



# Notes From the Field

## 2005 - 2010

Ever think about exploring caves, identifying corals, or hiking through a forest for a living?  
Biologists do.



## “Mauna Loa is a Really Big Mountain”

I grew up in the Sierra Nevada Mountains where I would hike, backpack, and ski. I thought those were big mountains, but they pale in comparison to Mauna Loa. Mauna Loa is the most massive mountain in the world, when we include the huge chunk that escapes our eyes under the ocean’s surface. The gradual slopes extend for dozens of miles to the summit at 13,679 feet (4,169 m). The endangered Hawaiian petrel (*Pterodroma sandwichensis*) nests on this volcano. My job is to spend my days hiking the enormous lava flows of Mauna Loa and monitoring the petrels’ breeding activity. The nests are spread out across the gigantic lavascape in areas where few people venture. Often the most exciting thing I’ll see at a nest site is white petrel feces, or “guano.” Guano is like gold to a seabird biologist like me. It tells me the birds have arrived. By the freshness of the guano I can generally tell when the bird dropped its unwanted cargo. There is often bad news on the mountain as well, like a find of petrel carcasses from depredation. Nest sites often feel like a crime scene, and recording and documenting evidence of petrels can help unravel mysteries regarding their behavior and breeding success.

The seabirds nest in small lava cavities, or burrows, in pāhoehoe flows from 1,500 to 5,000 years old. The adults first fly to the burrow in early April to prepare the nest and probably mate. The pair then heads out to sea to feed and store up enough energy to lay and incubate the egg in May. The egg laying event marks the beginning of a very long reproductive season during which the breeding pair, who mates for a life of up to 30 years, share in the duties. The male takes the first round of incubating while the female heads out to sea to feed. Theodore Simons investigated the breeding biology of Hawaiian petrels on Maui’s Haleakalā in the early ‘80s. He found that the male may sit on the egg for three weeks before the female returns to take her shift. The egg will hatch over a month later, and then both parents work all breeding season feeding the chick. The adults leave the burrow late at night and typically spend 7-14 days feeding out at sea. Then, one of the parents will return to the burrow slightly after sundown to feed the chick a rich regurgitated load of squid, small fish, and other sea creatures. The chick is fed for several more months until it is big and strong enough to first take flight in November. It is believed that the bird will not return to land again for another 6 years, when it will be old enough to breed.

The Hawaiian petrels’ cryptic behavior inspired me to get involved in further research into their breeding biology. I am a Master’s student at the University of Hawaii-Hilo in the Tropical Conservation Biology and Environmental Science program. In cooperation with the Pacific Cooperative Studies Unit and Hawai’i Volcanoes National Park, I investigate the petrel’s breeding season. It takes several hours to hike to the burrows, some of which are only reasonably accessible by helicopter. The highest known nest is near 9,700 feet. The pāhoehoe lava flows with the burrows are often flanked by huge ‘a‘ā flows. Crossing ‘a‘ā is not exactly a walk in the park; figuratively anyway. One would think that no other animals would use this habitat. Enter *Felis catus*, the domestic cat.

Feral cats have wreaked havoc on nesting petrels for decades. These cats are wild and adapt to the harsh and dry conditions of sub-alpine volcanoes across which they are known to travel several miles per day. I have found their scats at elevations near 10,000 feet. I collect and document the scats, and perform cat scat investigations to look for the characteristic black and white feathers of the Hawaiian petrel, which unfortunately I find frequently. I also find the soft grey down of chicks, as well as the beaks of squid which were presumably in the chicks’ bellies before being depredated. The petrels are easy pickings for feral cats. Surviving birds today often have burrows with very narrow entrances that the cats cannot squeeze into. The chicks however, are vulnerable late in the breeding season when they walk outside the burrow to stretch and exercise. Feral cat trapping yields captures every year, but there always seem to be a few cats that are savvy enough not to fall for the bait. The most damaging depredation events occur early in the season when the adults are incubating the egg. During this time, a cat may kill the adult, and the egg will fail. The majority of depredated nests have remained inactive for over 20 years.

Although burrow monitoring and predator control efforts take an enormous amount of time, they are essential to protect the national park’s rare and beautiful resources so that others may ponder these unique seabirds, and so the petrels can continue raising their young on the slopes of Mauna Loa.

— Seth Judge, Petrel Specialist



From left :  
Seth on Mauna  
Loa in petrel  
territory; Seth at  
a burrow site; a  
Hawaiian petrel  
pokes its head  
out of a burrow;  
the tarsus bone  
of a depredated  
petrel



## Adventures in Marine Fish Monitoring

On many tropical islands the flora and fauna are not very diverse since it is often a difficult journey for an organism to arrive and establish on an island. In the water, virtually the opposite is true. Life abounds in the warm tropical waters of nearly every small island in the Pacific. Often there is so much life that many sessile organisms must compete for space. For example, few people realize that many hard coral species are actually quite aggressive and may attack their neighboring corals whenever they get too close. This kind of competition for space and resources is not limited to the benthic community. Many marine fish have similar daily struggles to maintain territories and access to vital resources. Damselfish are a good example. These small bright and colorful fish are often the icon for South Pacific coral reefs. Yet few realize that they are actually some of the most pugnacious animals on reefs. With names like south seas devil and humbug dascyllus, these aggressive little fish are usually only three inches long yet can chase off scuba divers and even five foot barracuda.



Not everything on the reef is quite so bold. Many marine fish are highly cryptic, either in coloration or behavior, and sometimes both. In a habitat with literally hundreds of predator species, many smaller fish like blennies have adapted to hiding amidst cracks and crevices, and are able to dart quickly into a hole at the first sign of danger. Others, like the scorpionfish, are one of the dangers. These highly camouflaged ambush predators sit out in the open and wait for an unsuspecting meal to swim to them. We watch these behaviors and interactions as we conduct the marine fish monitoring protocol. This I & M protocol covers 30 dive sites within Pacific Island Network (PACN) waters each field season. Half of these are permanent transects which have already been established as part of the benthic marine community protocol. Our transects are 25m long from pin to pin (a pin is a large metal rod driven by sledgehammer into the steel-like basalt bedrock on the bottom of the ocean) and are in waters from 10-20m deep. The remaining 15 sites are randomly selected each year so that we can assess a wider area of our parks.



The marine fish protocol is co-located with the benthic marine community protocol. The marine fish protocol, however, is always started first. We do this for a few reasons. First and foremost, in many places lots of fish species see us as a threat and dive for cover or leave the area soon after we enter the water. In order to get accurate counts of the fish biomass and assessments of the fish assemblages we need to see what is there. We cannot do that if somebody scares away the fish before we have a chance to count and measure them. Secondly, humans are noisy and cumbersome underwater. Every time you exhale on scuba, a loud and very unnatural sound of bubbles escapes from your gear. While many fish acclimate quickly to this, some species never do.



Here at the National Park of American Samoa we typically see around 65 species of fish on a dive. These 65 can be very different among dives because different fish occur in different microhabitats and there are almost 1000 species of coral reef fish in park waters. Now consider that most of these 1000 fish species have a completely different color phase for juveniles, males, and females (somewhere around 2,500 color patterns to identify). With this kind of diversity we see some spectacular things and no two dives are ever quite the same; even at the same dive site. From moray eels, clownfish, humphead wrasses, triggerfish, and sharks to endangered sea turtles and humpback whales, there is always a great diversity in PACN coral reef parks just waiting to be explored.

— Paul Brown, Marine Ecologist

From top: black-backed butterflyfish (*Chaetodon melannotus*), Picasso triggerfish (*Rhinecanthus aculeatus*), and zebra moray (*Gymnomuraena zebra*)



This damselfish, called the orangefin dascyllus (*Dascyllus auripinnis*), is a wee bully of the reef

Right: Paul records data on the fish he encounters along a transect



## Anchialine Pool Invertebrate Inventories

When asked what sort of work I do, most people have blank looks on their faces when I respond, “I conduct inventories of aquatic invertebrates in anchialine pools in Hawaii’s national parks.” Judging by their confusion, I usually break it down by explaining that anchialine pools are rare coastal waters that exhibit tidal fluctuations and possess measurable salinities but lack a direct surface connection to the sea. Such pools are restricted to highly porous substrates (e.g., recent lava flows) and, in the U.S., are only found in Hawaii. Anchialine pools are where one might find charismatic shrimp, flies, crickets, snails, damselflies, dragonflies, and in rare instances, a blind eel.

We have surveyed approximately 150 anchialine pools in Hawai’i Volcanoes National Park, Kaloko-Honokōhau National Historical Park, Pu’uhonua o Hōnaunau National Historical Park, Pu’ukoholā Heiau National Historic Site, and Kalaupapa National Historical Park. Inventory results suggest that aquatic insects are the dominant native invertebrate group with flies, dragonflies, and damselflies comprising roughly 70% of the fauna. Native snails, shrimps, and crickets accounted for the remaining fauna, with highly variable densities from site to site.

The rarest native pool invertebrate is the endemic orange-black Hawaiian damselfly (*Megalagrion xanthomelas*) found at only 6 pools in three parks. This Hawaiian damselfly favors pools with some degree of canopy cover for protection from the hot sun. This once abundant coastal species is under consideration for listing as “endangered” by the U.S. Fish and Wildlife Service.

Prior to European contact, Hawaiians frequently modified anchialine pools to serve as potable water sources, baths, and fishponds. The impacts of traditional Hawaiian practices on the pools may have been minimal; but modern practices such as coastal development and the introduction of nonnative species seriously threaten many anchialine pool systems. Nevertheless, the native fauna, unique basin morphology, and rich history make studying anchialine pools a rewarding way to spend a day at the coast!

— Lori Tango, Invertebrate Specialist



Perched tandem *Megalagrion xanthomelas*

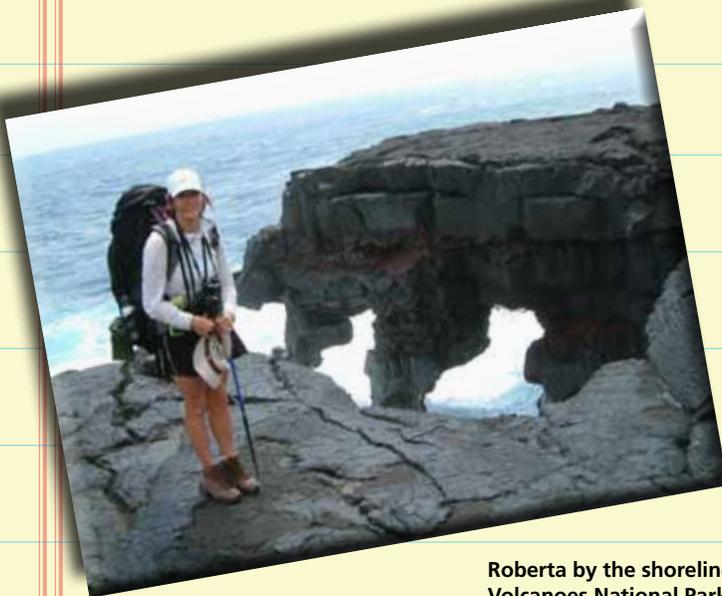
## Bird Surveys “Surf to Turf”

Hawai’i Volcanoes National Park Inventory and Monitoring program bird crew surveyed surf to turf from the rugged coastlines to the slopes of Mauna Loa. The season began with bird surveys along the entire length of the park’s shoreline. Volunteer Mike Hughes hiked for four days in socks and sandals after developing huge blisters crossing rugged coastal lava flows. As if that wasn’t enough excitement, the team ran out of water two miles from camp on day two, and watched our camp stove scorch our field notebook which we barely rescued from the small blaze. Luckily the conflagration boiled our water for the required time to kill microorganisms and we enjoyed a warm but much needed drink on the shores of beautiful Keauhou Bay.

In early spring, Kathryn Turner and I braved early mornings and hefted heavy packs to survey birds along the park trails. Countless gadgets to measure distance, direction, and weather hung from our necks and pockets and clanked with every step like wind chimes. Hours of hiking and miles of trails rewarded us with sightings of native ‘apapane and ‘amakihi, dramatic sunrises, and afternoons resting at remote park beaches.

In mid-Summer, our intrepid birders searched remote areas of HAVO for rare seabirds. Intern Evana Burt-Toland and I sighted rare band-rumped storm petrels, but Newell’s shearwaters were harder to find. We were never able to confirm sightings of this elusive bird despite late nights watching, listening, and broadcasting taped calls at the edge of craters and beaches. Despite this small disappointment, the Inventory and Monitoring bird crew was paid in full, in the raw beauty and solitude of the park’s backcountry.

— Roberta Swift, Bird Biologist



Roberta by the shoreline at Hawai’i Volcanoes National Park

## Snakes, Not Worms

The herpetological inventory (reptiles and amphibians) in Hawai'i Island national parks was developed in order to determine which species of amphibians and reptiles have established populations on park properties in Hawai'i, and if any of those species pose a marked threat to native Hawaiian ecosystems. We surveyed three national park units on the west side of the Big Island: Pu'uhonua o Hōnaunau, Kaloko-Honokōhau, and Pu'ukoholā Heiau (PUHE). While the majority of the "herps" that we encountered during the surveys are familiar to most Hawaiian residents, I noticed that one particularly seldom-seen species was found often at PUHE: a blind snake (*Ramphotyphlops braminus*), usually located low on the trunks of kiawe trees.

The blind snake is one of two species of snakes found in Hawaii, the other being the yellow-bellied sea snake, a rare visitor to Hawaiian waters. The blind snake usually goes unnoticed due to its burrowing lifestyle and its superficial resemblance to worms. Before working at PUHE my only encounter with a blind snake was the unexpected emergence of an individual through a crack in the tile of my bathroom floor. Due to the scarcity of tile floors at the historic site, I decided to venture into habitats slightly less anthropogenic. Within the unfamiliar environment of PUHE I was forced to base my search strategy on secondhand accounts more relevant to my surroundings. Based on these accounts I expected to find blindsnakes beneath potted plants in wet, shaded gardens — so to find the snakes climbing trees in dry, dusty soil was a real surprise.

This pan-Asian burrowing species of snake was introduced to Hawaii around 1930 from the Philippines. An unusual characteristic of the blind snake is that it is the only known species of snake to be parthenogenic; that is, all members of this species are female.

— Jason Bazzano, Herpetologist



**A juvenile blind snake found climbing a tree at night in Pu'ukoholā Heiau National Historic Site**



**Pahong (*Pandanus dubius*) found in limestone forests of the Mount Alifan Unit, WAPA**

## Nearly 400 Plant Species Identified in Guam Park

If someone asked me today to search for plants in 80+ degree weather and 80% humidity, where I might encounter stings from nasty wasps that will make my arm swell to twice its size, wade through sword grass that cuts flesh like butter, and carry out much of the work in tropical storm weather, I still would say....."Sure!" I had the wonderful opportunity to conduct a plant inventory at the War in the Pacific National Historical Park (WAPA) on Guam with my intrepid field partner, Jenny Drake, a local Chamorro woman and NPS biological technician extraordinaire.

WAPA was established to honor the bravery of soldiers that participated in World War II and to preserve cultural sites. However, the park contains significant biological resources as well. The park is well known for its diverse coral reefs, and has one of the highest levels of coral diversity of all the parks in the NPS. Nonetheless, it was our job to document WAPA's terrestrial plants. Therefore, Jenny and I spent a month

hiking through the park's seven units and recording all of the plants we observed. We collected and took photos of hundreds of plant species in the park to serve as a record of our findings. During the course of the survey and follow-up herbarium reviews, we identified almost 400 plant taxa from the park. About 44% are native to the Mariana Islands with 15 endemic species. Some native plants of conservation and/or cultural interest that we observed included: Pahong (*Pandanus dubius*), with fruit clusters that resemble a giant, spiny soccer ball; *Cerbera dilitata* with delicate white pinwheel flowers; and large ifit trees (*Intsia bijuga*), the territorial tree.

Besides the interesting plant life, we also found many remnants of World War II battles such as bunkers, gun emplacements, and fox holes. Jenny and I found it impossible to walk through the field without remembering the thousands of people that lost their lives a mere 60 years ago while fighting on the same ground that we were hiking. My experiences on Guam were memorable and not easily forgotten. If given the chance, I'd do it all over again, minus the wasp stings.

— Joan Yoshioka, Botanist

**Joan identifies and preserves plant samples collected for the herbarium**



## The Glamorous World of Stream Monitoring

When people hear I work in Hawaii in the water, a vision comes to mind of spending all day basking on beautiful beaches in a swimsuit. Little do they know that as a freshwater animals field technician I primarily wear a full 7mm wetsuit with hood, gloves, and booties. I spend most days hiking upwards of five miles with all kinds of crazy equipment and lying in a 22°C stream for hours on end counting and identifying creatures that call the streams home. There are five types of native gobies ('o'opu), two native crustaceans ('ōpae), and three native mollusk species that inhabit Hawaii's streams. Unfortunately, numerous introduced fish and a prawn (*Macrobrachium lar*) are also prevalent in the streams and pose a serious threat to native animals. We also monitor the habitat characteristics and water quality parameters that these animals inhabit and how those factors change over time. These data give us a better idea of changes to the ecosystem.

I initially came to Hawaii with grand hopes of studying charismatic marine megafauna like whales and turtles. However, I've discovered how important freshwater ecosystems are to the islands. Not only are they home to unique and often endemic organisms, but they also represent a key link between the terrestrial and marine environments.

This link is evident in the animals' amphidromous life cycle. This means they utilize different environments during their lifetime. They exhibit diadromy, which literally means "two runs" describing how newly hatched larvae flow out to the ocean and return later to the streams as juveniles. Generally, juveniles migrate up the streams to a location they choose as their home and stay in that general area for the rest of their lives. These small, sensitive animals can be key indicators of the health of the streams because they may quickly show signs of human land use activities such as agriculture, development, and stream diversions.

On our most recent adventure to Waikolu stream in beautiful Kalaupapa National Historical Park we witnessed spat (juveniles) of a native snail species called hihīwai (*Neritina granosa*) returning from the ocean and migrating up the streams. Groups of hundreds of individuals formed a line for their epic trek.

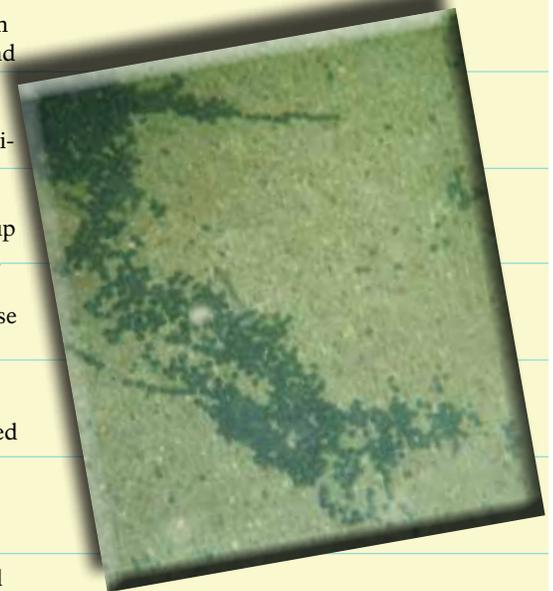
A crew of four intrepid stream ecologists also traveled to Haleakalā National Park for nearly two weeks of stream monitoring along four streams. We located many native species in these streams including a world-class climber 'o'opu alamo'o (*Lentipes concolor*). Similar to other gobies, this endemic species has a fused pelvic fin that forms a sucking disk enabling it to scale waterfalls. The alamo'o has been known to climb waterfalls as tall as 420 feet!

Field excursions are definitely not your typical Hawaiian "vacation," but I would not change a thing about my job or the amazing places in which I am so privileged to work.

— Anne Farahi, Aquatic Biotechnician



Anne with all of her gear



Hundreds of hihīwai return upstream



Waikolu stream



'O'opu alamo'o

## “Wait, did you say bats?”

This is a fairly typical response. It is usually followed by, “So you’re saying we have bats in Hawaii?” Yes, as a matter of fact, we do. The endangered Hawaiian hoary bat, *Lasiurus cinereus semotus*, is the only indigenous terrestrial mammal found in Hawaii. It appears to be related to the hoary bat living on the North American mainland, but just exactly how it landed in Hawaii is a mystery.

Researching and monitoring bats can be tricky. They are elusive and difficult to capture, are mostly active after dark, are plagued by public fear and misunderstanding, and in some parts of the world they might even show up as the main dinner course. In the Pacific Island Network (PACN), where the Hawaiian hoary bat typically roosts solitarily in small clumps of foliage, we have very little information regarding its population status and natural history. However, there is a glimmer of light at the end of our monitoring tunnel. With current advances in acoustic detection technology, we are working with partners to develop an acoustic-based monitoring protocol. This will allow us to track bat echolocation activity over time in selected areas of national parks in Hawaii. Think of it as eavesdropping on bat chatter as bats hunt for a suitable insect meal or try to find their way back to a favorite roost tree.

In preparation for acoustic monitoring of Hawaiian hoary bats in the PACN I visited John Day Fossil Beds National Monument, where we met with ecologist Tom Rodhouse for a crash course in use of the Anabat II detection system. After an intense few days of bat detection training, I brought my newly acquired skills back to Hawaii and put them to use straight away.

Under the watchful eyes of barn owls circling and twittering as I worked below them, I detected a short series of bat echolocation calls. I was impressed by how the Anabat system allowed us to either view real-time bat calls on a laptop screen or save bat call information to a compact flash card for downloading, viewing, and analysis. This latter approach will be particularly useful to our monitoring protocol, as it allows us to deploy the detection equipment and leave it in the field for weeks at a time.

— Heather Fraser, Bat Biologist



**Heather and Upper Columbia Basin Network Ecologist, Tom Rodhouse, discuss plans for recording bat activity at John Day Fossil Beds National Monument**

## Marine Monitoring at Kalaupapa



**Kazuki taking a photo on a monitoring point along a benthic transect to determine the percentage of living organisms**

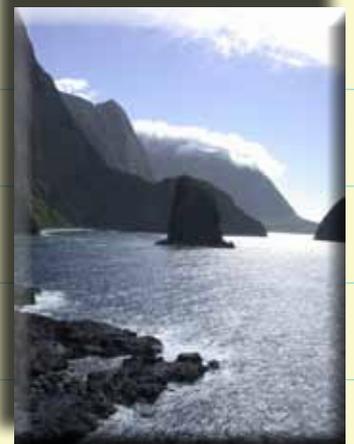
Situated on the north shore of Moloka’i, we are always at the mercy of Mother Nature and her fickleness. Weather/marine forecasts and predictions don’t bear much weight here at Kalaupapa National Historical Park (KALA). The ocean can turn from a flat calm to a roiling boil in a matter of hours. Even during our summer season when the ocean conditions are supposed to be “calm,” we find ourselves navigating through rough, white-capped, seas to reach our dive sites. Eric Brown (KALA marine ecologist), calls it “Victory at Sea!” However, once we drop into the water “hot” and submerge into the blue, the chaos above dissipates and we enter a realm of absolute beauty and tranquility.

As part of the National Park Service’s Inventory & Monitoring program, a total of 30 sites (15 fixed and 15 random) have been monitored along roughly sixteen miles of picturesque coastline and offshore islands at KALA. Our monitoring program integrates both the Marine Fish and Benthic Marine Community protocols on each dive. For the fish protocol, fishes observed along a 25 m by 5 m transect are counted and categorized by species and size. To determine the complexity of the reef habitat, a rugosity chain is contoured along the substrate and measured. Digital photographs of the substrate are taken at 1 m intervals along the transects for the benthic protocol. The images are analyzed to generate data for percent coral cover, percent macroalgae cover, and incidence of disease/bleaching of corals. We also installed coral settlement tiles in early April, after the first full moon, to coincide with the annual coral spawning event. The tiles were recovered at the end of the season to determine coral settlement rate.

We completed our first year of data collection from 2006. The following are some highlights of the results: The fish communities at KALA are not as taxonomically diverse as in other parks, but abundance and biomass levels are some of the highest found in the main Hawaiian Islands. Coral cover was uniform throughout the 30 sites; macroalgae cover was low overall, with the highest cover in front of Kalaupapa settlement; incidence of disease/bleaching were also low with the highest incidence (12 - 15 %) at scattered points around the park; compared to other areas in the state, coral settlement was low. Highest settlement occurred at Kahi’u Point (104 recruits, yr-1) and the lowest by Kalaupapa and Nihoa on the west end of the park (0 recruits).

— Kazuki Kageyama, Marine Biotechnician

**Kalaupapa National Historical Park shoreline**



## “Welcome to Beautiful Cool Guam”

I don't know if that airport sign was a joke, but I hope it was simply referring to the island's relaxed atmosphere, friendly people, and beautiful sights. In fact, the only way to be “cool” in Guam is to find water and jump in!

As an aquatic volunteer for the I&M program, that wasn't too hard. I had the exciting opportunity to wade through the streams of Guam one week and trudge through the wetlands of Saipan the next. I accompanied aquatic ecologists Tahzay Jones (NPS) and Anne Brasher (USGS) to Guam's War in the Pacific National Historical Park (WAPA) and American Memorial Park (AMME) on Saipan in the Northern Mariana Islands to test water quality and study freshwater animals. The trip was successful, plus we made great connections with local people. Anne, Tahzay, and I, along with scientists from Guam's Division of Aquatic & Wildlife Resources, examined the physical, chemical, and biological characteristics of area watersheds. We assisted fisheries biologist Brent Tibbats in snorkel and dip-net surveys to assess diversity, distribution, and densities of freshwater animal species. Using parallel methods, we extended the surveying into WAPA streams in the following days. We took physical and chemical measurements as well as captured and released many healthy gobies, snails, shrimp, and even some eels and crabs. The information we gathered told us a lot about the health and vitality of freshwater streams in our parks. Plus being wet all day is a great way to beat the heat!

In Saipan, we navigated AMME's dense red mangrove forest. Although surrounded by development, this modest wetland area stays shaded, quiet, and fairly secluded. Only remnants of human activity, such as an old metal mess kit from WWII, remain. It was nice to see areas deep in the forest with beautiful, healthy native mangrove habitats. Also within park boundaries, we tested the city of Garapan drainage water reservoir and the near-shore marine areas where this water flows. The water tested in those areas was poor quality and contaminated with excessive nutrients and pollutants.

People need to take time to learn about these habitats, like we did, as a reminder of how beautiful and special these places really are. It may make some people think twice about what they spray on their lawns or wash down the drain.

— Danielle McKay, Aquatic Volunteer



Danielle hanging loose



I traveled to Guam and Saipan in the Northern Marianas Islands to train field crews and begin data collection for the vegetation classification and mapping project in the Pacific Island Network.

## Vegetation Mapping Log on Guam and Saipan

**January 6** — I arrived in Saipan where I was joined by War in the Pacific NHP (WAPA) and American Memorial Park (AMME) staff. We headed out into the field to investigate the different vegetation communities and identify dominant plant species. This was important to help delineate plot locations and made the aerial imagery easier to interpret. A debriefing was held at the end of each day to discuss hazards and evaluate progress.

**January 7** — We began the day with a reconnaissance of the park's wetland area and covered site selection criteria. We also collected plants to be identified later. Afterwards, we surveyed two plots in a pandanus forest and an ipomea herbland in the wetland complex.

**January 8 and 9** — Additional field work was conducted in the wetland, coastal, and recreational areas of the park. A total of six vegetation plots were recorded and 144 digital photographs were taken at AMME. We used park workstations to organize our field data, download photographs, and backup all work.

**January 12 and 13** — We began field work in WAPA in savannah, leucaena forest, riparian woodland, and coastal forest.

**January 14** — We conducted a site visit to investigate plot locations in a limestone forest. Field work here will be challenging due to the terrain steepness, density of the vegetation, and abundance of mosquitoes.

**January 15** — Training continued as we downloaded all remaining data. A total of eight vegetation plots and nine observation points were recorded and 280 digital photographs were taken at WAPA. After a debriefing, I began decontamination of all my field gear to prevent transportation of new propagules to Hawaii. Field boots were brushed, soaked in a 5% bleach solution, and air dried.

**January 17** — I arrived at my Hawaii residence the prior day, January 16, having crossed the International Date Line en route.

— David Benitez, Botanist

## Respectfully Exploring the Caves of Kalaupapa

The sculpted green sea cliffs that hug the Kalaupapa Peninsula were our first glimpse of what was to be our Kalaupapa National Historical Park (KALA) adventure. Located on the northern tip of Moloka'i, the peninsula consists of a basaltic shield of revived volcanism originating from the Kauhakō Crater. Erupting 300,000 years ago, this crater is responsible for creating the peninsula; the youngest portion of this 265 square mile island. However, the geological forces that created this peninsula have long since gone, leaving behind a view that can only be described as breath-taking.

Even as we bounced between the tortuous fingers of turbulence, gripping the thick black seatbelts of our tiny Cessna, we couldn't help but be mesmerized by the view provided by the petite window of our "bush plane." The sharp green bosoms of Hālawā, Pāpalāua, Wailāu, and Pelekūnu seemed to beckon us to this special place. A place which was chosen as a Hansen's disease colony in the mid-19th century because of its isolated nature.

Speckled with quaint houses (Kalaupapa is still home to Hansen's disease patients), coconut palms, and a barrage of beach cats, we felt as if we had taken a step back in time with our first few steps off of the plane. "Welcome to Kalaupapa" said our NPS Cultural Resources Management contact, Jennifer Cerny. She greeted us with the kind of aloha that makes you feel like you are returning home. After familiarizing us with our living quarters (we stayed in the Bay View Dorms, a wonderful historic building with a fantastic view), we set out to complete our task of inventorying Kalaupapa National Historical Park caves.

In order to fulfill I&M and KALA's needs, 17 caves were selected for inventory purposes. A pre-established protocol developed by Hawai'i Volcanoes National Park (HAVO) was followed during the inventory process.

The cave inventory consisted of identifying and documenting resources. Resource types included:

- Biological resources – Cave adapted flora and fauna
- Geological resources – Stalagmites, mineral deposits, etc.
- Paleontological resources – Fossils, charcoal, etc.
- Archeological resources – Historic and prehistoric structures and artifacts

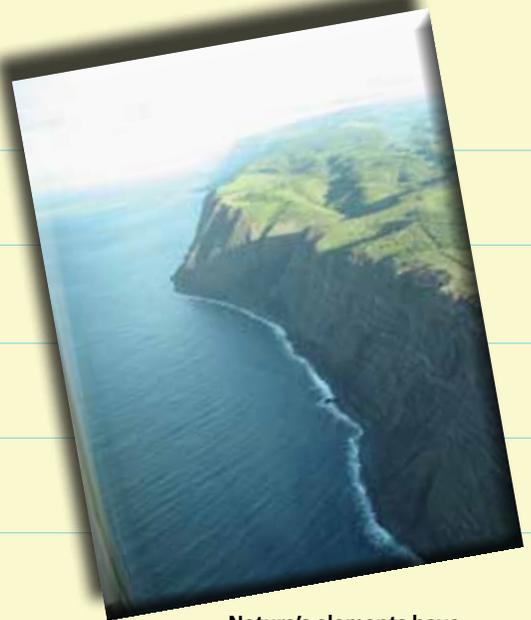
Our field work involved mapping, photographing, and taking inventory of resources in each cave. During our two weeks of cave inventory work, we identified several fauna species. One in particular, the *Oliarus kalaupapae* (pictured at bottom), was an exciting discovery because it is only found in Kalaupapa caves. Other species observed included: *Argiope appensa*, *Holocnemus pluchei*, *Salticidae* spiders, and *Periplaneta americana*. Data collected during the inventory will assist the National Park Service, Bishop Museum, and other scientists with future cave research.

— Jakhota Burrell and Kalena Blakemore,  
Archeologists

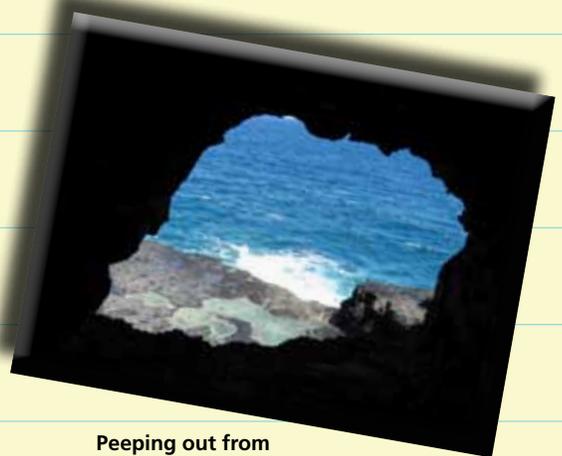


Many generations of adaptation to cave environments have aided this plant hopper, *Oliarus kalaupapae*, in its dark cave life

Spelunkers  
Burrell and  
Blakemore



Nature's elements have carved amazing features in the landscape, including caves and this majestic 2000 foot tall pali (cliff) off the north coast of Moloka'i



Peeping out from the depths of a Kalaupapa cave entrance



## Anchialine Pools are Microcosms of Life

Anchialine pools made early human settlement possible in West Hawai'i. Today, these brackish water pools play a special ecological role for other types of life.

When visitors come to West Hawai'i and see the rugged lava-covered coastline, they often perceive black rocks and little more. Many people do not understand why biologists are concerned about converting that 'barren waste land' into resorts with nice lawns and golf courses. However, apart from the intrinsic beauty those mauka (mountain) to makai (sea) lava fields possess, unique aquatic ecosystems hide in the cracks and dips of lava close to shore. In the entire US, only the state of Hawaii has these magnificent brackish water anchialine pools. Moreover, of the estimated 1000+ pools worldwide, the great majority are found on the Kona coast of Hawai'i. Kaloko-Honokōhau National Historical Park alone harbors about 160 of them. These pools were a reason that early settlement on the coast was possible as they were a primary source for fresh (albeit brackish) water. So not only are they a unique natural resource but are also a very important cultural resource.

So why not build around those pools? The pools are part of the subterranean water cycle. They are supplied with groundwater from upslope and ocean water with the incoming tide. When this water cycle is impacted by massive water withdrawal for human use, by pollutants and nutrients that enter the groundwater, or by interrupting the groundwater flow—the habitat availability for numerous unique and rare species decreases or disappears all together.

I have just started assembling the I&M Anchialine pool animals monitoring protocol. Every so often it is time to get re-acquainted with the material I'm writing about and make a field visit. Bringing lots of water (and extra salt after a near fainting spell), I accompany natural resources technician Lisa Marrack or PACN aquatic technician Lindsey Kramer when she does water quality sampling. Some pools display a red carpet of the characteristic 'ōpae 'ula (*Halocaridina rubra*) or red shrimp. Hiding in the dark corners of the pools loom their predators, a slightly larger red shrimp, the candidate endangered *Metabetaeus lohena*. There are six rare shrimp species documented in Hawaiian pools, four of which are candidates for listing as Endangered Species by the US Fish and Wildlife Service. Of these, only the *Metabetaeus* sp. have been recorded in PACN parks. I hope that one day I'll be able to add more sightings of these rare unique animals to the tally.

Snails can also be found in the pools; most common is the native pipiwai (*Theodoxus cariosus*). Crustaceans, fish (native and alien), crabs, worms, and insects inhabit the pools as well. A rare endemic pool insect to keep an eye out for is the orange-black damselfly (*Megalagrion xanthomelas*). This species has only been recorded in or near six pools in PACN parks. It completes its lifecycle in these pools, and therefore depends on them for survival.

Anchialine pools vary in size, surrounding vegetation, substrate, visible animal life, and historical use. As they are so unique in the world, I believe that it is a privilege to visit, study, and care for them.

Next time you visit the Hawaiian coastline, respectfully explore and marvel at this unique ecosystem.

— Mariska Weijerman,  
Marine and Aquatic Specialist



**These native shrimp called 'ōpae 'ula live in anchialine pools, sometimes in dense numbers**



**Native algae, *Ulva reticulata*, flourishes in an anchialine pool in Kaloko-Honokōhau National Historical Park**

**This food algae, sometimes called "sea lettuce," is easily recognized by thin, long, fettuccini-like blades with swiss cheese like holes**



**Mariska (left) and others collect GPS data at Kaloko-Honokōhau National Historical Park**



## “Fishy Whiffs”

The ultra pungent stench of tuna rose on the updrafts from Pago Pago Harbor (pronounced *pahn-go*) intoxicating bats, birds, and biologists alike. American Samoa is home to two species of fruit bats, nine shore and water birds, 22 land birds, and 28 seabirds; and the largest tuna canneries in the world. I joined I&M staff to trek about the National Park of American Samoa (NPSA) to conduct reconnaissance for monitoring fruit bats, seabirds, and land birds. In addition, we conducted an inventory survey for the sheath-tailed bat (*Emballonura semicaudata*).

Local Samoan knowledge helped us locate fruit bat roosts and flyways, and explain the cultural importance of many land and seabirds. For example, the lupe, or Pacific pigeon (*Ducula pacifica*), was traditionally hunted as a food source. Village chiefs competed to catch lupe using long-handled nets from massive stone platforms called

tia seulupe (star-mounds). We were also told that different villages favored different animals. For example, residents from Vatia, Tutuila, hunted fua’ō, the brown booby (*Sula leucogaster*), on the nearby sea cliffs, and the fua’ō is the village symbol. During fruit bat surveys we observed both species (*Pteropus samoensis* or pe’a vao; and *P. tonganus* or pe’a fanua) and found a new roost site in the Tutuila park unit. We were told that during periods of famine (e.g., after hurricanes), fruit bats come into the villages and plantations to feed.

Modified MP3 players with microphones were deployed to record the presence of nocturnal seabirds on Tutuila and Ta’u. Audio recordings failed to detect any seabirds. However, we obtained recordings of insects and several land birds. One remarkable land bird sighting was the blue-crowned lory (*Vini australis*) on the village side of Afono pass, Tutuila. This species is abundant in the Manu’a Islands, but usually absent from Tutuila.

We did not detect the sheath-tailed bat during 50+ hours of surveys using echolocation bat detectors. Although these surveys are not conclusive, the sheath-tailed bats appear to have vacated portions of American Samoa; as we did each time we caught scent of the tuna canneries.

— Rick Camp, Avian Ecologist



**Rick (center) poses in a lava lava with co-workers at the NPSA office**

## Remnants of Limestone Forest

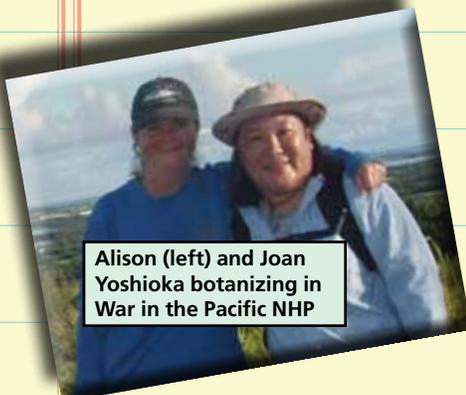
War in the Pacific National Historical Park (WAPA) on Guam is known for its memorials commemorating the campaigns of WWII; however, it also contains the only remnants of limestone forest within the National Park Service. These unique vegetation assemblages are restricted to ancient uplifted coral reef systems surrounded by a mosaic of more recent volcanic substrates. Despite Guam’s reputation as a “Petri dish” for invasive species where typical biotic interactions involve one invasive fighting another, members of the PACN vegetation protocol team (Jim Jacobi - USGS, Rhonda Loh - NPS, Joan Yoshioka and myself - University of Hawaii) were encouraged by the relative intactness of portions of these limestone forests on Guam during our visit.

We traveled to Guam and Saipan to discuss park specific vegetation monitoring needs with staff and conduct reconnaissance for focal terrestrial vegetation community and invasive species monitoring. Dwayne Minton, former resource manager at WAPA and AMME, identified limestone forests as a high terrestrial monitoring priority. The long term persistence of these forests on Guam appears to be threatened by invasive plants, animals, and wildfires. Even natural disturbances such as typhoons are threats to long-term forest integrity because they create opportunities for faster growing nonnative species such as vines. Four of the seven discontinuous WAPA units contain remnants of limestone forest. We explored two units (Mt. Alifan and Fonte Plateau) and were impressed by the dominance of native species within these communities, but were not terribly excited about the abundance of mosquitoes.

In order to gain a better perspective on the status of the WAPA limestone forests, we investigated forests along the road on the northern portion of the island. However, our walking tour was cut short by the arrival of the military police, which was not terribly surprising considering that we were adjacent to the air force base. Jim and Rhonda quickly explained to the MPs that we were innocent botanists admiring the giant native yoga trees (*Elaeocarpus joga*) along the roadside. Immediately, they relaxed and bombarded us with questions about various interesting plants they had observed around the island and recommended sites for us to visit.

We were fortunate to have the opportunity to discuss the status of Guam’s biota and invasion threats with park staff, territorial biologists, and an ecologist from the University of Guam. As a result of these discussions the vegetation monitoring protocols will be more useful to WAPA, and will also provide additional data on the status of limestone forest communities on Guam.

— Alison Ainsworth, Botanist



**Alison (left) and Joan Yoshioka botanizing in War in the Pacific NHP**

## The Alarm Sounds. Darkness All Around.

I hit snooze. Sleep. Snooze again. The bats would not wait. The White-naped fruit bats (*Pteropus tonganus*) would soon return to their collective roosts, as the Samoan fruit bats (*Pteropus samoensis*) would just be rising to start a new day.

As I splashed my face with frigid water, my heavy eyelids wondered how I would make it through a long day of field work. I heard my stomach churn and momentarily longed for a taste of the palusami (taro leaf and congealed coconut milk) I had eaten for dinner the night before. As I pulled on my gray I&M t-shirt and cap, I also began to long for the instant coffee from the infamous Seaside gas station. From Leone, the town where missionaries built the first Christian church in American Samoa, it would take between one hour to an hour and a half of pot holes and slow mini buses, to reach the much needed instant coffee.

When I finally arrived at the beloved fuel stop, the coffee was hot and the customer service was cold. But who could blame these groggy teenagers at five in the morning?

My dented rental car continued to rattle over uneven pavement until I reached my destination: a grassy spot on the side of the road in the seat of Amalau Valley. The sky was just fading from a dark indigo to a pale powdery pink as I doused my exposed neck and forearm skin in 100% DEET. The first flying fox appeared on the horizon.

In increments of ten minutes I counted the bats that soared from tree to tree. They were sampling the fruits of the *Palaquium stehlini* and *Syzygium inophylloides* while chasing one another; flirting and fighting in the day's first rays shining through the clouds. During the five minute breaks between counts, I sipped my dark, non-drip, brewed crystals; the caffeine stimulating my senses with every swallow.

During the seventh count I peered through my binoculars at a *Pteropus tonganus*, grooming its white nape. I watched as the mammal released a clump of guano onto the snag from which it hung.

Quiet. The call of the boobies and the rustle of the coconut crabs subsided. In the intimate moments that I shared with my surroundings, I realized a deeper connection between myself and the creatures I had been sent to study. Frequently the natural world cannot be confined to the columns and rows of our data sheets.

— Adam Miles, Graduate Student / Bat Biologist  
and Suzanna Welch, Volunteer



**Top:** White-napped fruit bat hanging from tree

**Left:** A fruit bat sticking out its tongue

**Right:** Adam readies surveying equipment such as the spotting scope

**Bottom:** Thickly vegetated forest typical of American Samoa



## Finding Inch-wide Wells in a 133 Acre National Memorial Park

From February 4th to 9th, 2010, scientists from the NPS Inventory and Monitoring Program traveled to Saipan to establish a groundwater monitoring station at American Memorial Park (AMME). The team included myself (Chris Rillahan stationed at War in the Pacific National Historical Park on Guam), Greg Kudray, Tahzay Jones, and Anne Farahi stationed at Hawai'i Volcanoes National Park. We were also accompanied and assisted by Scott Izuka, a hydrologist from the United States Geological Survey.

The objectives of our trip were to: (a) locate the two existing well sites, (b) place a CTD (an instrument that measures water conductivity, temperature, and depth) in each well, (c) record and survey reference marks for each well, and (d) leave the CTDs in the wells for a period of time to collect preliminary data. Although our goals were practical, there were several unknown factors that inhibited us from developing a clear methodology. For example, the two wells had not been used in twenty years.

Luckily, Mr. Victor Hocog from the AMME maintenance division was able to aid us in our search for the wells. Not only is Mr. Hocog exceedingly familiar with the grounds of AMME, he welcomes any visitor with his sense of culture and island hospitality. He even gave us some of his famous homemade Saipan coconut soup as a much-needed mid-day snack. With his assistance, we were able to find the wells within the first hour of searching. Each well was cut flush to the ground with an opening that was only one inch in diameter. These dimensions, which were previously unknown to us, made it difficult to adequately insert the CTD instruments into the wells without an external housing. We searched several hardware stores on Saipan for the materials to build the external housings, but none could be found. We therefore had to combine our ideas and previous experiences to successfully insert the CTDs into each well for the preliminary monitoring.

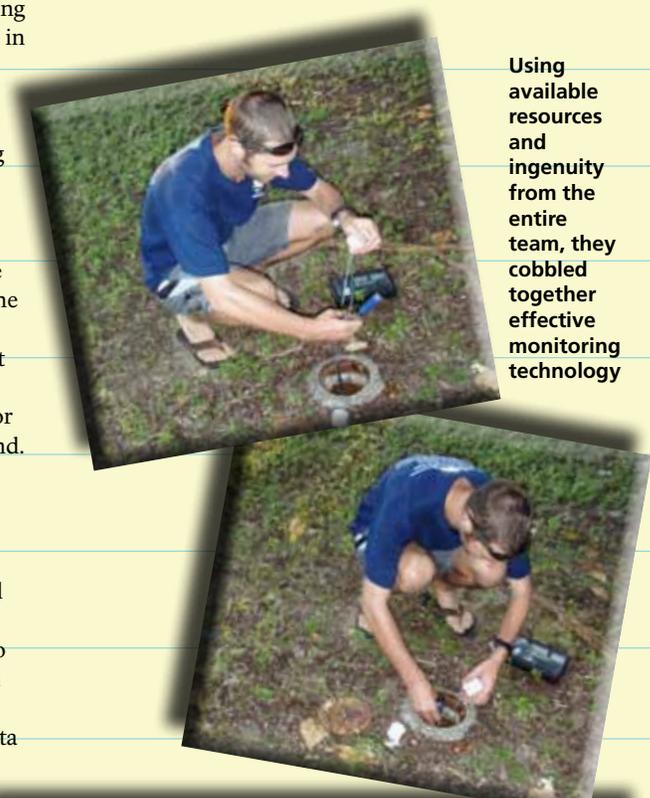
Over the next couple days our team calibrated the CTDs, measured salinity-depth profiles, and measured the depths to the water in the wells. The instruments were subsequently left to run for 24 hours to ensure that data were being collected accurately. We placed bolts in the ground near each well as reference marks in the event that they become damaged in the future. The wells were surveyed and the data recorded to establish a baseline to compare against future changes that might occur.

After the 24 hour trial period, the CTDs were placed in each well and the wells were closed. I returned after one month to collect the preliminary data and to install the specially-ordered external housings on each well. The data will be used to determine the depth at which the CTDs should be located in the wells. The instruments were then placed back inside of the wells, and data will be collected and monitored every two months in perpetuity.

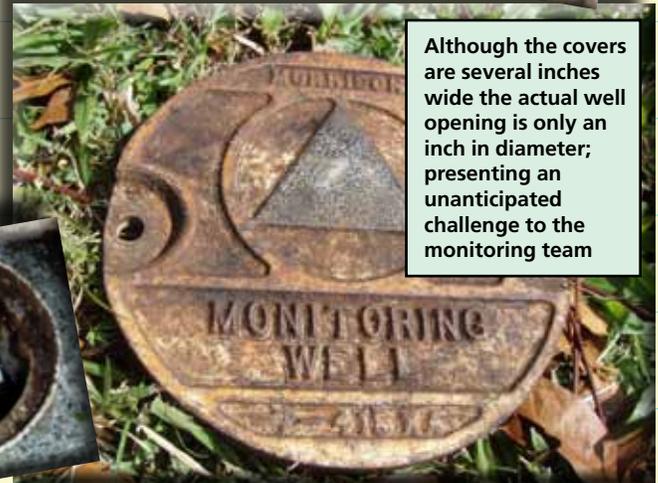
— C. Rillahan, Biotech



Chris uses surveying equipment to reference a groundwater monitoring well in front of the American Memorial Park sign



Using available resources and ingenuity from the entire team, they cobbled together effective monitoring technology



Although the covers are several inches wide the actual well opening is only an inch in diameter, presenting an unanticipated challenge to the monitoring team

