

Natural Selections

Department of Defense Natural Resources Program



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SUCCESS FOR THE ISLAND NIGHT LIZARD AND NAVY

By Jacque Rice and Melissa Booker, U.S. Navy, San Clemente Island

On April 1, 2014, the U. S. Fish and Wildlife Service (FWS) removed the Island Night Lizard (*Xantusia riversiana*, INL) from the federal endangered and threatened species list in recognition of long-term successful natural resources management by the Navy and the National Park Service (NPS). The INL is found only on three federally owned islands off the coast of Southern California: San Clemente Island (SCI) and San Nicolas Island (SNI), owned and managed by the Navy, and Santa Barbara Island (SBI), owned and managed by NPS.

The INL is slow-growing, approximately 5-8 inches long (including the tail), with an average lifespan of 13 years, although some individuals have been known to



Island Night Lizard (Xantusia riversiana) sunning himself on rock at Naval Auxiliary Landing Field (NALF) San Clemente Island, CA. Source: U.S. Navy

live up to 30 years. Pattern and color vary greatly. Individuals can be mottled, blotched, plain, or striped and range from grey to beige with brown to black markings. Contrary to its name, the INL is primarily active during the day. However, the term "active" is quite a stretch as the INL is known to be highly sedentary and spends much of its time hidden in dense vegetation or under rocks. Unlike most lizards, which lay eggs, the INL gives birth to live young.

When listed as threatened under the Endangered Species Act on August 11, 1977, very little was known about this species. Accordingly, the decision to list was not based on population numbers or densities but on threats from goats, fire, exotic plants, and cats, which had been introduced to SCI and SNI. Since its listing, our understanding of the INL's status has improved significantly. Through proactive management, hard work, and dedication by the Navy, feral goats, the primary threat to the INL were removed from SCI and SNI. As a result of subsequent habitat recovery, the INL population is currently estimated to be 15,300 on SNI, 17,600 on SBI, and 21.3 million on SCI (the largest of the three islands). In fact, SCI has one of the highest lizard densities recorded in the world.

Recovery of the INL is a testament to the strong partnership between the Navy, NPS and FWS, and the overall commitment, dedication, and persistence of everyone involved. Delisting this species benefits the Navy by reducing management costs, streamlining environmental review of Navy actions, and enhancing the testing capabilities at SNI and the training and testing capabilities at SCI, the Navy's only continental U.S. ship-to-shore live-fire training range.

The Navy is extremely proud to have contributed to the recovery of the INL. The incredibly high population numbers at the time of delisting confirm that effective management can achieve a balance between natural resources recovery and high-tempo Navy operations. To ensure the INL thrives for years to come, the Navy will continue to manage the species through implementation of our Integrated Natural Resources Management Plans under the Sikes Act.

NATURALLY SPEAKING

From the Desk of L. Peter Boice, Deputy Director, DoD Natural Resources Program, Director, Legacy Program and Alison Dalsimer, Senior Research Associate, DoD Natural Resources Program



Amphibians and reptiles are declining globally and going extinct at nearly unprecedented rates. Approximately 32 percent of the world's amphibians are known to be threatened or extinct (IUCN Red List of Threatened Species, 2014). Reptiles also continue to decline as a group. Currently, one in five of the world's reptile species faces extinction, and over 40% of all turtle species are threatened with extinction (Turtle Taxonomy Working Group, 2014).

In the United States, nearly all native amphibians have declined in range, and many populations have vanished, including the California Red-legged Frog, Houston Toad, and California Tiger Salamander. Six of 34 amphibian species (FWS ECOS Amphibian Species Search, 2014), and 18 of the 40 reptile species (FWS ECOS Reptile Species Search, 2014) listed by the U.S. Fish and Wildlife Service (FWS) as threatened or endangered under the Endangered Species Act occur on DoD lands, and dozens of amphibian and reptile species managed by DoD are "at-risk" of requiring this protection (FY2013 DoD annual Environmental Management Review data). To protect those species DoD spends millions of dollars annually.

From 1991-2013, DoD spent more than \$142 million on the conservation and management of listed reptile species and an additional \$17 million on listed amphibian species. By investing funds to manage these species, DoD has been able to maintain most of its training flexibility and capabilities. Additionally, because herpetofauna (or "herp," for short) occupy a wide array of habitats, these expenditures often benefit multiple species.

For these reasons, and to help ensure we accomplish herp-related objectives more efficiently and consistently among installations, as well as in coordination with other federal, state,

and non-governmental organization partners, we have been working with the Military Services to develop a "Strategic Plan for Amphibian and Reptile Conservation and Management on Department of Defense Lands."

The Plan's path to completion has been long and tortuous. Regular readers will recall the Plan first being mentioned in *Natural Selections* three years ago. Hence, when we planned this special herp issue, it was my fervent hope that we would be able to announce a completed Plan. Although that's not possible, I want to devote the rest of this column to a quick recap of where we started, the Plan's audience and purpose, and the hopefully short road ahead.

- The Plan is a product of a four-year process that began with two formal workshops in 2010. Since then, several stakeholder forums have provided what became the meat of this document. Military Service representatives participated in all events, including at the National Military Fish and Wildlife Association (NMFWA) training workshop and Sustaining Military Readiness conference.
- The Plan's goal is not to increase or decrease the amount of work done for herps, but to identify technical expertise and resources to help DoD conserve and manage herps and their habitats.
- The document's audience is primarily DoD natural resource managers, but will also be viewed by other stakeholders, both internal and external.

The people doing the work will be those same installation natural resource managers. As with the bird community, there is no formal organization that has to be joined or formal coordination to establish. That is, the Plan does not represent or describe a new program, but is intended to be a guidance document for implementing herp-related activities already ongoing at the installation level.

- A Working Group comprised of representatives from the Military Services is currently reviewing the draft final Plan in advance of the December 12, 2014 Formal Coordination deadline.
- The final step in the process will be to request signature approval by John Conger, our Acting Deputy Under Secretary of Defense for Installations and Environment.

We hope to have the final and much needed Plan in your inboxes before the Holidays.

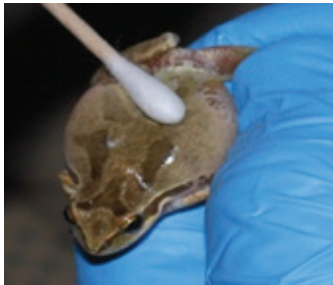


Sonoran tiger salamander eggs near Fort Huachuca. eDNA can detect aquatic species without disturbing animals or habitats. Source: Katherine Strickler

DOD AMPHIBIAN DISEASE SURVEY NATURAL RESOURCE MANAGER TRAINING AND DATA COLLECTION

By Chris E. Petersen, DoD PARC National Representative

DoD Partnerships for Amphibian and Reptile Conservation (PARC) members recently completed an important survey (Legacy Project 13-423) for the fungal disease chytridiomycosis, on DoD lands. Chytridiomycosis, caused by the pathogen *Batrachochytrium dendrobatidis* (Bd), is a major cause of amphibian population declines and extinctions worldwide. Although surveys for this pathogen have been previously conducted throughout the U.S., little is known about its occurrence or impact to amphibian populations on DoD installations.



Swabbing a Spring Peeper (*Pseudacris crucifer*). Source: Dr. Joe Mitchell

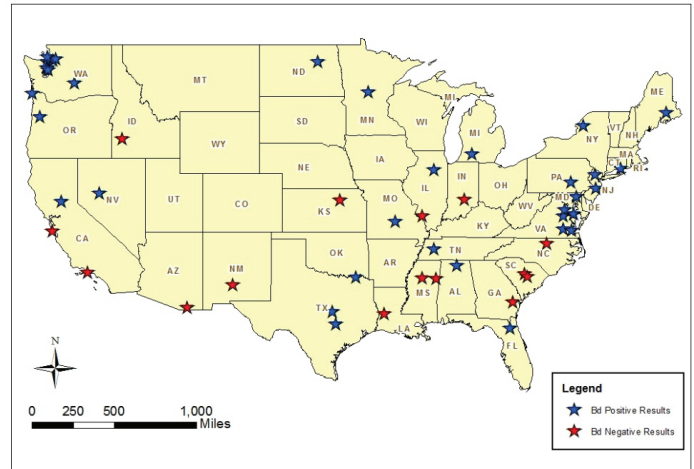
population declines from the disease (including threatened and endangered species).

Unlike the previous DoD PARC surveys where one researcher took samples at multiple military sites for Bd, in this investigation we trained DoD natural resource managers at multiple military installations to collect field data. To standardize the data collection effort, we developed an [amphibian swabbing training video](#) and datasheet, and conducted three online training sessions for project volunteers. We also sent volunteers field swabbing kits containing the necessary field data collection materials. Of the 71 field swabbing kits we mailed to military

As an extension of previous studies conducted by DoD PARC members in 2009 and 2011 (Legacy Projects 09-423 and 11-423), this investigation sought to discover the spatial distribution of Bd on DoD installations; whether sampled amphibians show signs of chytridiomycosis; which amphibian species are carriers; and which amphibian species are most vulnerable to

installations, 52 were returned containing 932 unequivocal results for the presence of Bd.

Study results revealed that although Bd is present on many military installations across the United States, it is not reaching the levels of the disease chytridiomycosis and negatively impacting amphibian populations on the sites. This supports the hypothesis that Bd can today be considered endemic (likely to have been spread through North America decades ago) rather than epidemic (spreading as a wave and wiping out individuals, populations, and species in its path).



Military sites with positive and negative results for the Bd pathogen, 2013. Source: Chris Petersen

Please contact the [Legacy Program](#) or [Chris Petersen](#) for a full copy of the report.

RECOVERED ISLAND NIGHT LIZARDS TO DEBUT AT THE ZOO



Juvenile Island Night Lizard (*Xantusia riversiana*) at NALF San Clemente Island, CA. Source: Robert E. Lovich -- DoD PARC Photo site

Island Night Lizards are well represented in museum, university, and other collections, yet only five specimens (0.03%) have been collected since 1980. The listing of the species as threatened under the [Endangered Species Act](#) in 1977 effectively limited collecting, and has consequently limited the types of research that can be undertaken. For example, because there are also only five tissue specimens in major museums, comparative studies to

examine changes in body size, parasite loads, and diet through time, as well as genetic analyses, have been severely restricted. Having a gap of over 30 years in specimen

collection means science has been unable to determine what changes took place from native habitat restoration and removing non-native species, or what climate change impacts may be occurring.

The good news is that the U.S. Navy gave five individuals to the San Diego Zoo in July 2014 as result of recent funding (Legacy Project 12-614) and the delisting in April, which has allowed a range-wide genomic analyses of the Island Night Lizard. One of the individuals gave birth to two juveniles in September! These same lizards will soon be on exhibit for millions of visitors to see.

These types of collaborations allow science to advance, protect the species, and highlight the need for multi-stakeholder partnerships to ensure the best future for our natural heritage.

IT'S IN THE WATER – FINDING AQUATIC SPECIES WITH eDNA

By Dr. Katherine Strickler, Dr. Alex Fremier, and Dr. Caren Goldberg,
Washington State University

Before we can manage rare species, we have to find them. That can be difficult with traditional survey methods, which send well-trained biologists into the field to capture, identify, and count organisms that can be highly cryptic or elusive. In aquatic environments, we can now use a new sampling tool called environmental DNA, or eDNA, to help find rare species. Aquatic organisms release DNA in the water through sloughing of skin cells and excreting waste. This DNA may remain in the water for a few weeks after the organism has traveled through the pond, lake, or stream. Researchers can use a small sample of water to detect the target species' DNA and determine whether the species has recently been present in the water body – without ever having to see, hear, or capture individuals.

eDNA sampling has the potential to be highly cost efficient and effective for monitoring populations of rare species. In some systems, eDNA methods can actually be more sensitive to species presence than field surveys, though not always a replacement technique. Using water samples instead of field surveys can shorten field search time, eliminate stress to sensitive species, minimize disturbance of sensitive habitats, and may facilitate permitting for federally protected species. An added benefit is that multiple species can be identified from a single water sample, including pathogens and other ecologically important microorganisms. Additionally, species that can't be identified by eye (e.g., fairy shrimp), can be distinguished in the eDNA sample.



Arizona treefrog (*Hyla wrightorum*) at Fort Huachuca, AZ Source: Meryl Mims

Although eDNA has been used to detect species in a variety of aquatic systems, it has not been systematically applied to monitor at-risk species. Through the support of DoD's [Legacy Program \(12-616\)](#) and [Environmental Security Technology Certification Program \(ESTCP\) \(RC-201204\)](#), researchers at Washington State University (WSU) are demonstrating the use of eDNA for detecting at-risk species and their threats at DoD installations. The team is developing field and lab protocols for widespread application of eDNA sampling across DoD installations and beyond.

The WSU team has demonstrated eDNA tests for eight species of at-risk frogs, salamanders, snakes, and fish at Fort Huachuca, AZ, Yakima Training Center, WA, and Eglin AFB, FL. From the same water samples they are also testing for the presence of

threats to those species including invasive American bullfrogs, barred tiger salamanders, and brook trout, as well as the amphibian pathogens Bd and ranavirus. To compare sampling efficiency and sensitivity, eDNA researchers work alongside biologists conducting field surveys for target species. Our work has shown that detection rates with eDNA are generally very high, with some variation based on species.

Accurate information about the location of aquatic species is necessary to effectively manage populations and habitats while preventing constraints on military training. eDNA offers DoD natural resource managers another tool for tracking the location of at-risk species and the invasive species and pathogens that threaten them. DoD is playing a key role in transitioning novel eDNA technology to a powerful tool that allows managers to monitor aquatic species efficiently, reliably, and with minimal ecological impacts to sensitive species.

For further information, please email [Dr. Katherine Strickler](#).

CONSERVATION OF AN ENDANGERED SALAMANDER ON EGLIN AFB

By Thomas Gorman, Carola Haas, and Kelly Jones, Virginia Tech

The reticulated flatwoods salamander (*Ambystoma bishopi*) was listed as federally endangered in March 2009 after being recognized as a distinct species from the frosted flatwoods salamander (*A. cingulatum*), a federally threatened species. Habitat loss and alteration were the major threats and causes of population declines for both species.

Working with partners (including the DoD Legacy Program, Eglin Air Force Base, Hurlburt Field, U.S. Fish and Wildlife Service, and Florida Fish and Wildlife Conservation Commission), Virginia Tech has been intensively monitoring breeding populations of flatwoods salamanders throughout all of its life stages. This work has resulted in descriptions of egg deposition habitat, updated distribution data through larval sampling (including discovery of previously unknown breeding sites), documented recruitment of metamorphs into the terrestrial population, and adult population sizes.

Virginia Tech has also been investigating methods to restore flatwoods salamander breeding habitat, including mechanical woody mid-story removal, application of wetland approved herbicides, and prescribed fire. Through these partnerships, we are working to understand how management can be tailored to support population growth of this endangered species. Both Eglin AFB and Hurlburt Field play a critical role in this species' future as two of the last few remaining land holdings that support known breeding populations.



Left to Right: Reticulated Flatwoods Salamander egg; larva; metamorph; and adult on Eglin Air Force Base, FL. Source: Kelly Jones



STEPPINGSTONES CORNER: VIEW FROM THE EYRIE

HOW DOES DOD PIF PROVIDE MISSION SUPPORT?

By Richard A. Fischer, PhD, DoD Bird Conservation Program Coordinator and Partners in Flight Technical Representative

The DoD Partners in Flight (PIF) program has had 23 successful years of avian conservation and management activities that support the military mission. As the new Program Coordinator, I am committed to ensuring that the Program’s focus continues to be based on our Mission Statement: “DoD’s bird conservation activities sustain and enhance the military testing, training, and safety mission through proactive, habitat-based management strategies that maintain healthy landscapes and training lands.” This mission, promulgated through the recently updated [Strategic Plan](#), and guided by leadership from Peter Boice and the Office of Secretary of Defense, provide the framework for DoD’s bird conservation activities now and into the future – a framework that ensures a proactive approach that is focused on supporting mission readiness.

We are guided by a 29-person Steering Committee representing all Military Service branches who work to address bird conservation and management issues that directly or indirectly affect DoD mission areas. The Steering Committee meets annually to further the implementation of the Strategic Plan, discuss contemporary avian issues relevant to mission impacts and support, and to be proactive in identifying upcoming issues (e.g., species listings) that could impact our training mission. As the Program Coordinator, it is also my job to keep the Services informed of ongoing and upcoming activities, and to seek ways to support the Services by distributing technical information, research, monitoring, and management recommendations.

DoD PIF also has Working Groups, each led by a Steering Committee member, that focus on contemporary bird issues relevant to supporting the military mission. Examples include: Renewable Energy, Integrated Natural Resources Management Plan Updates, [DoD Mission-sensitive Priority Species List](#), Research and Monitoring, Bird and Wildlife/Aircraft Strike Hazards (BASH), Education and Outreach, and Invasive Species.

Other actions we are working that should provide additional benefits to all of the DoD natural resources community include:

- **Migratory Bird Treaty Act (MBTA) Training** – The Navy is developing a series of training opportunities using the existing

MBTA platform developed by the U.S. Fish and Wildlife Service (FWS), Migratory Bird Office. DoD PIF, and Navy are developing a DoD-specific training agenda and plan to offer 3-day training opportunities at multiple locations across the country over the next two years.

- **Developing Metrics for Mission Support** – We are gathering metrics and success stories that illustrate how bird conservation activities undertaken by installation natural resources managers support the military mission, especially stories that resulted in an increase in the number of training days available and saved DoD money.

Each installation has a [DoD PIF Regional Representative](#) on the Steering Committee, and anyone interested in bird conservation and management on DoD lands should contact their Representative.

WHAT’S HOPPIN’ IN DOD PARC

By Robert E. Lovich, PhD, DoD PARC Technical Representative and Chris E. Petersen, DoD PARC National Representative



About our Logo – The DoD PARC logo was designed to reflect the long-standing relationship DoD and the Military Services have with protecting our nation and its resources. By intertwining the rattlesnake with the tasseled American flag, the DoD PARC logo

harkens back to the original Gadsden flag image which served as ‘an emblem of vigilance... of magnanimity and true courage.’ By showing the flag with tassels, the logo depicts heroics in battle and honors earned through victory. Ultimately, the logo is meant to represent how DoD protects the natural resources with which it has been entrusted, and how those resources in turn provide for and protect the military’s ability to prepare for its warfighting and peacekeeping duties.

DoD PARC continues to make advances in the conservation and management of amphibians and reptiles on DoD lands, and our work in 2014 was no exception. These advances would not have been possible without the hard work of our installation biologists, trainers, and other partners. They are the core of DoD PARC and are the ones who ensure that DoD’s partnership for amphibian and reptile conservation is working so that our

military personnel have access to conduct mission-essential activities. We are thankful to all of you who have contributed to the success of DoD PARC, and look forward to working with you into the future.

Our current projects and recent accomplishments include:

Lecture Series – We conducted several web-based lecture series this year, including FrogWatch USA, eDNA, and Herpetofauna Biodiversity on Navy Lands. The lecture series' goal is to help members stay connected and current with scientific studies and news. Copies of the presentations can be downloaded from the DoD PARC website. Lectures are advertised to DoD PARC members one week before the lecture. If you would like to receive lecture announcements, please email [Chris Petersen](#).

DoD Legacy Projects – Group members recently completed three important DoD Legacy projects this year. The first project, DoD Amphibian Disease Survey: Natural Resource Manager Training and Data Collection, sampled for chytrid fungus on 52 military installations within the continental United States. The other two projects, Herpetofauna Biodiversity on Department of the Navy Shore Installations and Herpetofauna Biodiversity on Marine Corps Installations, updated and analyzed the herpetofauna species lists for 71 Navy and Marine Corps sites with Integrated Natural Resource Management Plans. For copies of the final reports please email [Chris Petersen](#).

Legacy Program Support – DoD PARC developed and applied an evaluation criteria to assess 2015 Legacy Program pre-proposals and proposals related to herpetofauna conservation and management. The criteria were developed jointly with the DoD Partners in Flight program and were used by both the amphibian and reptile and the migratory bird conservation programs to evaluate and rank taxa-specific proposals.

Photo Website – There are more than 1,000 pictures of amphibians and reptiles on the DoD PARC photo website available for free download by group members. Pictures from the photo website were used to create two educational posters *Venomous Snakes of Navy Shore Installations* and *Venomous Snakes of Marine Corps Installations* that were distributed to 50 military installations.

Looking Ahead – Below are some of the tasks we are currently working on and would like to complete in 2015. We can always use more help, so if you would like to become involved, please contact [Rob Lovich](#) or [Chris Petersen](#).

- Finalize the DoD Amphibian and Reptile Conservation Strategic Plan
- Develop a library of herpetofauna surveys and reports conducted on military lands
- Continue to update herpetofauna species lists, including Army and Air Force sites
- Continue to grow and mature our efforts, including identifying regional representatives and officers, who can help coordinate on-the-ground activities
- Develop INRMP guidance for the conservation and management of herpetofauna on military lands

MORALE, WELFARE AND RECREATION MISSION BENEFITS MORE THAN MILITARY: VERNAL POOLS AT GPOAC

By [Ian Trefry](#), Great Pond Outdoor Adventure Center

In spring 2014, the Navy conducted a survey for vernal pools and the species of amphibians that use these wetland habitats at Great Pond Outdoor Adventure Center (GPOAC), a Navy Morale, Welfare and Recreation (MWR) Facility in Hancock County, Maine. At GPOAC, resource awareness for facility planning and education outreach is the goal of the conservation program at GPOAC. To achieve this, knowledge of sensitive habitats and species utilization is important to ensure support of the recreation mission while meeting conservation goals.

A vernal pool, also known as a seasonal pool, is a natural, temporary to semi-permanent body of water occurring in a shallow depression that typically fills during the spring or fall, and is subject to drying during the summer months. Vernal pools have no permanent inlet or outlet, and no viable populations of predatory fish. In the northeastern United States a vernal pool may provide the primary breeding habitat for wood frogs (*Rana sylvatica*), spotted salamanders (*Ambystoma maculatum*), blue-spotted salamanders (*A. laterale*), and fairy shrimp (*Eubranchipus* sp.) as well as valuable habitat for other plants and wildlife, including rare, threatened, and endangered species.

Two visual encounter surveys were performed during the peak breeding season for wood frog (April 28-May 2, 2014) and mole salamanders (May 19-23, 2014) at Great Pond, King Pond, and Alligator Lake on GPOAC. Out of 19 potential vernal pools surveyed at GPOAC, 15 meet the definition of vernal pool habitat and three are considered significant vernal pools. In accordance with the State of Maine definition, significance is determined by the number of egg masses observed during the vernal pool species breeding window. For example, in a 4,000-square foot vernal pool, 255 wood frog and spotted salamander egg masses were observed over the two-week survey period. These pools provide important breeding habitat for vernal pool species and require more stringent protective measures during facility development planning.

These new data directly support the 2012 GPOAC Integrated Natural Resource Management Plan and will be used for environmental management and conservation in support of the installation recreation mission. The GPOAC advertisement motto of "Stay! Play! Relax!" benefits more than just military and DoD civilians. Come see for yourself.

Please contact [Ian Trefry](#) for a full copy of the survey report.



Counting egg masses in the vernal pool survey. Source: Paul Block

USMC AND DOD LEGACY LEAD THE WAY IN EASTERN DIAMONDBACK RATTLESNAKE MANAGEMENT

By Jayme L. Waldron, Shane M. Welch, Marshall University; and John D. Holloway, Marine Corps Recruit Depot Parris Island

The eastern diamondback rattlesnake (EDB) is endemic to pine savanna-woodlands of the southeastern United States. Once ranging from North Carolina to Louisiana, the historic distribution of the EDB closely mirrored the historic distribution of the longleaf pine ecosystem. However, habitat loss, shooting, and over-collection have resulted in the species' imperilment and review for federal protection under the Endangered Species Act.

The Marine Corps Recruit Depot Parris Island (MCRDPI), on the South Carolina coast, has been at the forefront of EDB management since 2008. Using mark-recapture and radio telemetry as tools for baseline data collection, researchers have closely monitored the EDB population at the MCRDPI. Researchers collect data to estimate critical life history parameters and examine the EDB's movement ecology. Long-term monitoring of this poorly understood species has allowed natural resources personnel to balance public safety and EDB conservation in a proactive manner.



Eastern Diamond-backed Rattlesnake (*Crotalus adamanteus*) at Marine Corps Base Camp Lejeune, NC. Source: Carmen Lombardo -- DoD PARC Photo site

Six years of intensive population monitoring has provided insight into the EDBs 'slow' life history. EDBs require 5-6 years to reach reproductive maturity, and once mature, adult females reproduce at delayed intervals (more than 3 years). Adult EDB survival is high, which is likely contingent on the way EDBs use the landscape. Adults exhibit high spatial fidelity, or tend to stay in the same areas for a number of years, and their home-range size seems to be defined by human land use, with EDBs avoiding areas with high anthropogenic disturbance (e.g., frequently-mowed lawns). The link between high spatial fidelity and adult survival suggests EDBs 'learn' their landscape. Radio telemetered snakes have repeatedly wowed researchers by using the same unique haunts within the same week over successive years. These data have equipped the MCRDPI with information needed to better manage Parris Island's EDB population.

DoD Legacy has provided support to continue EDB monitoring through 2015. One of the goals of this Legacy project is to examine if habitat modifications, which were implemented in 2012 to improve training operations, affected EDB movement ecology. In short, are EDBs changing the way they use habitats on the MCRDPI as a result of habitat improvements? Check back in 2015 for an update on this exciting research program!

PIN-POINTING THE HABITAT AND ECOLOGY OF A NEEDLE IN A HAYSTACK

By Daniel J. Leavitt, PhD, Arizona Game and Fish Department, and Janet Lynn, Arizona Army National Guard

Finding a needle in a haystack has gotten easier. Over the past five years, a partnership between the Arizona Game and Fish Department and the Arizona Army National Guard has investigated the ecology and habitat use of Tucson shovel-nosed snakes at the Florence Military Reservation (FMR). In so doing, these partners have done what may have seemed as challenging as finding a needle in a haystack. The Tucson shovel-nosed snake is a small-bodied desert dweller adapted to burrowing in the soil, hence the need for a shovel-nose. Extirpations, or local extinctions, of this species from within metropolitan Phoenix and Tucson have resulted in conservation concern and its candidacy for listing as federally threatened or endangered in 2008.

Beginning in 2008, the partnership developed a predictive model for Tucson shovel-nosed snake presence at FMR. The model was validated through annual trapping efforts within military training areas that overlap suitable snake habitat and road surveys conducted concurrently on State Route 79 (SR 79), which bisects FMR. The trapping efforts were marginally successful compared to road surveys, and although detections were within expected habitat, they were rare. To refine the search, the researchers within the partnership used radios to track snake movements.

Acknowledging concerns that Tucson shovel-nosed snakes were too small and too fossorial (burrowing) to make radio telemetry a worthwhile endeavor, the researchers tested the radio telemetry methods in a laboratory, examining the speeds of snakes and ability to undulate and burrow with and without transmitters. Telemetry of 10 individuals in the spring of 2014 shed light on their activity patterns and habitat preferences. Each snake was monitored, on average, for 12 days. During the 12 days, researchers detected an average of 6 movements of 4 meters per snake. Ultimately, this means that they do not move very often and when they do it is not very far. From these short and infrequent movements, researchers learned that these snakes utilize rodent burrows most often found below the base of creosote bushes.



Tucson shovel-nosed snake at the Florence Military Reservation, AZ. Source: Janet Lynn

Development in this region is shifting towards agriculture and expansion of the suburban neighborhoods of Phoenix and Tucson--two potential threats to the species. DoD-managed lands, including FMR, can play an important role in maintaining regional populations of species and can assist neighboring land managers with future conservation efforts. For the Tucson shovel-nosed snake, survey and research efforts at FMR offered valuable knowledge about the distribution and movements of this species in the face of a rapidly developing region.

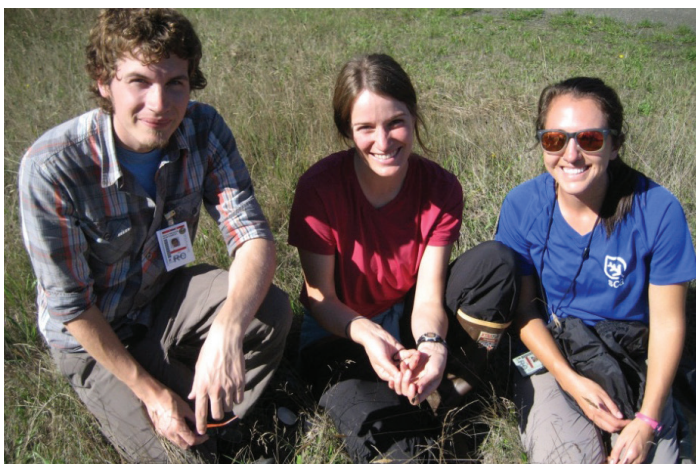
SCA INTERNS PROVE A VALUABLE RESOURCE AT NAVMAG INDIAN ISLAND

By Cindi Kunz, Naval Facilities Engineering Command Northwest



During the 2013 herpetofauna surveys at NAVMAG Indian Island, SCA interns Navit Reid and Erik Kunz collected samples to support the Batrachochytrium dendrobatidis (Bd) disease study. Source: Cindi Kunz

In the spring of 2013, Naval Facilities Engineering Command (NAVFAC) Atlantic biologists conducted reptile and amphibian surveys at Naval Magazine (NAVMAG) Indian Island, in Jefferson County, WA. The purpose of the reptile and amphibian survey was to confirm species presence on the facility. Observations and data collected from the study provided baseline data for the Integrated Natural Resource Management Plan (INRMP) and were useful for environmental planning, natural resource management, and conservation in support of the military missions of the installation.



From left: Alexander Petersen, Christina Hersum, and Kim Ramos helping with species collections. Source: Cindi Kunz

NAVFAC biologists have extra survey support through the Navy/Marine Corps Cooperative Agreement with the Student Conservation Association (SCA). The six SCA Conservation Interns (Christina Hersum, Erik Kunz, Jackson Letchworth, Navit Reid, Alexander Peterson, and Kim Ramos) were recent college graduates serving a one-year appointment at NAVFAC Northwest. They were involved in all aspects of the survey effort – review of the study plan, conducting surveys using various field methodologies, collecting Global Positioning System data to record the location of animals observed, and reviewing the final report. This survey effort will be expanded to other Command

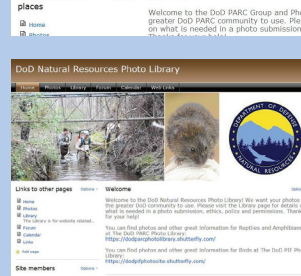
Navy Region Northwest installations in the coming years through the use of SCA interns.

The SCA Cooperative Agreement with Navy/Marine Corps provides a cost-effective solution for implementing INRMPs, achieving the Navy's stewardship goals, and accomplishing meaningful natural resource work, while providing young adults with valuable work experience and skills through public conservation service.

For more information on the Navy/Marine Corps Cooperative Agreement with SCA, please contact Cindi Kunz, NAVFAC NW Senior Biologist, 360-396-1860.

PHOTOGRAPHS SERVE AS THE FOUNDATION FOR OUTREACH AND EDUCATION

By Paul Block, Naval Facilities Engineering Command Atlantic



DoD has developed three websites designed as outreach tools for sharing information within DoD and with other federal agencies, state and local governments, and others partners in the natural resources community. Introduced in 2012, the DoD PARC Group and Photo Site was the first website and has had great success in membership (216 members), member interest (5,916 page views), and shared photographs (over 1,000 member photographs posted). The DoD PIF Photo Library and DoD Natural Resource Photo Library were developed and released earlier this year and are off to great beginnings. The DoD PIF Photo Library is a place for members to post their photographs of birds. The DoD Natural Resource Photo Library is a place to share photographs and knowledge of the other areas of natural resource not represented by the other two websites (e.g. mammals, fish, plants, and invasive species).

Please visit all three websites and become a member today! You may join one, two, or all three sites. Membership is free and is requested through the websites. All members can use the photographs and documents for free for use in outreach, management and conservation related publications. Submission guidelines and policies are posted on each site.

UNDERSTANDING THE COMPLEX SPATIAL AND TEMPORAL VARIATION IN SOURCE-SINK DYNAMICS OF SALAMANDERS

By Raymond D. Semlitsch, PhD, William E. Peterman, and Lori S. Eggert, University of Missouri



Ringed salamander (*Ambystoma annulatum*) walking Source: Dana Drake

Introduction. The concept of source-sink dynamics is important for the management of most species, especially those of conservation concern. Some populations are “sources” that produce an excess of offspring and others that fail to produce adequate offspring, are declining, and are considered “sinks.” Understanding why sources and sinks produce excess offspring or are declining is essential to natural resource management and conservation of threatened and endangered species.

Background. Pond-breeding amphibians, for example, use aquatic habitats as breeding resources. Aquatic habitats are abundant in many regions, are subject to seasonal filling and drying, and often undergo natural succession or alteration due to human land use. Managers struggle with understanding how habitat quality varies spatially and temporally, and subsequently how that quality affects the production and sustainability of species’ populations.

Study. Two pond breeding salamanders (ringed - *Ambystoma annulatum* and spotted – *A. maculatum*) at U.S. Army Fort Leonard Wood, MO, were used to study population dynamics over a three-year period. The study concentrated on a group of 200 ponds in an area with the typical forested landscape of the central Ozark Highlands. Researchers measured abundance at the larval and the next stage when larvae transform to miniature adults (metamorph) stages at each pond to estimate demographic production that results in juvenile recruitment into local populations and provides dispersers among populations.



Spotted salamander (*Ambystoma maculatum*) Source: Paul Block

Approach. We also used microsatellite DNA assessments at each pond to estimate dispersal rate, distance, and connectivity among ponds. Initially, the team assessed the evidence for three alternative hypotheses to explain why spotted salamanders had lower genetic differentiation and no apparent population structure compared to ringed salamanders across the same landscape:

1. spotted salamanders, on average, disperse farther than ringed salamanders;
2. spotted and ringed salamanders differ in their response to landscape resistance, with landscape features limiting dispersal in ringed salamanders; and
3. differences in life history, specifically time of reproduction, affect the spatial distribution of available breeding habitat.

Results. Data indicated that metamorphs were never found in ponds with fish, and were 6.6 times more likely to be found in ponds with a semi-permanent hydroperiod. Other pond habitat findings include that they vary widely in quality across the landscape, very few consistently produce high quality metamorphs, and most ponds produce a small number of metamorphs, if any.

The contribution of ponds was significantly repeatable across the three years of study, indicating that at least for the short-term, high and low producing pond habitats can be identified. This suggests that local salamander populations are spatially dynamic in their contribution to the metapopulation, consisting of a few hotspots that are likely true source populations.

In assessing the three hypotheses we found that based on the genetic data, the average dispersal distance of spotted salamanders is greater (3,297 m) than ringed salamanders (2,680 m). While both species show significant isolation-by-distance, there is no evidence affecting genetic differentiation in either species, and there was no significant difference between the minimum distance between spotted and ringed salamander breeding ponds during the years surveyed. From our analyses, spotted salamanders disperse further than ringed salamanders.



Sampling at a pond at U.S. Army Fort Leonard Wood, MO. Source: Raymond D. Semlitsch, PhD

Discussion. The combination of ecological and genetic data has yielded an understanding of spatial and temporal dynamics than either approach alone. Identifying which ponds contribute most, and which are critical for reducing local extinction, might help target added protection for those ponds. This can be accomplished, for example, by using a terrestrial buffer to protect the breeding pond and surrounding upland terrestrial habitat. Also, knowing which ponds have low contribution could suggest where land use or wetland loss can occur without affecting metapopulation stability. Knowledge of spatial dynamics allows alternative management strategies to be developed with a balance between conservation of important source ponds and land-use demands of military activities.

COMING SOON! WILDLIFE TRADE AND THE U.S. MILITARY ABROAD: MOBILE DEVICE APP – WILDLIFE ALERT

By Heidi Krester, PhD, Wildlife Conservation Society

When overseas, military personnel sometimes purchase wildlife products as souvenirs. What they may not realize, however, is that many of these products are illegal to purchase or own according to U.S. law, military regulations, or local country laws. Military personnel must be able to distinguish threatened and endangered wildlife so they can avoid inadvertently purchasing items that might be confiscated by customs or create legal problems.

To address this challenge, the Wildlife Conservation Society (WCS), with funding from DoD Legacy (Project #12-444), developed a mobile app to help military personnel identify products made from animal fur, skin, horns, or ivory, and provide guidance on which items can and cannot be traded or purchased. This collaborative project will help protect wildlife in Asian and African countries while also helping to stop poaching and other illegal activities. The partnership between DoD and WCS directly supports the President's Advisory Council *National Strategy to Combat Wildlife Trafficking* issued in February 2014.

Herpetofauna Biodiversity on Department of the Navy Shore Installations (Project 12-423) – Final Report, Fact Sheet, & Poster

The objective of this study was to analyze data from 54 major Navy installations (including 131 distinct parcels) within six Navy regions (Mid-Atlantic, Washington, Southeast, Midwest, Northwest, and Southwest) in the continental United States to provide installation natural resource managers and Navy leadership with an assessment of the amphibian and reptile species biodiversity across the Navy landscape. The data presented in the final report and the resulting herpetofauna species lists for the Navy sites evaluated can be used by natural resource managers at installations to identify survey or research gaps and by senior Navy leadership for an overall view of herpetofauna diversity on Navy lands.

Le Conte's Thrasher (*Toxostoma lecontei*) Occupancy and Prediction of Occurrence Modeling: Barry M. Goldwater Range and Yuma Proving Ground in Southwestern Arizona (Project 11-343) – Final Report, Manuscript, & Fact Sheet

The Le Conte's Thrasher (LCTH) is considered a DoD Partners in Flight bird species of concern and is on the Tier 1 (high overall priority) Partners in Flight watch list. Researchers addressed concerns regarding the current distribution and status of LCTH on three DoD installations in southwest Arizona and assisted in guiding future habitat management to fulfill mission critical activities while maintaining existing LCTH populations.

Demonstration of a Non-destructive Technique to Sample DNA from Butterflies (Project 12-608) – Final Report & Fact Sheet

Scientists demonstrated a non-destructive DNA sampling technique to obtain viable DNA samples for population genetic analysis in this project. The results include a description of the population status of the wild and captive populations of Palos Verdes blue butterfly, and proof of the viability for a method of non-lethal DNA sampling for butterflies.

NATURAL RESOURCES DOCUMENTS

Highlighted here are reports, fact sheets, spreadsheets, and presentations that will soon be uploaded to the Natural Resources page of the DENIX site. These documents are designed to benefit installation Natural Resource Managers by promoting greater understanding and appreciation of natural resources for the military and the public.

Recovery Tool for Enhanced Black Abalone Recruitment on the California Channel Islands and Coastal Habitat (Project 12-635) – Final Report, Fact Sheet, & Poster

Black abalone inhabit the rocky intertidal areas of DoD land in southern California (San Clemente and San Nicolas Islands). To avoid potential negative impacts on training and operations on these islands, this project developed management strategies necessary for successful recovery of black abalone and protection of these ranges.



Snake Awareness Day at Papago Park Military Reservation. Source: Janet Lynn

MONARCH BUTTERFLIES ARE IN TROUBLE. WHAT CAN YOU DO? PLANT MILKWEED!

Monarch butterflies are struggling. Counts of the familiar orange-and-black insects, admired for their flights of up to 5,000 miles a year, are trending down so sharply that their migration is now under threat. That means fewer monarchs to pollinate crops, spread seeds and feed birds. One simple way to help is collecting and sowing milkweed seed. There are over 100 milkweed species that are native to North America, many of which are used by monarchs. But don't delay. In much of the country, milkweed pods are ripe for picking in early fall.

Milkweed is the lone plant on which the butterflies lay their eggs in spring and the only food source for monarch larvae. One reason monarchs are failing is that milkweed is



Created by Monarch Watch and funded by Monarch Watch and the Monarch Joint Venture

disappearing from the American landscape. Herbicide use on milkweed, urban sprawl, and development have contributed to decreasing monarch habitat.

For more information on monarchs and milkweed, visit <http://monarchwatch.org/bring-back-the-monarchs/>, www.monarchjointventure.org, <http://www.fws.gov/pollinators/>, or <http://www.dodpollinators.org/index.html>.

UPCOMING EVENTS CONFERENCES, WORKSHOPS, AND TRAINING

American Water Resources Association (AWRA) Annual Conference

November 3-6, Washington, DC

AWRA celebrates the 50th anniversary of its annual conference with over 80 concurrent technical sessions on a range of water resources research, policy, management, education, and technical topics, including special tracks of Climate Change, Dynamic Reservoir Operations, Flood Management, Green Infrastructure, International Water, Management Tools, Open Water Data, Social Science and Emerging Contaminants, Water Quality, and Watershed Protection Modeling. Find out more information on the [Annual Water Resources Conference website](#).

Defense Energy Summit

November 11-13, Austin, TX

The Defense Energy Summit will build the foundation for a new Defense Energy Center of Excellence with the stakeholders and working groups. The Summit focuses on this initiative and how to accelerate clean energy and infrastructure solutions for DoD. Find out more information on the [Defense Energy Summit website](#).

4th Annual Defense, National Security, & Climate Change Symposium

November 18-19, Washington, DC

This symposium addresses the growing efforts of U.S. Defense, intelligence and national security communities on assessing and responding to climate change. 2014's Symposium addresses preparedness and resilience and the national security implications of climate change. Additional topics include operational and installation energy considerations and greenhouse gas reduction activities throughout DoD. Find out more information on the [Defense, National Security & Climate Change Symposium website](#).

Clean Air Through Energy Efficiency

November 18- 20, Dallas, TX

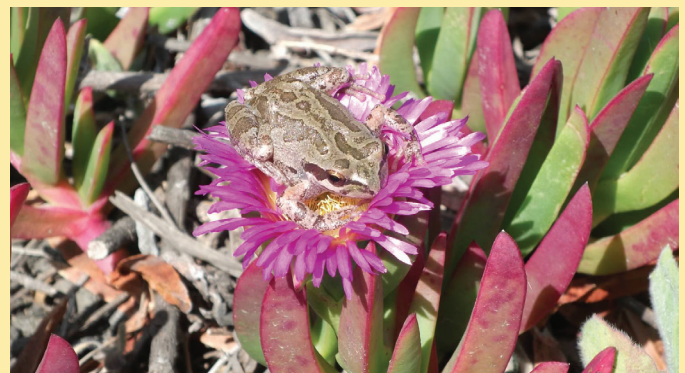
Co-hosted by the Energy Systems Laboratory and the Texas A&M Engineering Experiment Station, this conference is designed to help communities improve decisions that

determine the energy and water intensity of the built environment and reduce related emissions. Find out more information on the [Clean Air Through Energy Efficiency website](#).

Behavior, Energy and Climate Change (BECC) Conference

December 7-10, Washington, DC

The BECC conference focuses on understanding individual and organizational behavior and decision-making related to energy usage, greenhouse gas emissions, climate change, and sustainability. Academics, practitioners, and policymakers from a variety of fields will discuss innovative policy and program strategies, share important research findings, and engage in building dynamic networks and collaborations. Find out more information on the [American Council for an Energy-Efficient Economy website](#).



Baja California treefrog (*Pseudacris hypochondriaca hypochondriaca*) on Naval Base Ventura County, CA. Source: Brent Eastty -- DoD PARC Group and Photo Site

LINKS OF INTEREST

AFPMB

The Armed Forces Pest Management Board (AFPMB) recommends policy, provides guidance, and coordinates the exchange of information on pest management throughout DoD. Their mission is to ensure that environmentally sound and effective programs are in place to prevent pests and disease vectors from adversely affecting DoD operations.

CESU Network

The Cooperative Ecosystem Studies Unit (CESU) Network is a national consortium of federal agencies, tribes, academic institutions, state and local governments, and nongovernmental conservation organizations working together to support research, technical assistance, education, and capacity building. There are 17 CESUs which link DoD and other federal agencies, a host university, and partner institutions. One of the benefits of joining a CESU is a reduced, Network-wide Finance and Administration (i.e., overhead) rate of 17.5% for federal agencies.

DENIX

The DENIX Natural Resources home page is an electronic environmental network and information exchange that provides access to natural resources information, such as Executive Orders, policies, guidance, INRMPS, fact sheets, and reports.

DoD Biodiversity Handbook

On this website you will find a thorough introduction to biodiversity and how it applies to the military mission; the scientific, legal, policy, and natural resources management contexts for biodiversity conservation on DoD lands; and practical advice from DoD natural resources managers through 17 case studies. A Commander's Guide, Conservation Toolbox, and additional biodiversity outreach tools are available on the site.

DoD Invasive Species Outreach Toolkit

This site provides education and outreach materials to help DoD land managers communicate about invasive species. It contains modifiable outreach materials such as posters, brochures, reference cards, and a PowerPoint presentation. A list of resources to help identify information and funding sources also is included.

DoD Legacy Resource Management Program Tracker

The DoD Natural Resources (NR) Program funds high priority natural and cultural resources projects that have regional, national, and/or multi-Service benefits through the DoD Legacy Program. The Legacy Tracker lets users download fact sheets and reports for completed Legacy-funded projects.

DoD Natural Resources Conservation Program

DoD's NR Program provides policy, guidance, and oversight for management of natural resources on all land, air, and water resources owned or operated by DoD. The website offers information on DoD's natural resources initiatives, programs, presentations, and links to other DoD conservation and natural resources sites.

DoD PARC

DoD Partners in Amphibian and Reptile Conservation (PARC) is an inclusive partnership dedicated to the conservation and management of herpetofauna--reptiles and amphibians--and their habitats on military lands. DoD PARC membership includes natural resource specialists and wildlife biologists from the military Services and individuals from state and federal agencies, museums, universities, and environmental consultants.

DoD PARC Group and Photo Site, DoD PIF Photo Library, DoD Natural Resource Photo Library

The three sites are designed to share pictures, news, information, and ideas with the DoD Natural Resources, DoD PARC, and DoD PIF communities. Members may use the websites to download photographs for reports, Power Point Presentations, and educational materials such as brochures and posters. There is also a forum for posting questions to group members, a calendar listing upcoming events, and a library where reports and documents are stored.

DoD Partners in Flight

The DoD Partners in Flight Program supports and enhances the military mission while it works to develop cooperative relationships to ensure a focused and coordinated approach for the conservation of resident and migratory birds and their habitats.

DoD Pollinator Initiatives

This website provides an overview of pollinators and the reasons they are important to DoD. It contains fact sheets and technical reports, how-to guides, resource lists, and more describing some of the simple ways that people can help pollinators and their habitats.

REPI

Under Readiness and Environmental Protection Integration (REPI), DoD partners with conservation organizations and state and local governments to preserve buffer land and habitat around military installations and ranges as a key tool for combating encroachment. By promoting innovative land conservation solutions, REPI supports the military's ability to train and test at its lands now and into the future.

SERDP and ESTCP

Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) harness the latest science and technology to improve environmental performance, reduce costs, and enhance and sustain mission capabilities. They are independent DoD programs managed from a joint office to coordinate the full spectrum of efforts, from basic and applied research to field demonstration. SERDP and ESTCP, in conjunction with the Legacy Program, support readiness, quality of life, adherence to legal mandates, and responsible environmental stewardship of natural and cultural resources.



DOD NATURAL RESOURCES PROGRAM

Enabling the Mission, Defending the Resources

www.dodnaturalresources.net

<http://twitter.com/#!/DoDNatRes>

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