Wildlife Service who works in the agency’s Carlsbad office. Beck works with Wolf and also biologists at neighboring Camp Pendleton to help create solutions for wildlife management.

While creating plans that satisfy several entities isn’t easy, Beck said working with the Department of Defense is, in many ways, easier than working with private interests.

“Their missions mesh very well with our objectives because they (military) don’t want a lot of development,” he said.

Beck and Wolf have worked together more than 21 years in a relationship built on respect for each other’s knowledge and objectives.

“(Wolf) knows what her mission is, and is good at providing feedback on what we can and cannot do,” Beck said.

One project that proved particularly challenging about three years ago was when officials at Fallbrook had to secure a holding yard in which vehicles loaded for ordnance transport were parked. Because of the highly sensitive cargo, the yard needed to be well-lighted 24 hours a day.

Female Stephens' Kangaroo Rat

Such lighting is detrimental to the Stephens' Kangaroo Rat's typical nocturnal behaviors, Wolf said, and several burrows were found next to the yard. So she came up with a solution that Beck says illustrates Wolf's creativity in accomplishing the best of both worlds.

In exchange for adding new lights at the vehicle storage yard, the military worked to remove outdated, excessively bright lighting – which creates disability glare and wastes energy – in other areas of Fallbrook and updated it with Dark Sky-compliant fixtures. This helped the displaced animals find new habitat, and also improved the security of areas that military officials didn't necessarily need brightly lit, Beck said.

That effort was among those that garnered Fallbrook a Secretary of the Navy Environmental Award in 2020.

Wolf is proud of the award, she said, but she is more rewarded by the work they do every day to protect natural resources at Fallbrook.

“We are responsible for this land in the public trust,” she said. “How do we really and truly set these resources up for future generations? My goal is to leave it better than I found it.”

Common Name: Stephens' Kangaroo Rat

Scientific Name: Dipodomys stephensi

Conservation Status: Threatened

Geographic Location: Endemic to three geographic regions of southern California: Western Riverside County, northwestern San Diego County, and central San Diego County.

Habitat: Grasslands and sparse coastal sage scrub with ample bare ground.

Diet: Primary food source is seeds. They can get all the water they need from seeds they eat.

Breeding: Reproductive output is relatively low for rodents their size. Produce two litters per year with an average litter of two or three pups each. Breeding season is late winter and spring.

Threats: Urban and agricultural development.

Benefits: The Stephens' Kangaroo Rats are able to promote the growth of native plants and help with plant dispersal through a diet of seeds and burrowing. Their complex burrows increase soil fertility and water filtration. They also serve as an important prey source for native predators.

1960	Sikes Act
1973	Endangered Species Act
1988	Stephens' Kangaroo Rat listed as endangered
2022	Stephens' Kangaroo Rat downlisted to threatened

Video of female Stephens' Kangaroo Rat

Story Map

DoD Legacy Resource Management Project

All photos and videos	Joel Sartore, Joel Sartore Photography
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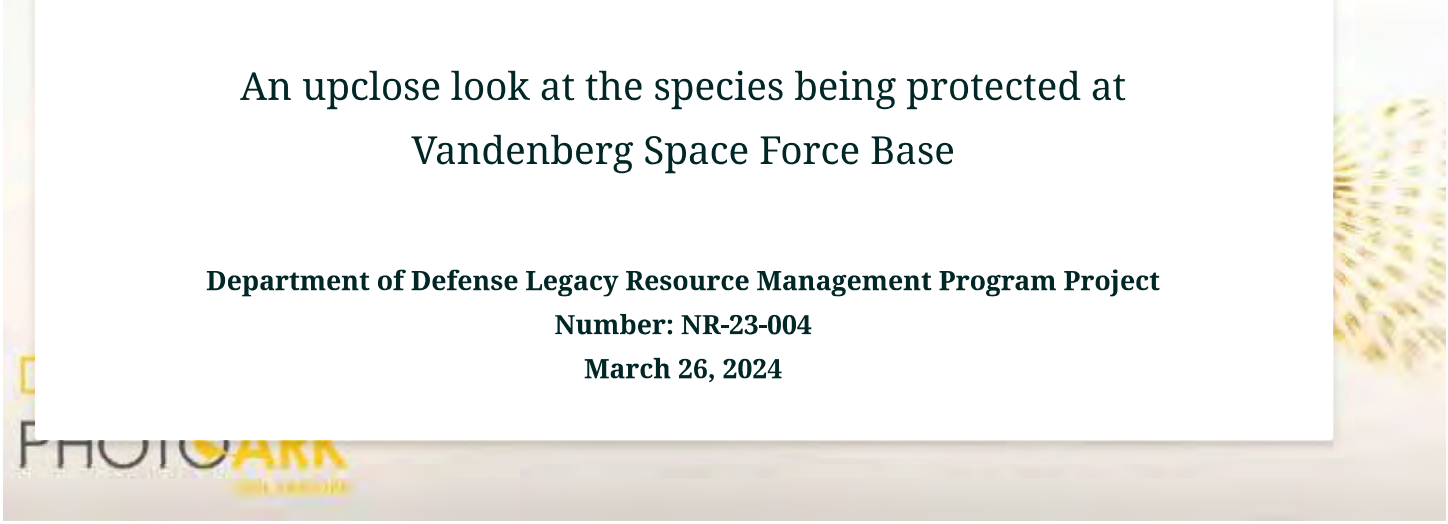
APPENDIX C - SAVING SPECIES, SUPPORTING THE MISSION STORY MAP

Saving Species, Supporting the Mission

An upclose look at the species being protected at Vandenberg Space Force Base

Department of Defense Legacy Resource Management Program Project Number: NR-23-004
March 26, 2024



All photos were taken on Vandenberg Space Force Base by Joel Sartore, Joel Sartore Photography, with assistance from the dedicated Department of Space Foce, Environmental staff.

Vandenberg Space Force Base (VSFB) is at the forefront of launching rockets and satellites, but some of the most amazing discoveries on Earth are happening on the grounds of this coastal California installation.

Among the more than 850 plant and animal species dispersed across VSFB's 99,500 acres are 17 federally listed threatened or endangered species, along with endemic species only recently identified or so new to science, they have not been fully identified.

“All of the base is habitat,” said Rhys Evans, Vandenberg Space Force Base lead wildlife biologist. “We have 99,500 acres, and of that maybe 15% is developed. We have a 42-mile coastline, and maybe 200 yards of it is developed. Our coastline is pristine and awesome.”

“Vandenberg’s mission is pretty straightforward," Evans said. "U.S. Space Force Guardians and U.S. Air Force Airmen launch rockets and support a test range for Air Force Global Strike Command assets like the Minuteman intercontinental ballistic missile – minus the munitions, of course. SpaceX, United Launch Alliance, and Firefly Aerospace are among the base’s commercial partners that currently use Vandenberg to launch satellites. In 2023 VSFB personnel supported approximately 35 launches. Each launch complex needs a large buffer where no housing, offices or other development can exist," Evans continued. "Although it doesn’t often happen, there is always the possibility that a rocket or missile will pose a hazard or have an anomaly before or shortly after launch. As a result, most of the base is undeveloped.”

This creates a vast wildlife habitat that includes 9,000 acres of sand dunes and 5,000 acres of wetlands, and is home to 53 mammal species, 315 species of birds, 17 reptiles and 10 amphibian species, along with myriad insects. Among those are ten animal species protected by the federal Endangered Species Act (ESA).

In addition to federal and state environmental protections, VSFB biologists also must follow the 1960 Sikes Act, which requires the Department of Defense to identify, monitor, and create recovery programs for the natural resources and ecosystems that occur on military-owned lands. In some ways, the Sikes Act is stricter than the federal ESA, as it requires protection plans to include species recovery efforts.

Tidewater Goby, Lompoc Grasshopper, Arguello Slender Salamander, Southwestern Pond Turtle, Western Spadefoot Toad, and Buckwheat Blue Butterfly located on Vandenberg Space Force Base

Among the species Evans and his team monitor and protect are the Southwestern pond turtle (Actinemys pallida), Western spadefoot toad (Spea hammondii), a fish called the tidewater goby (Eucyclogobius newberryi), the Lompoc grasshopper (Trimerotropis occulens), the Arguello slender salamander (Batrachoseps wakei), and buckwheat blue butterfly

(Euphilotes spp.) (undescribed), endemic to Santa Barbara County, that, so far, has defied definitive scientific identification.

VSFB biologists first identified the butterfly in 2005, and initially thought it might be a subspecies or otherwise related to the El Segundo blue butterfly, a federally listed endangered species that lives in similar areas along the coast, about 150 miles away.

Buckwheat Blue Butterfly

In 2007, researchers announced it was more likely a new species, but further genetic testing made them unsure. Fast-forward to 2020, when geneticists from the University of Hawaii published that they still don't know what this butterfly is, but they know what it's not – the El Segundo or any other known blue butterfly, Evans said. It is its own species, but they haven't officially named it yet.

For now, it is informally called the buckwheat blue butterfly because it lives entirely on, in, and around the seacliff buckwheat plant in Santa Barbara County, Evans said, rarely moving more than 2 feet away from its host plant. It feeds on the plant, finds a mate there, lays eggs there, and lives out its larval and instar stages on or under the plant.

At one point in its development, the larva goes into diapause underground for 10 to 13 months (or longer), depending on the weather. Evans said biologists tracking it have to be quick. The adult males live only about 7 to 9 days, and the females live about 11 to 14 days.

"In the right time of year, we have biologists out on the range for 30 straight days," he said.

Scientists can tell the overall age of the butterfly by looking at the condition of its fragile wings, which easily tatter with wind and other weather elements. By the end of its brief life, the butterfly's wings become virtually nonfunctional, and it dies.

Protecting such a rare and limited species as this butterfly means protecting its highly limited habitat. That means not only habitat protection, but also restoration – and even expansion.

If a species is protected under the ESA, expanding territory becomes tricky, if not downright impossible. There is no way to legally change the location of the protected species' habitat – even if the new spot appeared to be better, Evans said.

But for the buckwheat blue butterfly, being separated from the federally protected El Segundo species has paved the way for habitat expansion. Biologists at VSFB planted buckwheat in new places, and waited for the butterflies to expand their range, Evans said. When after five years it became apparent that the butterflies weren't traveling to the new habitat – which, Evans noted, was better than where they were - a biologist actually hand-carried them from Point A to Point B to establish them in the new spot.

"We put quite a bit of money and time into creating new habitat. We did habitat restoration and plantings in new places," he said, adding that it was good for Vandenberg and so far, seems to be good for the butterfly.

Elsewhere along VSFB's pristine coastline is the perfect habitat for the tidewater goby, a small fish that was placed on the federal ESA list in 1994 and proposed for downgrading to threatened status in 2014.

The tidewater goby needs an estuarine environment that exists in coastal lagoons, where fresh water meets the sea.

Habitat desecration from development can push too much saltwater into the lagoons or expunge lagoons all together. VSFB's unspoiled coastline plays an important role in protecting these tiny fish because the lagoons are intact.

Tidewater Goby

These coastal lagoons aren't the only aquatic habitats that support species in peril at VSFB. Farther inland, vernal pools and other freshwater basins provide habitats for Southwestern pond turtles and amphibians such as the Western spadefoot toad.

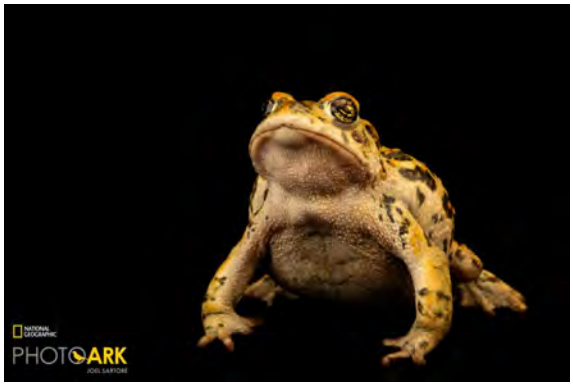
The Arguello slender salamander is a relatively new species discovered in 2006 by VSFB-affiliated scientists. It lives in a very small area of the region – maybe 2 to 4 square miles – and spends most of its life underground, Evans said. It needs to stay very moist, and recent droughts have not helped this species thrive. Right now, it is believed to exist solely at VSFB and nearby properties, although biologists are hoping to find it in other areas of the Santa Barbara region.

Arguello Slender Salamander

"It is very narrowly distributed, with very low numbers," Evans said. "If it was not on Vandenberg Space Force Base, the land it's on would probably be a golf course or housing development and the animal would be extinct."

The spadefoot toad needs two distinct habitats to thrive – an aquatic area for breeding and raising tadpoles, and a drier terrestrial area for foraging and estivation – a type of summer hibernation for reptiles and amphibians. Vernal pools provide the aquatic component, and as they dry up the spadefoot

burrows into the ground and estivates until it rains again. As of 2023, the Western spadefoot remained under review for federal ESA listing.



Western spadefoot toad

And what's good for salamanders and toads is good for turtles. Protected freshwater habitats at VSFB also provide a home for Southwestern pond turtles, one of two of the West Coast's only native freshwater turtles.

In 2020, the Western pond turtle was divided into two species, the Northwestern Pond Turtle and the Southwestern Pond Turtle, which is the one that lives in and around VSFB. Both species were recommended for threatened status under the ESA in 2023.

Southwestern Pond Turtle

But perhaps one of the most amazing stories of what ecological treasures occur on VSFB's massive land mass is that of the Lompoc grasshopper – an insect named after the nearby city, the name of which comes from a Chumash word that means "estuary," or "where the waters meet."

Alice Abela, a contracted biologist at VSFB, said the search for the Lompoc grasshopper got serious during a base-wide invertebrate survey in 2004-2005. Scientists collected a grasshopper species that was different that others seen across the base and that looked very similar to the Lompoc species, which was described in 1984 from mounted museum specimens collected in 1909 and 1938.

"No one had ever seen one of these alive," Abela said of the survey team. So in 2006, two specialists were sent to VSFB to

find more. But the trip didn't turn out as planned.

"Back then we were using Mapquest," she said. "And it sent them up Harris Grade."

That road is a narrow, winding bit of mayhem that creeps near VSFB's eastern border. As the scientists were standing outside their vehicle trying to figure out where they were supposed to be, one of them spotted what turned out to be a Lompoc grasshopper in the white shell deposits of the roadbed.

Lompoc Grasshopper

"There was so much skepticism as to whether this was a real species or not," Abela said. "So it was exciting to find it on Harris Grade. It was kind of serendipitous."

VSFB also has such shell-filled gravel deposits in its wildfire breaks, she said, so biologists then knew where to look for these insects that are masters of camouflage. And they found them.

"They really like the rocky fire breaks on Vandenberg," Abela said. "Where the rocks are really white, the grasshoppers are white, and where (the rocks) are gray, they are gray."

The notion that a grasshopper species not seen alive since 1938 could be found on VSFB may seem surprising to those who don't study species found on military installations but the biologists who study such areas know better. And VSFB has yet to reveal all of its secrets. There are at least three as-yet unidentified species of Jerusalem crickets on the base, and three undescribed species of flies, among other things.

“Vandenberg is a bit of a Noah’s Ark,” Abela said. “You don’t see such big tracts of undeveloped habitat (elsewhere) in California, and there is a limited pool of people who go out there.”

Tidewater Goby

Common Name: Northern Tidewater Goby, Tidewater Goby

Scientific Name: Eucyclogobius newberryi

Conservation Status: Endangered (a proposal to downgrade the Northern Tidewater Goby is under consideration). A proposal to split the species into two different species -- northern and southern-- is probably further along the process.

Habitat: Gobies prefer shallow, warm water that is not significantly stagnant. Adults and especially juveniles are sensitive to the salinity of water with salinity typically being less than 12 parts per thousand.

Diet: Consume bottom dwelling aquatic invertebrates such as crustaceans, snails, and insect larvae. Their hunting techniques include mid-water catch, disturbing aquatic sediment, and plucking prey from the water surface.

Breeding: While tidewater gobies only live for approximately one year, they have the ability to breed and reproduce more than once during that time. If they don't manage to breed during the year, some may survive and attempt to reproduce the next.

Threats: Climate change, drought, invasive species (predators), and loss of habitat all impact this species.

Benefits: They are a food source for native fish including steelhead, Staghorn Sculpin, and Sacramento Perch.

Lompoc Grasshopper

Common Name: Lompoc Grasshopper

Scientific Name: Trimerotropis occulens

Conservation Status: Endangered

Habitat: Commonly found in rocks in Bishop pine woodland. Population is considered to be highly fragmented.

Diet: Currently unknown.

Breeding: Currently unknown.

Threats: Habitat destruction and land/housing development.

Benefits: Likely a food source for species such as birds and amphibians.

Southwestern Pond Turtle

Common Name: Southwestern pond turtle

Scientific Name: Actinemys pallida

Conservation Status: Threatened

Habitat: Southwest Pond Turtles will often soak in the sun to help to fight off parasites. They are located below elevations of 6,000’ and are found in many aquatic habitats including ponds, streams, marshes, and irrigation ditches.

Diet: They exclusively hunt and eat in the water. Their diet includes aquatic vegetation, insects, tadpoles, snails, fish, and frog eggs. Being opportunistic hunters, they typically consume whatever they can catch.

Breeding: Mating season is from the end of April to the beginning of May. Females lay between one and thirteen eggs, 0.3 miles or more from their aquatic habitat.

Threats: During the 20th century this species was overharvested and has not been able to recover. Current threats include harvesting, invasive species competition, shell disease, habitat loss and chemical pollution.

Benefits: Pond Turtles are a food source to predators, including birds, fish, and the American Bullfrog.

Western Spadefoot Toad

Common Name: Western Spadefoot Toad

Scientific Name: Spea hammondii

Conservation Status: Near Threatened

Habitat: They are a grassland species that are occasionally found in pine-oak woodlands of valley foothills. They will dig burrows up to 3 feet deep, using the unique hind foot, complete with a shovel-like addition, for which they are named. The toads will also use mammal burrows if available but can form their own. They spend a significant amount of their life underground as they aestivate until rainfall.

Diet: Diet includes worms, insects, and other invertebrates. Feeding is done terrestrially.

Breeding: Spadefoot toads require temporary (or “ephemeral”), shallow ponds for breeding which must remain for four weeks in order for complete metamorphosis to occur. When males arrive, they will emit a low vocalization to encourage breeding aggregation.

Threats: Loss of breeding habitat, drought, invasive species competition (such as the American Bullfrog), noise, wildfires, pollution, and climate change threaten the toad’s population.

Benefits: The tadpoles and juveniles provide a food source for California tiger salamanders, wading birds, dabbling ducks, and some small mammals.

Arguello Slender Salamander

Common Name: Arguello Slender Salamander

Scientific Name: Batrachoseps wakei

Conservation Status: Undetermined.

Habitat: It is evidenced that this species evolved due to movement of the California faults that divided populations of the Batrachoseps species. They respirate through their skin and tissues in their mouth. Found only on and near Honda Point in Santa Barbara County. Endemic to Santa Barbara County.

Diet: It is not completely known what they eat but similar species consume invertebrates and use their tongue to catch their prey.

Breeding: Species similar to this one develop fully in the egg before they hatch. Females will lay the eggs underground in a moist space.

Threats: Because of its endemic quality, this species is particularly vulnerable to environmental degradation such as habitat destruction, climate change and invasive species.

Benefits: Unknown at this time.

Buckwheat Blue Butterfly

Common Name: Buckwheat Blue Butterfly

Scientific Name: Euphilotes spp. (undescribed)

Conservation Status: Unknown. This species has not been formally described. At Vandenberg Space Force Base, this species was considered to be the closely related (and Endangered) El Segundo blue butterfly for about 15 years.

Habitat: Exclusively found on and near the seacliff buckwheat plant (Eriogonum parvifolium), at altitudes between 50 and 1500 feet above sea level.

Diet: 100% dependent on seacliff buckwheat for feeding, egg/larval deposition and growth

Breeding: Very brief life cycle, adult males typically live 7-10 days, females less than 14 days. There are several “instar” or pupal stages.

Threats: The similar Smith’s Blue Butterfly has been on the Endangered Species List since 1976 due to habitat destruction.

Benefits: Pollination. They seemingly have a close symbiotic relationship with several species of native harvester ants.

1973	Endangered Species Act
1994	Lompoc grasshopper and tidewater goby listed as Endangered
2023	Southwestern pond turtle listed as Threatened

Story Map

DoD Legacy Resource Management Program

All photos and videos	Joel Sartore, Joel Sartore Photography
Written Content	Susan Snyder, Select Engineering Services
Production	René Parker and Aaron Bronson, Select Engineering Services
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