

CONSERVATION UPDATE

SAN DIEGO ZOO
INSTITUTE FOR
CONSERVATION
RESEARCH.

THE HEART AND SCIENCE OF SAVING WILDLIFE™



DELVING INTO THE SECRET LIVES OF KIWIS

Sarah Jamieson, Ph.D.,
Conservation Research Postdoctoral Fellow,
Reproductive Physiology Division

When most people hear the word “kiwi” they think of a tasty, furry fruit. However, the fruit was actually named after furry-looking, medium-sized flightless birds found only in New Zealand. Although New Zealanders hold kiwis very close to their hearts, most have never seen them in the wild because these birds are very shy and nocturnal. They spend most of the day resting in deep underground burrows or hollow logs, and as night begins to fall they slowly poke their bills out to sniff the air, relying more on their sense of smell than sight when assessing their environment. If the coast is clear, they cautiously emerge to begin their nightly routine of gorging themselves on worms and other invertebrates.

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SPRING 2011

But their secretive behaviors are not the only reason kiwis are difficult to see in the wild: they are also quite rare, with at least one species numbering fewer than 400 individuals. The reason for their low numbers is two-fold. First, the juveniles are very vulnerable to predation by introduced mammals (stoats, weasels, and ferrets), which results in more than 90 percent mortality. Second, many breeding-aged adults do not breed, and those that do often produce eggs that fail to hatch. While much kiwi conservation



The author with a successfully radio-tagged 8-day-old kiwi chick.

work within New Zealand is focused on removing the introduced predators, little has been done to determine why kiwis are poor breeders.

Last year, doctoral candidate Dawn Cummings and I joined the San Diego Zoo Institute for Conservation Research to explore the breeding ecology of the North Island brown kiwi in the wild. We moved to New Zealand to join a research team led by Dr. Isabel Castro at Massey University. Our work takes us to an isolated island in the Hauraki Gulf near Auckland, an ideal location for our study as it has one of the highest densities of kiwis in the world and is free of their main predators. We currently have 40 birds tagged with radio transmitters that allow us to locate them using radio-telemetry.

Dawn and I work together as a team to unlock the secrets of kiwi breeding. She concentrates on their physiology, while I focus more on the behavioral aspects of reproduction. The breeding ecology of brown kiwis is fascinating: females lay 1 to 2 eggs that each weigh about 20 percent of their body mass—the equivalent of a 130-pound woman giving birth to a 26-pound baby! The males then incubate the eggs for 2.5 to 3 months without any help from the females.



typical kiwi burrow entrance

Emilia Broberg

We are studying how blood hormone levels vary over the annual reproductive cycle as well as differ between breeding and nonbreeding birds. We are also interested in whether these hormone dynamics correspond to the behavioral changes we observe in the birds. By documenting body mass dynamics throughout the year and comparing the amount of time birds spend foraging before, during, and after breeding, we can better understand how kiwis cope with the substantial energetic investment needed for breeding. Dawn and I have just finished our first year of

fieldwork and are in the process of analyzing our samples and data. We are eager to improve and expand our studies based on our results, then get right back into the field!

Working with kiwis can be a bit of a challenge. They like to hide in very deep holes and live in areas that tend to be very steep and wet, not a good combination for clumsy researchers! Despite this, conducting research in New Zealand has been an incredible experience. Watching these amazing birds—their heads bobbing back and forth while continuously sniffing the forest floor for a juicy worm, surrounded by shrubs and trees found nowhere else on the planet—is like catching a glimpse into another world. Every time I hear a kiwi calling in the night I am thankful for this opportunity, and I hope that the information we collect will ensure that future generations will be lucky enough to experience the call of the wild kiwi. 🌿



Doctoral candidate Dawn Cummings prepares to take a blood sample from an adult female kiwi.

Camille LeCointre

MEET A CONSERVATION RESEARCHER

Lance Miller, Ph.D., Scientist, Behavioral Biology



Ken Bohn/SDZ

With the unusual array of items in his office, it's clear that Dr. Lance Miller either has a really cool job or strange taste in workplace decor. Not many scientists stock their shelves with extracts (banana, mint, and orange), perfumes, distilled water, and spray bottles for research purposes. But for Lance, these items are as important to his work in the Behavioral Biology Division as sharp knives are to a chef. "We are doing exciting work with our large felids and documenting individual and species-specific scent preferences," Lance said. "Environmental enrichment helps keep animals in zoos physically and psychologically healthy, by promoting natural behaviors like play and exploration."

Born in Chicago, Lance grew up going to the Brookfield Zoo with his parents. And he saw his first Pacific white-sided dolphin at the Shedd Aquarium (years later, he was elated to see them in the wild!), a species that remains one of his favorites. He is also a diehard Cubs fan, enduring "30 years of heartache" with his team! Lance completed his undergraduate work in biology and psychology at Rollins College in Winter Park, Florida. Although the biology of animals was interesting, Lance was motivated by why they do what they do and also discovering the processes underlying behavior and cognition. Pursuing this approach led him to the University of Southern Mississippi and into a doctoral program in experimental psychology. "This field is fascinating to me because it focuses on animal behavior. I am interested in species and individual preferences, which can then provide better enrichment opportunities in a zoo setting," explained Lance. He wrote his dissertation on how dolphin shows and interaction programs affect dolphin behavior and evaluated their educational value for people.

As a scientist, Lance's goal is to "make a difference in animal care and management, which can ultimately lead to increased reproductive success for many endangered species." He attributes much of his success to his parents, who have always been supportive of his endeavors. "Without them, I wouldn't be where I am," he added. These days, Lance misses being out on the water studying dolphins and sea turtles, but he is really enjoying his time at the Institute. "The numbers of different species at the Zoo and Safari Park are amazing," he said. "It's really exciting to be a part of an organization that is science-driven and really makes an impact on saving endangered species and advancing animal management."

Music is a big part of his life, with Widespread Panic being his undisputed favorite band and the Beatles a close second. His new hobby is cooking, especially Cajun cuisine made from scratch. Lance is getting married in October to a woman he met while waiting for class to start the first day of graduate school. That sounds like an "olfactory love song"! 🌿

A Loss for Bear Conservation

Wilbur Mamani Delgado, aged 23, of Culebrayoc, Peru, was killed in a motorcycle accident on November 27, 2010, near his home. Wilbur had worked with our Andean bear program for nearly two years, beginning as a local logistical assistant but gaining progressively more skills and responsibility as well as participating in biodiversity research with other teams in the area. He is survived by his wife, Christina, their young children, Jessica and Royer, and numerous other family members. Wilbur was a good man and friend on his way to being a strong force for conservation in the area. He will be missed.



Russ VanHorn, Ph.D.



A burlap sack filled with meat becomes “prey” for this young tiger and encourages natural behavior.



Lance Miller, Ph.D.

GPS collar



Ken Bohn/SDZ

A Safari Park lioness quickly “hunts” the cardboard giraffe and finds the meat inside.

The
SCIENCE
of
ANIMAL MANAGEMENT
PROMOTING
NATURAL
BEHAVIOR

LANCE MILLER, PH.D.,
Scientist,
Behavioral Biology Division

Photos by Ken Bohn,
San Diego Zoo Photographer

The San Diego Zoo and San Diego Zoo Safari Park have always been committed to the welfare of animals. So what better way to continue that commitment than to develop a research program dedicated to the science of animal management? In the Behavioral Biology Division, we have been working closely with the Collections Husbandry Science Department to create a program examining the behavior and welfare of animals within the collection. Our goal is to provide the highest quality of care, increase the reproductive success of endangered species by meeting both their physical and psychological needs, and ensure that our guests have a chance to see some amazing animals engaging in natural behavior.

One of my first projects involved examining the walking rates of African elephants at the Safari Park. Working with the elephant animal care team and Behavioral Biology staff, we were able to determine walking rates using collars equipped with GPS units specifically

designed for our elephants. We found that our elephants walk similar distances within a 24-hour period when compared to wild elephants. Typically, wild elephants will only walk distances greater than those seen at the Safari Park when searching for food or water in times of severe drought. This suggests that with proper animal management, zoo elephants can receive enough exercise to live a long and healthy life as educational ambassadors for their wild counterparts.

More recently, I started an environmental enrichment project for some of our large felid species: lions, tigers, and cheetahs. Providing environmental enrichment creates opportunities for species-appropriate behavior: it offers choices to animals and gives them greater control over how they interact with their surroundings. In particular, by providing opportunities for exploration and play, we hope to enrich the lives of the animals in our care, ultimately leading to enhanced welfare and breeding success.

In this project, I use techniques that lead our lions to choose between two different objects to determine which items they prefer. Our animal care experts set up an indoor enclosure with two different enrichment items, for example, a gourd and a pine log, and then we allow the animals, one at a time, to interact with these objects and choose their favorite. Our goal is to determine the preferred items that produce species-appropriate behaviors. We have now suc-

cessfully completed all of our trials with lions and are working hard to complete the tiger and cheetah trials.

So far, the results are interesting and varied between male and female lions. We found that lionesses spend the majority of their time with moveable objects that can be “hunted” (for example, gourds). However, the male lion almost always scent marks on the acacia and other browse clippings we provide. These contrasting results make sense when we relate them back to the natural history of lions. In a wild pride, female lions are the hunters and males often scent mark their territories. By providing our lions with gourds and browse, we allow both sexes to engage in the behaviors that come naturally to them. Learning about individual and species’ differences allows us to provide the highest quality of care for our animals as well as share our findings with other institutions.

Moving ahead, we will develop and evaluate new tools so the animal care staff can continuously monitor animal behavior at the Zoo and Safari Park. This will help us better understand how changes in animal management routines can positively affect their welfare. We will also continue to collaborate with other zoos and universities in order to share results and resources. It is only through science-based management that we will better understand the behavioral needs of these amazing animals to ensure they are both physically and psychologically healthy. 🌿

Author’s note: I would like to thank the Collections Husbandry Science Department staff at the San Diego Zoo Safari Park, without whose hard work and dedication to improving animal welfare this research would not have been possible.

Building an Archive of Understanding

Maggie Reinbold,
Conservation Program Manager,
Conservation Education Lab

Because applied conservation experience is so hard to come by, especially for younger students, the Conservation Education Lab at the San Diego Zoo Institute for Conservation Research is playing a vital role in our community. In our state-of-the-art research laboratory, more than 10,000 students from kindergarten to graduate school have learned firsthand about the tools and techniques that our scientists use to save plants, animals, and habitats in our own backyard and around the world.

Working alongside innovative conservation educators Robin Keith and Corrin LaCombe, students visiting the Conservation Education Lab explore and examine some of the most pressing conservation issues of our time. They are learning about the complex set of factors that contribute to the global bushmeat crisis and are discovering how we use tools such as DNA barcoding and the resources of the Frozen Zoo® to combat the illegal trade in rare species. Students are discovering the importance of audio communication for a variety of animals and even creating their own digital recordings of species at the San Diego Zoo Safari Park, in addition to exploring our use of remote monitoring techniques to study animal “conversations” from thousands of miles away. They are learning about our efforts to address the worldwide decline of amphibian species, our planet’s most devastating mass extinction crisis. They are learning about the ways our scientists determine if and when animals are ready to breed, and also how they are constantly working to enhance reproductive success and recruitment.



Corrin LaCombe

Robin Keith helps a curious middle school student master the art of loading a gel.



Robin Keith

Corrin LaCombe (second from right) mentors 7th and 8th grade students every summer as part of our “Wild CSI” Summer Camp experience.

Teachers interested in bringing a class to visit the Conservation Education Lab are encouraged to contact us at 760-747-8702, ext. 5756.

Here students explore the potential effects of industrial noise on polar bear denning habits in the Arctic and are fascinated to discover the many important insights that we gain from working with bears at the San Diego Zoo. They have the opportunity to try out some of the methods that our scientists use to monitor species and ecosystems right here in San Diego County, such as cactus wrens and coastal sage scrub. They are also learning to see nature in a new light: as a great teacher of effective design and efficient process, which encourages thinking about ways that we as humans might be able to borrow some of nature’s best ideas and adapt them in the field of biomimicry. And they are learning about the overwhelming time, energy, and monetary commitment needed to recover even a single species, embodied

through the iconic conservation success story of the California condor. Most importantly, our visiting students are empowered with tips on how they can help with each conservation challenge, thereby enlisting them in the fight to save biodiversity across the globe.

We hear back from visiting students and teachers every week and the consensus is clear: the Institute’s Conservation Education Lab offers a truly unique experience in conservation research and is preparing students to confidently address the conservation challenges of our time. 🌿



Ken Bohm/SDZ

CONSERVATION ACHIEVEMENTS

HONORS AND AWARDS

We received the **Partners in Conservation Award** from the United States Bureau of Land Management for the Applied Plant Ecology Division’s role in the Seeds of Success program.

We were a partner institution on this year’s Association of Zoos and Aquarium’s **International Conservation Award** for our collaborative work in support of the El Valle Amphibian Conservation Center in Panama.

WILD/COAST/COSTASALVAJE field staff for our Baja California Condor Recovery Program received the annual **Conservation Award** from the Mexican government’s Commission of Natural Protected Areas.

San Diego Zoo Global was a winner in the 2010 **Waste Reduction Award** Program of the California Department of Resources Recycling and Recovery.

THE SCIENCE OF SAVING SPECIES™

Ellstrand, N. C., D. Biggs, A. Kaus, P. Lubinsky, L. A. McDade, K. Preston, L. M. Regan, V. Rorive, **O. A. Ryder**, and K. A. Schierenbeck. 2010. Got hybridization? A multidisciplinary approach for informing science policy. *BioScience* 60: 384-388.

In this paper, a multidisciplinary group explores the growing problem of hybridization as a challenge to the integrity of species’ gene pools.

Schrenzel, M. D., C. L. Witte, J. Bahl, T. A. Tucker, N. Fabian, H. Greger, C. Hollis, G. Hsia, E. Siltamaki, and B. A. Rideout. 2010. Genetic characterization and epidemiology of helicobacters in non-domestic animals. *Helicobacter* 15: 126-142.

This study evaluates 154 collection species for the presence of helicobacters, characterizes genetic diversity of these pathogens across species, and documents patterns of interspecies transmission.

Swaigood, R. R. 2010. The conservation-welfare nexus in reintroduction programs: a role for sensory ecology. *Animal Welfare* 19: 125-137.

This paper explores how integrating behavioral and ecological disciplines can be used to further conservation and welfare goals in animal reintroduction programs.



Ken Bohm/SDZ

CONSERVATION RESEARCH GIFTS AND GRANTS

The Institute for Conservation Research is grateful to the following for their investments in imperiled species conservation:

An **Anonymous Foundation** funded a microscope for the Reproductive Physiology Division. The **Arcus Foundation** made a three-year commitment to conservation field research in the Ebo Forest of Cameroon. A grant from the **Beckman Coulter Foundation** will provide field trip visits for Fullerton High School science students. The **Broadcom Foundation** gave a grant for GPS equipment and donated computers for giant panda field research in China. The **Daphne Seybolt Culpeper Memorial Foundation** gave a grant to the Wildlife Disease Laboratories for the purchase of a microscope. The **Virginia Friedhofer Charitable Trust** gave a grant to sponsor two Summer Student Fellowships in 2011. A grant from **Genentech** will allow teachers to attend the 2011 Teacher Training Institute. The **Heller Foundation of San Diego** awarded a grant for a 2011 Bud Heller Conservation Fellowship in the Applied Animal Ecology Division, for California condor reintroduction. A grant from the **Helm Fund** at the San Diego Foundation will sponsor a 2011 Summer Student Fellow. The **Caesar Kleberg Foundation for Wildlife Conservation** gave a grant to the Genetics Division to purchase two incubators, cameras, and software upgrades for the Frozen Zoo® and laboratories. A grant from the **Lakeside Foundation** will advance field conservation of the California condor and the Andean bear through the Applied Animal Ecology Division. **Life Technologies Corporation** donated a PCR machine for the Molecular Diagnostics Lab and funding for middle school teachers to attend the 2011 Summer Teacher Workshops in Conservation Research. A grant from the **McCarthy Family Foundation** will benefit local school groups to visit the Conservation Education Lab. The **Armstrong McDonald Foundation** gave a grant in support of the Reproductive Physiology Division. **Jean Schiro-Zavela and Vance Zavela** contributed to California condor recovery. A grant from the **Conrad Schlum Charitable Trust** will provide a Schlum Fellowship in seed banking through the Applied Plant Ecology Division. The **John and Beverly Stauffer Foundation** gave a grant to support the work of the Genetics Division and the Frozen Zoo®. A grant from the **Strauss Family Foundation** for the Wildlife Disease Laboratories Division made possible the purchase of laptops and specialized software for diagnostic investigations. The **Alice C. Tyler Perpetual Trust** gave a grant for science classes from low-income school districts in Los Angeles and Orange counties to participate in field trips to the Conservation Education Lab.

In February 2011, the trustees, their spouses, and staff of the Arthur Vining Davis Foundations joined us for a site visit at the Arnold and Mabel Beckman Center and the San Diego Zoo Safari Park. The Arthur Vining Davis Foundations, based in Jacksonville, Florida, gave us a three-year grant in support of our Summer Teacher Workshops in Conservation Research. Thanks to their generosity, 90 high school teachers from all over the United States participated in this inquiry-based, hands-on teacher training program for the life sciences. One of the visit’s highlights was meeting Majani the cheetah with animal trainer Kim Hanley.

WHAT'S NEW IN CONSERVATION RESEARCH



CONSERVATION UPDATE

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Ken Bohn/SDZ

Two of our long-standing island conservation restoration efforts reached key milestones with the release back to the wild of the Hawaii Endangered Bird Conservation Program's 200th puaiohi and the Caribbean Regional Program's 125th Anegada iguana.

In the first known study of *in vitro* fertilization in gemsbok, up to 47 percent of oocytes fertilized *in vitro* by our reproductive physiology researchers successfully formed embryos.

Our Wildlife Disease Labs identified more than 30 species of hoofed animals that carry malignant catarrhal fever, including the characterization of 45 novel virus strains, and will use this information to help prevent disease outbreaks.



Ken Bohn/SDZ

Researcher Megan Owen served as a panelist for Polar Bears International's Tundra Connections, which broadcasted discussions and presentations from the field on polar bears, their conservation status, and climate change impacts on sea ice.

As part of a nationwide project to collect native plant seeds for restoration and long-term conservation, our Bureau of Land Management Seeds of Success interns provided 22 seed collections to the USDA Forest Service Seed Extractory.

Our partner, Elephants Without Borders, successfully deployed another five satellite data collars on elephants in Namibia and Botswana as well as launched a new aerial survey to count elephants, wildlife, and trees over 88,000 square kilometers.

Our geneticists developed a low-cost, easy-to-use molecular tool that will help to improve management of captive and wild populations of two-toed sloths by allowing species identification and detection of hybrids.

Support the San Diego Zoo's conservation efforts by joining the Global Action Team at WWW.GLOBALACTIONTEAM.ORG.

CONSERVATION UPDATE

SAN DIEGO ZOO
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THE HEART AND SCIENCE OF SAVING WILDLIFE™

COCHA CASHU CACHET

A Peruvian Field Station Extraordinaire

Ron Swaisgood, Ph.D.,
Director of Applied Animal Ecology,
Brown Endowed Chair

I sit spellbound in a primeval forest abundant with all forms of life that once roamed the Earth free of human presence. Soon the animals move closer to me, passing over like animated waves through the trees. A large group of white-lipped peccaries rushes through first. I find myself enveloped as they snort and root and clack their tusks. The next wave is a group of squirrel monkeys, leaping from one palm frond to another. Moments later I am standing under a cathedral-like fig tree, staring at a group of spider monkeys staring back at me. The tree alone is awe-inspiring, its huge branches spreading out in all directions, buttressed by aerial roots that plummet to the ground like stalactites. The monkeys above me are truly amazing creatures, moving through the branches with acrobatic ease—and they're also curious!

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SUMMER 2011



This is one of the last places on Earth where nature reigns supreme.

Ken Bohn/SDZ



Ken Bohn/SDZ



Russ Van Horn, Ph.D.

After flying in to Manu, Peru, it takes a good two days of river travel to reach Cocha Cashu.



Ron Swaisgood, Ph.D.

The field station's single rustic building will be expanded to accommodate more visiting researchers.

PATRICIA ALVAREZ, Ph.D. HELPING BUILD A STRONG PARTNERSHIP

The key ingredient to any good partnership is the ability to understand the perspectives, goals, and vision of each of the partners. Recently, the San Diego Zoo Institute for Conservation Research entered into a cooperative partnership with the Peruvian National Service for Protected Areas of the Ministry of the Environment to operate the Cocha Cashu Biological Station in Manu National Park. A key player in the process was the current Station Director for Duke University, Patricia Alvarez, Ph.D. A Peruvian postdoctoral fellow at Duke University and a longtime alum of Cocha Cashu, Patricia was instrumental in brokering the agreement between the parties and played a key role in helping each understand the perspectives of the other. In the end, a strong partnership was formed, agreements were signed, and everyone was pleased with the outcome. Thank you, Patricia!



Such are the scenes that play out daily in the deep forests of Manu National Park in southeastern Peru. This rhythm of life and death has repeated itself uninterrupted for eons. Manu has changed little in the last few thousand years since the rise of human civilization. This is one of the last places on Earth where nature reigns supreme.

Looking Back

I am here with colleagues from the San Diego Zoo Institute for Conservation Research, Alan Lieberman and Dr. Russ Van Horn, at the invitation of Dr. John Terborgh, one of the world's most distinguished tropical ecologists. Thirty years ago John came to this remote corner of the Earth to begin work at a field station, Cocha Cashu, located on the shore of

a small oxbow lake. Over time, Cocha Cashu has established a reputation for ecological research surpassed by none. The unique selling point of Cocha Cashu is its pristine nature, affording an unrivalled opportunity to study natural processes that are undisturbed by human influence. For the Amazon, this is the place to study nature as it should be. It provides a baseline, a goal for us to strive for when attempting to recover other areas degraded by human activity. For me, it has always been the Holy Grail—the ultimate place to experience wild nature.

Taking on a Legacy

So, why are we here? John is retiring and looking to pass the baton to someone else: the field station needs a new administrator, a new scientific

team to carry on the legacy. Imagine my surprise when one Sunday afternoon nearly two years ago I found an e-mail from John Terborgh waiting in my inbox. He had learned of our work with Andean bears in the region and knew of our Institute's fast-growing reputation for conservation science worldwide. John thought it worth exploring the possibilities of a regime change, with San Diego Zoo Global at the helm. I can never adequately convey the deep sense of honor—and responsibility—that comes with John's overture.

We're Onboard!

Fast-forward a year and Alan and I have just returned from another trip to Peru. This time we had reached a major milestone—a signed agreement with the Peruvian government parks

authority to run Cocha Cashu for the next 10 years...and longer. Now, our work is about to begin. Our primary goal is to revitalize the scientific program at Cocha Cashu and build conservation capacity in Peru by improving infrastructure and promoting scientific research, contributing to the knowledge and conservation of biological diversity. We will develop an education, outreach, and training program that will create more demand for the field station while fostering the development of the next generation of conservation scientists.

A Naturalist's Dream

In addition, we will develop our own research program as a model of field station-based science. Our plan is to tackle some of the keystone species, for example, illuminating the cascading effects that top predators like jaguars, harpy eagles, and giant otters have on the ecosystem. This is right in line with our mission at the Institute: we are working diligently to save as many species as possible that make up the puzzle of life. When we strive to rescue the condor, the giant panda, or the kangaroo rat, we are bringing back species that play key roles in maintaining the web of nature, an ecosystem's balance. The future is uncertain, but one thing is sure: we will have stories to share for years to come, because Manu is a magical place—a naturalist's dream. 🌿



Ken Bohn/SDZ

A NEW ERA FOR THE FROZEN ZOO®: CONSERVATION GENOMICS

OLIVER RYDER, Ph.D., DIRECTOR OF GENETICS, KLEBERG ENDOWED CHAIR

I've been asked many times, "Isn't it an exciting time to be a geneticist?" My answer is "Yes!" It is an exciting time, and the current burst of effort devoted to the field of genome biology—based on determining the genome sequence of species—is particularly exhilarating for a conservation geneticist. Since the discussion began to establish the Human Genome Project, I have felt that there should also be an effort to use this technology to benefit threatened and endangered species. Now, the Frozen Zoo® is contributing to scores of genome-sequencing projects through our involvement in the Genome10K Project, an unprecedented effort to assemble 10,000 whole genome sequences representing the diversity of fishes, amphibians, reptiles, birds, and mammals.

There is a widespread belief among biologists that genomic studies will lead to advances in understanding many aspects of biology. Much of the impetus for developing genome-sequencing technologies came from an effort to better understand the genetic basis for human health and disease, and this knowledge can now be applied to other species. New insights into infectious diseases, identification of genes associated with disease risks, the role of genetic variation in adaptation to changing environments, and the effect of genes on variable attributes such as athletic abilities and digestive capabilities will be coming soon.

Students visiting the San Diego Zoo Institute for Conservation Research live in a world of expectation that there will be significant new insights into how the DNA blueprint of an organism directs the workings of the cell, the development of an organism, and its interaction with the environment. As genome sequences for other species have become available—and there are now over 30 well-characterized mammalian genomes—practical applications are already becoming a reality.

The genome sequence of the dog confirmed that they were domesticated from wolves, but it was a surprise to learn that genes introduced from domestic dogs have benefited wild populations of wolves. A gene variant



Ken Bohn/SDZ

that produces black coat color has been introduced from domestic dogs into Arctic wolves, because dark wolves have an advantage over lighter-colored wolves in forests. The horse genome sequence is helping identify the genetic basis for heritable diseases in domestic horses and also provides new insights into the evolutionary differences and similarities between domestic horses and their closest wild relative, the Przewalski's horse.

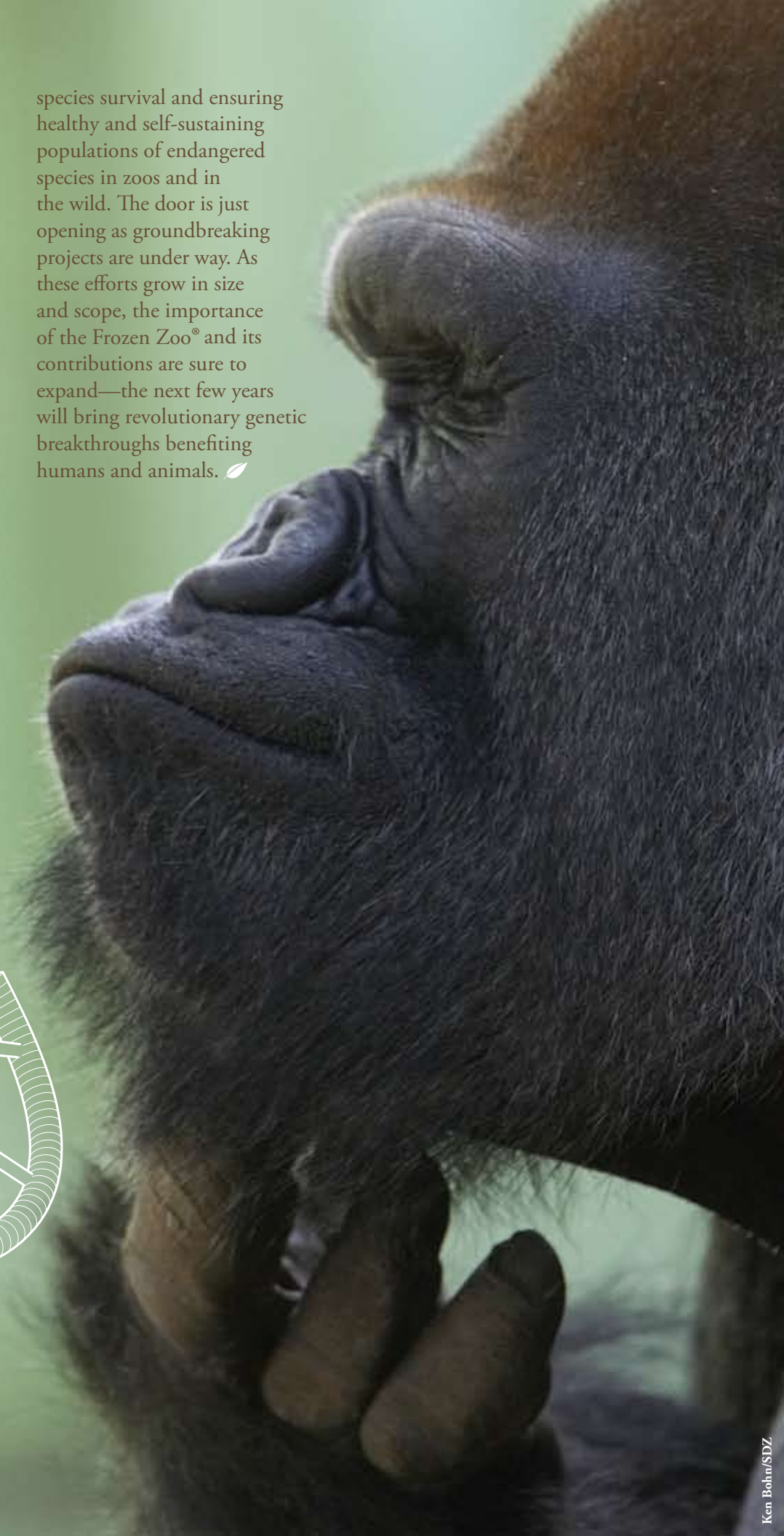
In zoos, black rhinos have developed iron storage disorders that have impacted their longevity. The Human Genome Project has

identified a number of genes that influence the ability to take up, transport, and manage iron across the cells of the body. Knowledge of the genetic basis for the pathways of normal iron metabolism and iron metabolism disorders in humans is now being applied to the black rhino. Advancing these studies will ultimately require the complete genome sequence of the black rhino. Using the resources of the Frozen Zoo®, completion of whole genomes for several species of rhinos is just around the corner.

Cardiovascular disease is a common illness and cause of death in great apes, just as it is for people. Human and great ape genome studies complement one another and together stand to broaden our views of cardiac health and disease for both people and great apes. As new studies are being designed, the hundreds of great ape DNA samples secured in the Frozen Zoo® will be a critical resource.

While we can be confident that scientific advances in genome biology will follow, we feel the urgency to direct our efforts toward

species survival and ensuring healthy and self-sustaining populations of endangered species in zoos and in the wild. The door is just opening as groundbreaking projects are under way. As these efforts grow in size and scope, the importance of the Frozen Zoo® and its contributions are sure to expand—the next few years will bring revolutionary genetic breakthroughs benefiting humans and animals. 🌿



Ken Bohn/SDZ

A VIBRANT POSTDOCTORAL FELLOWSHIP TRAINING PROGRAM

Cynthia Steiner, Ph.D.
POSTDOCTORAL ASSOCIATE,
GENETICS DIVISION

As a postdoctoral associate working in the Genetics Division at the San Diego Zoo Institute for Conservation Research, I arrived in 2008 from the University of Montpellier II, France, where I studied the molecular evolution of South American marsupials. At the Institute, I am part of a collaborative effort with other institutions that is searching to define the evolutionary history and relationships of mammals, a project known as "Assembling the Mammalian Tree of Life." My interests encompass reconstructing the evolutionary tree of highly endangered species, such as rhinoceroses, tapirs, and Przewalski's horses, in order to establish an appropriate context for species identification. Using the resources of our Frozen Zoo® (DNA, tissue, and cell samples), I study patterns of genetic variation between and within species. This plays a crucial role in conservation by allowing us to define species' boundaries and identify conservation priorities in the field.



Ken Bohm/SDZ

Population declines of the desert tortoise in the western Mojave Desert resulted in the U.S. federal government listing them as threatened in 1990. One factor contributing to their decline is disease. San Diego Zoo Global is managing a growing population of captive desert tortoises in Las Vegas at the Desert Tortoise Conservation Center. These animals are to be released back to the wild to benefit conservation of the species. However, because of their diverse backgrounds and possible contact with other species during captivity, whether reptile or mammal, they may be carriers of disease agents. My postdoctoral research focuses on assessing the health status of these animals and learning about the diseases that affect the population. Using postmortem examinations and molecular tools, my colleagues and I have identified bacterial and viral pathogens causing respiratory diseases. This knowledge will benefit the development of prerelease health-screening protocols and support a healthy, sustainable desert tortoise population in the wild. 🌿

Josephine Braun, D.V.M.
POSTDOCTORAL ASSOCIATE,
WILDLIFE DISEASE LABORATORIES



Ken Bohm/SDZ



CONSERVATION ACHIEVEMENTS

Ken Bohm/SDZ

HONORS AND AWARDS

The Institute's Hawaii Endangered Bird Conservation Program was honored with the Association of Zoos and Aquariums (AZA) **Avian Scientific Advisory Group's Plume Award** for significant achievement in avian husbandry of critically endangered Hawaiian birds.

Dr. Barbara Durrant, Director of Reproductive Physiology, was elected **Vice President of the Foundation Board of the International Embryo Transfer Society**.

THE SCIENCE OF SAVING SPECIES™

Frederick, C., R. Kyes, K. Hunt, D. Collins, **B. Durrant**, and S. Wasser. 2010. Methods of estrus detection and correlates of the reproductive cycle in the sun bear (*Helarctos malayanus*). *Theriogenology* 74: 1121-1135.

This multi-institutional collaboration between eight North American zoos describes the estrous cycle of the Malayan sun bear (*cub pictured above*) through vaginal cytology, behavior and physiological observations, and steroid hormone analysis.

Lopez-Toledo, L., C. Gonzalez-Salazar, D. F. R. P. Burslem, and M. Martinez-Ramos. 2011. Conservation assessment of *Guaiacum sanctum* and *Guaiacum coulteri*: Historic distribution and future trends in Mexico. *Biotropica* 43: 246-255.

This paper presents a framework that can be used to assess rates of habitat loss and the conservation status of threatened species of trees.

Niu, K., **C. L. Tan**, and Y. Yang. 2010. Altitudinal movements of Guizhou snub-nosed monkeys (*Rhinopithecus brelichi*) in Fanjingshan National Nature Reserve, China: Implications for conservation management of a flagship species. *Folia Primatologica* 81: 233-244.

An investigation of altitudinal movements by Guizhou snub-nosed monkeys showed a daily movement pattern reflecting the need to find food and avoid predation within mixed evergreen and deciduous broadleaf forest habitats.

CONSERVATION RESEARCH GIFTS & GRANTS

The Institute for Conservation Research is grateful to the following for their investments in imperiled species conservation:

The **Annenberg Foundation** continued its five-year commitment to provide low-income school districts in Los Angeles with visits to the Conservation Education Lab as well as to assist with Institute operating costs. An **Anonymous Foundation** made a three-year commitment to advance the Hawaii Endangered Bird Conservation Program. A grant from the **Bay and Paul Foundations** will assist the Reproductive Physiology Division with a study of the reproduction, health, and habitat of the whiptail lizard. A gift from **Carolyn and Bob Condon** will support research work in Cocha Cashu, Peru. Educational posters for locals in the Ebo Forest area of Cameroon have been provided by **Berggorilla and Regenwald Direkthilfe**. Supplies for the Wildlife Disease Labs have been provided by a grant from the **Albert and Madeline Brandi Family Foundation**. Grants from the **Butcher Fund**, the **McBeth Foundation**, and the **Rozella E. O'Bryant Animal Fund** at the San Diego Foundation will make possible the purchase of an RNA/DNA extraction system for disease diagnosis at the Wildlife Disease Labs. The **Foundation for Sustainability and Innovation** will sponsor a 2011 Summer Fellow at the Institute. A grant from the **International Iguana Foundation** was given for Fiji iguana genetics studies. A grant from the **Llagas Foundation** will assist with recovery of the mountain yellow-legged frog. The **Margot Marsh Biodiversity Foundation** awarded a grant in support of the snub-nosed monkey ecology field research project in China. Grants from the **Money/Arenz Foundation** and the **C. Neil and Carolyn Norgren Foundation** are advancing conservation of the Andean bear in Peru. The **Moore Family Foundation** awarded a three-year grant for recovery of the alala through the Hawaii Endangered Bird Conservation Program. The Reproductive Physiology Division received support through the **NOJ Foundation**. The **Otay Mesa Grassland Mitigation Fund** at the San Diego Foundation gave a grant for San Diego County burrowing owl (*pictured below*) and habitat ecosystem recovery. Gifts from **Patricia Beckman** and from the **Takahashi Family Fund** at the San Diego Foundation will assist with the BE WiSE (Better Education for Women in Science and Engineering) science overnight for middle school girls at the Beckman Center. The 2011 Summer Fellowship program will benefit from a grant from the **Don and Marie Van Ness Fund** at the San Diego Foundation. A grant from the **Walton Family Foundation** will contribute to the Institute endowment and provide charter school visits for low-income students at the Conservation Education Lab.



Ken Bohm/SDZ

WHAT'S NEW IN CONSERVATION RESEARCH



CONSERVATION UPDATE



Ken Bohn/SDZ

Our Applied Plant Ecology team planted 10,000 native grass seedlings as part of a collaborative effort to restore habitat in support of Stephens' kangaroo rat translocations in southwestern California.

In China, our behavioral biologists are using infrared camera technology to monitor the altitudinal movements of Guizhou snub-nosed monkeys to help design effective conservation management plans for their survival.



Ken Bohn/SDZ

Our geneticists are preparing an enriched microsatellite DNA library that will enable detailed studies of genetic variation across Southern California populations of the coastal cactus wren.

A Memorandum of Understanding was signed with the Peruvian government formally granting us management responsibility for Cocha Cashu Biological Station in Manu National Park, one of the most biodiverse lowland rain forests in the world.

In collaboration with our Vietnamese colleagues, we produced and distributed a 2011 educational lunar calendar to more than 3,000 households in the villages surrounding the Tonkin snub-nosed monkey species/habitat conservation area in Ha Giang, Vietnam.



Ken Bohn/SDZ

The Desert Tortoise Conservation Center provided the first training course designed to standardize the way health assessments of wild desert tortoises are conducted across their range and ensure that well-informed decisions are made regarding tortoise translocations.

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For more information about the San Diego Zoo's global conservation efforts and how you can help us in our fight against extinction, please visit our Web site, WWW.SANDIEGOZOO.ORG/HOPE.

CONSERVATION UPDATE

SAN DIEGO ZOO
INSTITUTE FOR
CONSERVATION
RESEARCH.

THE HEART AND SCIENCE OF SAVING WILDLIFE™



Robbie Whyrock

IMPROVING CONSERVATION By Empowering Passionate People

Bethan Morgan, Ph.D.
Central Africa Program Head

There is more to our Central Africa Program than simply conducting research and conservation activities in the remaining rain forests of southwestern Cameroon. The way that we work toward our conservation goals is by empowering our national staff to reach their full potential, by conducting fieldwork in the forest, working with local communities, and by expanding their understanding of the science behind conservation.

We have been working in Cameroon for a decade, conducting much of our detailed research work in the biodiverse Ebo Forest. Our three research stations are each permanently staffed by a team of five people, who usually spend 2- to 3-week stints in the forest observing study animals, recording their vocalizations, and documenting animal signs, such as dung and footprints, along a series of transects through the forest.

FALL 2011

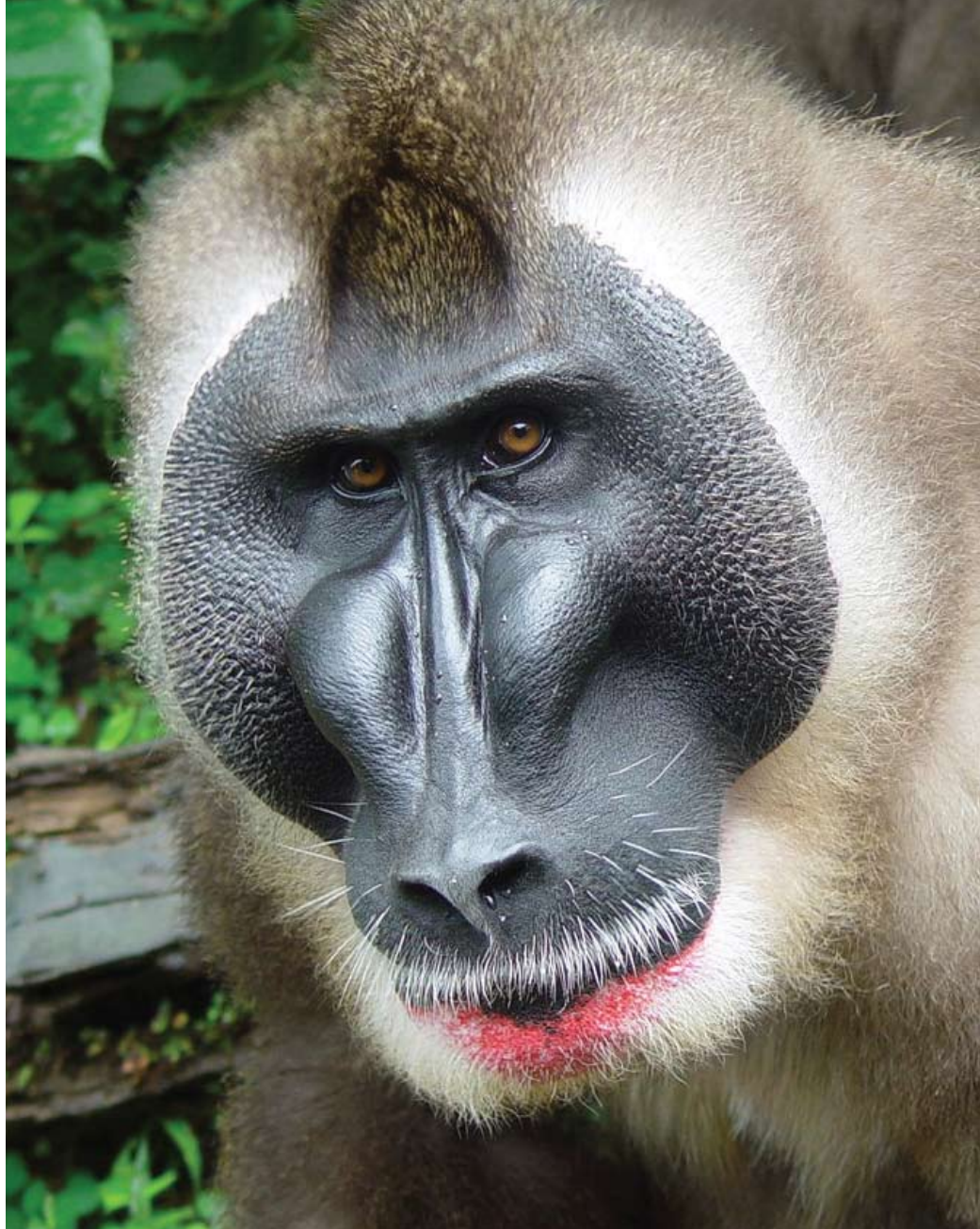
(Continued on page 2)

(Continued from page 1)

Ekwoje Abwe, manager of our Ebo Forest Research Project, is based at our office in Limbe. Ekwoje grew up in a remote village in the mountains of Cameroon, excelling both in high school and later at university, before coming to us in 2003, after which he soon became passionate about wildlife in the Ebo Forest, particularly chimpanzees.

The Ebo chimpanzees are the most endangered chimpanzee subspecies (pictured lower right) in Africa: as few as 3,500 individuals remain across Cameroon and Nigeria, with one of the largest populations (about 750 individuals) in the Ebo Forest. In 2006, Ekwoje was the first scientist to witness the Ebo chimpanzees smashing open hard-shelled fruits using quartz hammers. Ekwoje studied tool use in chimpanzees and went on to obtain his master's degree from Oxford Brookes University.

Later this year, our most senior French-speaking staff member, Daniel Mfossa (pictured below), will pursue his



A drill on the Pandrillus ranch in Nigeria, a sister organization to the Limbe Wildlife Centre.

master's degree in tropical wildlife resource management at the University of Liege, Belgium. Daniel's passion is botany—he conducted a forestwide survey measuring thousands of trees and lianas, many of which are yet to be identified. The presence of several species of yellow-flowered begonias suggests that the forest is ancient, with origins well before the last Ice Age.

Our senior staff members come from all over Cameroon to work, usually with undergraduate degrees from Cameroonian universities. We also have



Ebo Forest Research Project



Anare Idoiaga/Pandrillus



Richard Bergl



Bethan Morgan, Ph.D. / SDZG

MOLECULAR DIAGNOSTICS AND RESEARCH LABORATORY *at the* LIMBE WILDLIFE CENTRE, CAMEROON

By Mark Schrenzel, D.V.M., Ph.D.
Wildlife Disease Laboratories

Cameroon's Limbe Wildlife Centre stands as a unique haven where local people, conservationists, and international scientists come together with the shared goal of saving the extraordinary biodiversity and natural beauty of Central Africa. Established in 1993 as a sanctuary for the rescue and rehabilitation of abused and imperiled wildlife, Limbe houses a variety of rare mammals, birds, and reptiles, most of which have been confiscated by government officials from those selling live animals, which is usually a byproduct of the commercial trade in bushmeat. Limbe houses some of the world's most endangered primates, including Cross River and western lowland gorillas, Nigeria-Cameroon chimpanzees, drills, mandrills, and guenons. Through the care they provide, Limbe's dedicated staff of curators and veterinarians have impacted the survival of numerous species and thousands of individuals, growing into one of the most advanced conservation centers in Africa.

We have recently partnered with Limbe to create a modern, on-site diagnostic and research laboratory. The facility will improve immediate medical care for animals by providing veterinarians with rapid diagnostic tests and enabling expansion of our current field conservation projects. Through cutting-edge molecular assays, devastating infectious diseases such as tuberculosis, pneumonia, and a variety of highly contagious viruses can be accurately detected, allowing containment of outbreaks and more effective treatment of ill animals. Important genetic information will be generated to inform field studies, and the laboratory will create a foundation for developing collaborations with other scientists throughout Africa, including establishing sample archives for future studies. With the support of the Government of Cameroon and international conservation groups like the Pandrillus Foundation, the lab is well positioned to support forensic investigations of illegal plant and animal trade through DNA analyses.

The Limbe Molecular Diagnostics and Research Laboratory, made possible through the generous support of the Offield Family Foundation, will help connect the experience and expertise of our scientists with like-minded people throughout Central Africa, helping save wildlife for many years into the future. 🌿

research assistants who grew up in villages surrounding the Ebo Forest. Many of these men used to be hunters. Zacharie Bekokon, for example, used to be a bushmeat trader, but now he runs our project on critically endangered Preuss's red colobus monkeys. Zacharie and his team spend each day combing the steep mountainsides, trying to locate these elusive primates and understand their ecology and behaviour. Paid employment has led to longer-term financial stability for Zacharie and his family, allowing him to establish a small cocoa and plantain farm in his village as an alternative to hunting.

(Continued on page 4)

(Continued from page 3)

Every year we say good-bye to some staff members and then welcome new ones. This year we are excited to have hired some of our first female research assistants, which is a particular achievement. It can often be difficult for women to accept work that keeps them away from their families for long periods, but societal progress is enabling some women to embrace opportunities that would have been much more difficult even five years ago.

As the Central Africa Program moves into the next stage of its evolution, it can boast a strong and committed team of national staff. The long-term goal of the Ebo Forest Research Project is to become a center of excellence for rain forest research and conservation in this region of Africa. We will achieve our goal by attracting national and international researchers to conduct their studies as well as through mentoring, empowering, and enabling national staff to convert their passion for wildlife into affirmative conservation action. 🌿



The long-term goal of the Ebo Forest Research Project is to become a center of excellence for rain forest research and conservation in this region of Africa.



Ebo Forest Research Project

The Central Africa Program's strong national staff—with just part of Bethan's team pictured here—now numbers both women and men.



Ebo Forest Research Project

Ekwoqe Abwe, manager of the Ebo Forest Research Project, and Dr. Bethan Morgan crossing the Dibamba River.

MEET A CONSERVATION RESEARCHER



Ebo Forest Research Project

Dr. Bethan Morgan heads the Institute's Central Africa Program and has lived in Cameroon since 2002. Along with her team of 37 dedicated Cameroonian staff, her passion is conserving the unique assemblage of plants and animals that live in Africa's north-central rain forests in some of the most biodiverse yet most heavily populated areas on the continent.

Bethan's name gives away her origins: she was born in the Welsh countryside and attributes her love for tropical forests to the damp and lush greenness that characterizes Wales. Growing up in a loving family, her supportive parents always told her that she could follow whatever dream she chose, even when it came to doing a solo parachute jump at the tender age of 15, to tackle her vertigo—but it didn't work!

Her undergraduate degree in Zoology from the University of Bristol, England, led to a master's degree in Biological Anthropology at the University of Cambridge. It was at Bristol that Bethan first realized it might be possible to follow her passion for the outdoors by working with animals. During her summer

vacations she always traveled, from working as a guide in the Peruvian Amazon to joining a gorilla habituation program in the Central African Republic. One of her most memorable experiences there involved coming upon a band of nomadic Pygmies in the forest who had never seen a white-skinned person before.

Bethan's doctoral thesis studied the relationship between forest elephants and their environment in what is now the Loango National Park, Gabon. She spent almost two years camping in a remote wilderness, photographing wild elephants daily, and narrowly avoiding being gored by African forest buffalo and irritated hippopotamuses. After leaving Gabon, Bethan became a visiting fellow at Harvard University, before joining the Institute for Conservation Research in 2002.

Bethan's life has made following her other passions challenging, but she loves playing the piano—when she can find one! Bethan's partner, James Christie, joined her in Cameroon in 2006 as a technical assistant advisor, and together with their national staff, they continue to build this remarkable program. 🌿

CONSERVATION EDUCATION

INSTITUTE FOR CONSERVATION RESEARCH 2011 SUMMER STUDENT FELLOWS

We believe strongly in connecting people with the wonders of the natural world in order to make a difference for conservation. One way we achieve this goal is by providing unique, hands-on conservation research experiences that fully engage students, drive their sense of curiosity, and inspire them to discover new conservation solutions. Each summer we host college student fellows from across the country at the Institute for Conservation Research. This summer we had the privilege of working with 15 exceptional students, all of whom were supported by the equally exceptional generosity of some very special donors.

For more information about this unique program, please visit us at www.sandiegozoo.org/conservation.

APPLIED ANIMAL ECOLOGY

Matthew Golembeski, University of California, Los Angeles – Frabotta Endowed Fellow

Matthew is studying strategies for deterring predators of the endangered Stephens' kangaroo rat to increase survival rate of translocated individuals.

Kira Marshall, Colorado State University – James and Kathryn Colachis Fellow

Kira is translocating and observing California ground squirrels in an effort to create and sustain suitable habitat for the burrowing owl.

Stephanie Wakeling, University of Nevada, Reno – Weedon Endowed Fellow

Stephanie is working on identifying individual mountain yellow-legged frog tadpoles to understand more about this critical life stage.

APPLIED PLANT ECOLOGY

Scott Gressard, University of California, San Diego – Sefton Endowed Fellow

Scott is researching cactus wren nesting behavior and surrounding habitat so that they can be successfully established in Southern California fire restoration sites.

Doug Wylie, San Diego State University – Foundation for Sustainability & Innovation Fellow

Doug is assessing habitat suitability for the coastal cactus wrens in the San Pasqual Valley to determine vegetation preferences for nesting.

BEHAVIORAL BIOLOGY

Amelia Meier, University of California, Berkeley – Neeper Endowed Fellow

Amelia is studying scent preference in lions, tigers, and cheetahs for animal welfare and enrichment purposes.

Erika Norton, University of Connecticut – Bonner Endowed Fellow

Erika is studying the vocal behavior of the coastal cactus wren to aid in monitoring conservation efforts for this California species of special concern.



Ken Boland/SZG

CONSERVATION EDUCATION

Jonathan Ismail, Grinnell College – Weedon Endowed Fellow

Jonathan is developing a curriculum module on the mountain yellow-legged frog reintroduction program and conducting research on the relationship between human emotions and animal behavior.

Samantha Young, San Diego State University – Helm Fund Summer Fellow

Samantha is building interactive lessons focused on reconstructing phylogeny, biomimicry, evolution, and the Hawaii Endangered Bird Conservation Program.

GENETICS

Margot Brandt, Wake Forest University – Frye Endowed Fellow

Margot is using mitochondrial DNA sequencing and karyotype analysis to determine whether gazelles at the San Diego Zoo and Safari Park are hybrids or pure Soemmerring's gazelles.

Elizabeth Shattuck, Michigan State University – Zable Fellow

Elizabeth is using genetic relationships and extinction probabilities to inform managers about conservation priorities for species in the Bovidae and Cervidae families.

REPRODUCTIVE PHYSIOLOGY

Kaitlin Croyle, University of Maryland – Sefton Endowed Fellow

Kaitlin is exploring new methods of ovarian tissue vitrification with coyote, dog, and cat ovaries in order to optimize assisted reproduction techniques by improving the preserved quality of ovarian tissues in the Frozen Zoo®.

Rachel Gerrard, Missouri State University – Friedhofer Fellow

Rachel is studying gene expression in giant panda vaginal cells to detect patterns of expression during the estrous cycle.

WILDLIFE DISEASE LABORATORIES

Yukwah “Jenny” Kwok, University of Pennsylvania – Sefton Endowed Fellow, and Matthew Starr, University of Arizona – Friedhofer Fellow

Jenny and Matt are trapping mosquitoes and testing them for different diseases, including West Nile virus and avian malaria, as well as using molecular techniques to determine the species upon which the mosquitoes are feeding.



Ken Behm/SDZG

CONSERVATION ACHIEVEMENTS

CONSERVATION RESEARCH GIFTS & GRANTS

The Institute for Conservation Research is grateful to the following for their investments in imperiled species conservation:

A donation from the **Campbell Family Foundation** was directed to the Reproductive Physiology Division for assisted reproduction studies. Grants from the **James and Kathryn Colachis Fund** at the San Diego Foundation sponsored a Colachis Summer Fellow at the Institute in 2011, assisted with yellow-legged frog recovery, and purchased GPS devices for the Applied Animal Ecology Division. A grant from **Conservation International** was directed toward an Asian primate workshop for Asian professionals. A grant from **Genentech** made it possible for teachers to attend the 2011 and the 2012 Summer Teacher Workshops in Conservation Research through the Conservation Education Division. The **International Primatology Society** assisted with conservation education on the snub-nosed monkey. The **Offield Family Foundation** gave a grant in support of the Central Africa Program, for species recovery. A gift from **Dick and Sharon Resch** will support research work in Cocha Cashu, Peru. A grant from the **Ellen Browning Scripps Foundation** will establish a Scripps Spatial Ecology Laboratory at the Arnold and Mabel Beckman Center for Conservation Research. Continued support from the **Joan Irvine Smith & Athalie R. Clarke Foundation** will assist with seed banking efforts through the Applied Plant Ecology Division. A grant from **Solar Turbines** will provide hands-on science visits at the Conservation Education Lab for children from low-income school districts. A grant from the **John and Beverly Stauffer Foundation** was directed to genetic studies benefiting a number of species through the Genetics Division. A grant from **U.S. Bank and US Bancorp Foundation** allowed for science educators to attend the 2011 Summer Teacher Workshops in Conservation Research. The **Steven and Carole Weinberg Foundation** provided funds for the purchase of an Olympus DP25 camera for the Wildlife Disease Laboratories.

HONORS AND AWARDS

Dr. Allan Pessier, Wildlife Disease Laboratories, received a **Fifth Year of Service Instructor's Award** at the Association of Zoos and Aquariums Amphibian Biology, Conservation and Management Course held at the Toledo Zoo.

Dr. Bryan Endress, Applied Plant Ecology, and **Maren Peterson**, Conservation Partnership Development, were **recognized by the California Indian Culture and Sovereignty Center at Cal State San Marcos** for their support of the book, *Luiseño Landscapes: Celebrating People, Plants, Land, and Culture*.

Corrin LaCombe, Conservation Education, received the **2011 Larry Jacobsen Environmental Development Award** from the International Primatological Society for her alternative livelihood and conservation education work in Vietnam.

San Diego Zoo Global was honored with the **2011 Recycler of the Year** award from the City of San Diego.

THE SCIENCE OF SAVING SPECIES™

Modi, W. S., M. Romanov, E. D. Green, and O. A. Ryder. 2009. Molecular Cytogenetics of the California Condor: Evolutionary and Conservation Implications. *Cytogenetic and Genome Research*. 127(1): 26-32.

This paper develops a cytogenetic map for the California condor, a valuable conservation and management tool for identifying factors influencing disease risk and other negative effects of inbreeding.

Pessier, A. P., and J. R. Mendelson. 2010. A Manual for Control of Infectious Diseases in Amphibian Survival Assurance Colonies and Reintroduction Programs. IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, Minnesota.

This manual provides protocols for reducing the spread of disease in managed populations of amphibians (*tomato frog pictured*) and reintroduction programs, including an overview of infectious disease testing and treatment.

Swaigood, R. R., and B. A. Schulte. 2010. Applying knowledge of mammalian social organization, mating systems, and communication to management. Eds. D. G. Kleiman, K. V. Thompson, and C. K. Baer, 329-343. In *Wild Mammals in Captivity*. 2d ed. Chicago: University of Chicago Press.

This review focuses on the use of behavioral and ecological theory for solving breeding and other management problems in zoos, with an emphasis on signals and mate choice and how these can be manipulated to serve conservation goals.

GORDON AND BETTY MOORE FOUNDATION

Great things happen when you mix passion, innovation, and vision with the resources to make it all happen. Gordon and Betty Moore have never been shy about their goals. They set out to make the world a better place by committing their resources to advancing the science of conservation in the world's most critically threatened areas. Part of this commitment has been to the South American Amazon region. Their foundation is providing the San Diego Zoo Institute for Conservation Research with the first three years of start-up funding to make critical infrastructure improvements to the Cocha Cashu Biological Station in Manu National Park. Improvements will include reliable transportation (boats and motors!) into the heart of the park; replacement of structures that have suffered from the tropical environment; tent platforms; and basic amenities like showers and latrines for visiting scientists and students. These improvements will help to attract the steady stream of international researchers who have made Cocha Cashu Biological Station the premier location for tropical rain forest research over the past 30 years.



WHAT'S NEW IN CONSERVATION RESEARCH

We recently installed 40 remote camera traps (photo below) to monitor habitat use and movement patterns of the last remaining population of Guizhou snub-nosed monkeys in China, estimated at about 750 individuals.



Our geneticists are collaborating with colleagues on a plant DNA barcoding project to identify and replace coral trees that perished during gall wasp infestations in Hawaii.

At our California condor release site in Baja California, Mexico, we successfully installed a remote digital video camera system that will allow us to record parental behavior and monitor the health and development of the chick until it fledges.



After several weeks of intensive behavioral and physiological monitoring by Institute scientists, our giant pandas, Bai Yun and Gao Gao, were introduced and bred successfully.

Our plant ecologists conducted resource management workshops in three Maijuna indigenous villages in the Peruvian Amazon that focused on sustainable harvest methods (fruit pictured) for aguaje palms.



CONSERVATION UPDATE

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For more information about the San Diego Zoo's global conservation efforts and how you can help us in our fight against extinction, please visit our Web site, WWW.SANDIEGOZOO.ORG/CONSERVATION and join the Global Action Team!

CONSERVATION UPDATE

SAN DIEGO ZOO
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THE HEART AND SCIENCE OF SAVING WILDLIFE™



A MIGHTY TASK FOR A SMALL RODENT: Grassland Restoration for the Stephens' Kangaroo Rat

Story and Photos by Sara Motheral,
Research Technician, Applied Plant Ecology

As I watch the stream of water pouring from the spout of my watering can darken the soil around a young native bunchgrass, a breeze lifts the edges of my wide-brimmed hat, and I am thankful that the weather has been kind to us. The temperatures are in the 90s and the breeze feels good—great weather for August in Riverside County where it often reaches triple digits. I look around and notice that a group of volunteers, reserve staff, and researchers, all armed with watering cans, are gathering to look at something on the ground. They are taking a short break from the work at hand to inspect a Stephens' kangaroo rat burrow. It is to help this small nocturnal rodent that this diverse group of people has come together on a hot day to hand water thousands of grass seedlings.

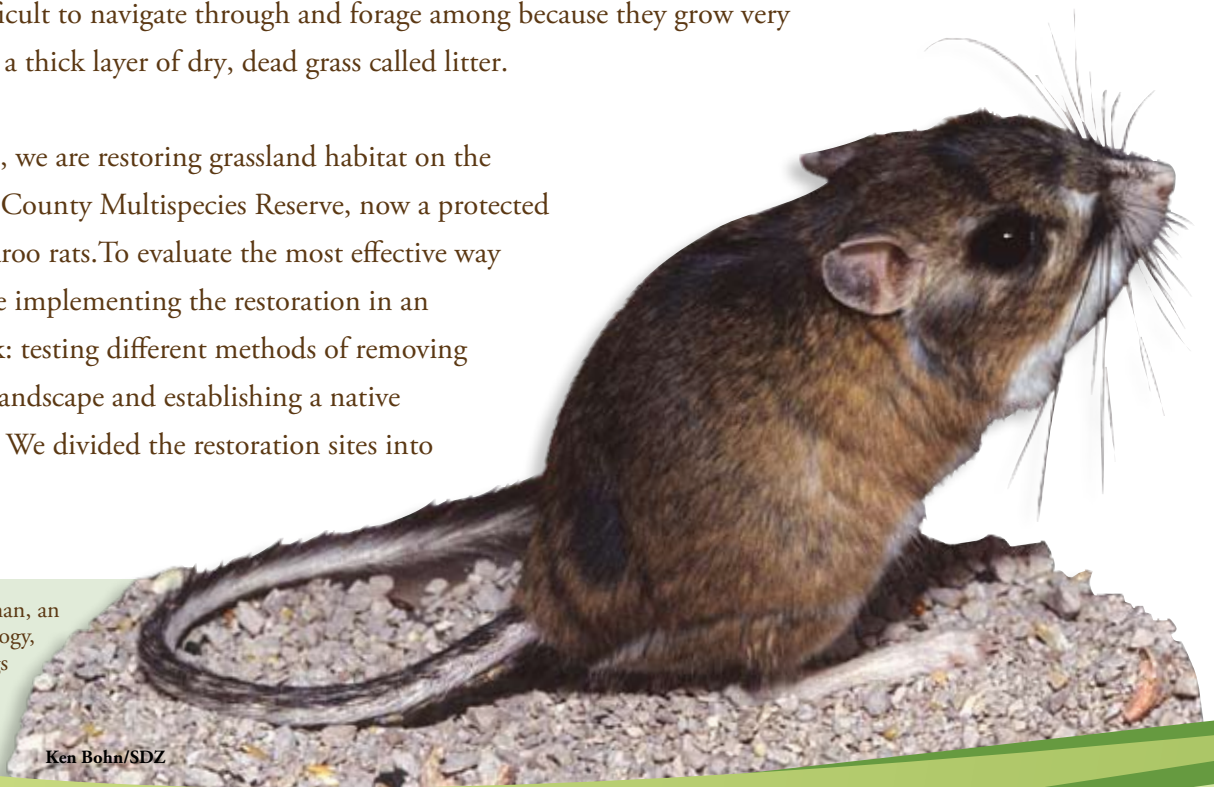
Sara Motheral

WINTER 2011

(Continued on page 2)

The Stephens' kangaroo rat is an endangered species that requires native grasslands, a type of habitat that is disappearing because of extensive urbanization and the invasion of exotic plant species. California grasslands were once composed mostly of long-lived, or perennial, bunchgrasses such as purple needle grass, which grow in clumps with patches of bare ground between them. In this type of habitat, Stephens' kangaroo rats can forage for seeds within the small open spaces, then quickly dash along trails that meander between the tufts of grass to the safety of their burrows while avoiding predators such as coyotes. Unfortunately, native perennial bunchgrass communities have been largely replaced by exotic annual grasses brought in by European settlers. The kangaroo rats find these annual grasses difficult to navigate through and forage among because they grow very densely and accumulate a thick layer of dry, dead grass called litter.

To help save this species, we are restoring grassland habitat on the Southwestern Riverside County Multispecies Reserve, now a protected area for Stephens' kangaroo rats. To evaluate the most effective way to restore habitat, we are implementing the restoration in an experimental framework: testing different methods of removing exotic grasses from the landscape and establishing a native bunchgrass community. We divided the restoration sites into



Cover photo: Angelique Herman, an intern with Applied Plant Ecology, holds up a flat of grass seedlings about to be planted at the site.

Ken Bohn/SDZ

different segments, each of which was either burned, mowed, or grazed by sheep to remove the exotic grasses. Half of these segments were left alone to see how they would recover without any further management; the other half will receive active restoration over a period of two years. Restoration is a time-consuming and labor-intensive process that involves carefully spot-spraying herbicide to knock back any re-sprouting exotic grasses; planting over 20,000 native grass seedlings across 6 acres; installing temporary, translucent plastic tubes around each seedling to protect them from herbivores; and watering the seedlings by hand

through their first summer to ensure they survive and become established.

As the project enters its second year, we are excited to see early signs of success. A population of Stephens' kangaroo rats, translocated from a site slated for development, now inhabits the area, and they appear to prefer the burned sections of the restoration sites. Furthermore, over 87 percent of the native grass seedlings planted last winter have survived the hot, dry summer and are now established well enough to survive on their own. The restoration has



Reserve staff member Dave Borcheff stands in a recently planted restoration plot.



Bryan Endress, Ph.D.

CAL Fire crews conducted controlled burns within triangular segments of each plot to remove exotic grass vegetation.



The restoration treatments opened up space for a variety of native wildflowers to emerge from the soil seed bank in the spring.



In September 2011, the protector tubes were removed and a census was taken to estimate survival. Over 87 percent of the plants survived through the summer and are therefore likely to survive into the future without any additional assistance.

Everyone involved has dedicated huge amounts of time and labor through all phases of the project, including performing controlled burns, planting in the rain, and watering on hot summer days.

also benefited other plant species in the community by opening up space for a variety of native wildflowers to emerge. But we are not done yet: in the coming year, we will plant another 10,000 seedlings, which we will care for throughout next summer, and we will continue to evaluate the long-term effectiveness of the restoration.

Of course, none of this would have been possible without the help of our collaborators: the Institute's Applied Animal Ecology Division, the Southwestern Riverside County Multispecies Reserve, CAL Fire, and a number of

enthusiastic volunteers. Everyone involved has dedicated huge amounts of time and labor through all phases of the project, including performing controlled burns, planting in the rain, and watering on hot summer days. Taking breaks to look around us and notice the grasses peeking over the tops of their protector tubes, the colorful wildflowers, and growing numbers of kangaroo rat burrows reminds us what this work is all about. Although the group inspecting the burrow will not see a Stephens' kangaroo rat today, they know that their work is much appreciated not only by us but also by these small but mighty rodents! 🌿



Thu Hoai

Conservation and Education: Inextricably Intertwined

BY JAMES DANOFF-BURG, PH.D., DIRECTOR, CONSERVATION EDUCATION DIVISION

What makes a successful conservation project? Is it enough to have thorough scientific understanding of the ecological and biological challenges facing a species or habitat? What goes into defining a project as sustainable over the long run so that species survival is guaranteed? How does human economic well-being relate to conservation success, and should it? These are questions worth asking, and ones that my team and I will consider.

Before joining San Diego Zoo Global last August, I taught conservation and education classes for 14 years at Columbia University, studied the value of urbanized green space for insect conservation in New York City, and directed an environmental restoration and poverty alleviation project in the Dominican Republic. These diverse experiences indicate to me that a conservation project is more successful when the local community is involved. By keeping a community informed and gaining its support, the most urgent conservation problems can be discussed and culturally appropriate strategies can be implemented. With the community as partners in the struggle to save endangered species, our projects are more likely to succeed.

At San Diego Zoo Global we recognize the value of education: training local people in the care and management of endangered species and their habitats is the first step, making good stewardship a way of life. We also suggest more sustainable livelihood alternatives to typical short-term destructive practices. If conservation is to succeed, people need to find new ways to support their families. In the Ebo Forest of Cameroon, many park rangers are former bushmeat hunters who are now dedicated to protecting wildlife. We also partner with local researchers and government officials to help ensure support for our field projects. Sharing and teaching about the numerous breakthroughs our researchers have accomplished with local and international conservation groups is key to our interactions.

Conservation education and skills training increase community involvement in a project and address people's day-to-day needs. Corrin LaCombe (pictured above) from our Conservation Education Division works in a remote region called Khau Ca, part of Ha Giang Province in northern Vietnam and home to one of the world's rarest primates, the Tonkin snub-nosed monkey. Corrin talks with local people to identify their needs and the hardships they face, which could affect a proposed protected area for the monkeys. She currently works with the local community to come up with appropriate and environmentally sensitive solutions to reduce these conflicts, giving people the resources they need to survive and ensuring animals will thrive in a safe and healthy ecosystem.

Many of our conservation projects have an education component, such as the one led by Russ Van Horn, Ph.D., in our Applied Animal Ecology Division, involving the conservation of Andean bears near Lambayeque, Peru. Russ has found that wood and sapote fruit harvesting are major threats to these bears because they destroy forest habitat. Samantha Young, Conservation Education research technician, works with Russ to inform the local community about these bears, the value of reforestation efforts, and the unique aspects of biodiversity in this area. She is also involved in education outreach at the community level, which builds support for our conservation efforts there.

The real long-term stewards of wildlife and natural resources are the local people living near the areas where we work as conservation biologists. These communities will persist long after we leave, and they will determine the long-term success of any conservation efforts. By considering the well-being of both animals and people in our 100-plus conservation projects around the world, the Conservation Education team is working hard to ensure that local communities are equipped with the best possible skills and knowledge—they will be at the forefront of conservation for years to come. 🌿

MEET A CONSERVATION RESEARCHER

Perhaps it began at the tender age of five when she fearlessly thrust her head into an orca's mouth at a wildlife park in England. The book *Golden Bats and Pink Pigeons* by Gerald Durrell also may have swayed her formative years toward conservation biology. Or maybe it was her outdoorsy upbringing in the verdant countryside that piqued her interest in wildlife, eventually leading her to a "bat track" of research and conservation. "I have always loved furry animals with big, dewy eyes," said Dr. Allyson Walsh, Associate Director of Conservation Programs at the San Diego Zoo Institute for Conservation Research. "And bats are the only flying mammal—many species are quite adorable! Bats around the world do a huge service to the environment by eating insects, pollinating plants, and regenerating forests through seed dispersal—and they are a big conservation challenge." Allyson goes on to explain that the estimated 1,116 species of bats make up about 20 percent of terrestrial mammals, but it can be a tough sell to get people to appreciate bats and conserve them. However, if anyone can sway the masses into helping bats, it's the ebullient and enthusiastic Allyson Walsh!

Allyson earned her honors degree from Southampton University, majoring in Biology and Oceanography. She completed her doctorate at Bristol University on the conservation biology of bats, then worked in London for the Bat Conservation Trust and



Allyson Walsh, Ph.D.

Richard Jenkins, Ph.D.

later in Texas at Bat Conservation International, before becoming director of Lubee Bat Conservancy in Florida. Her rich conservation experience includes three methods used to count bats: roost counts as they leave their shelter in the evening; counting sleeping bats in their winter torpor haunts; and walking (or riding) transects with a bat detector at dusk. This is a device that converts bat echolocation ultrasound signals into audible signals the human ear can hear. "I love working with high-tech gizmos," said Allyson. "With a bit of practice using a bat detector, you can identify the bat species and type of call by its rhythm and tone."

In her role at the Institute, she will be "supporting and managing a wider portfolio of applied field conservation programs." In other words, less time

with bats. Fortunately, a new fruit bat exhibit is opening at the Safari Park, so Allyson can get her flying fox fix when needed.

With her penchant for gadgets and gizmos, it's no wonder one of her most admired people is the late Steve Jobs: "He made technology warm and fuzzy—and beautiful." Another is aviator and business tycoon Howard Hughes. "My Dad was an aerospace engineer, and I have always loved flight," said Allyson. She further embraced modern technology by finding her man on match.com, and they were married last May. Weekends you can find them hiking the backcountry with their dogs, Gretta and Dakota. And Allyson creates art pieces that showcase the beauty of...bats, naturally! 🍃

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REGIONAL CONSERVATION PROGRAM HIGHLIGHTS



TRACKING ELUSIVE MAMMALS IN THE PERUVIAN AMAZON

By Mathias Tobler, Ph.D., Applied Animal Ecology

Madre de Dios in southeastern Peru contains vast areas of primary Amazonian rain forest. Tapirs, peccaries, and jaguars are abundant, and flocks of macaws can be seen flying across the large rivers every evening. But this might change rapidly. Last year, the Inter-Oceanic Highway that connects Brazil to the Pacific coast was paved, cutting the region in two. The new road will bring with it an increasing stream of new settlers who hope to make a living in the timber industry by farming a small piece of land or by mining the rivers and forest for gold. I have been studying large mammals in Madre de Dios for the last six years, using cutting-edge technology such as GPS telemetry collars and camera traps to collect information on home range size, habitat use, and diet of tapirs, peccaries, jaguars, and pumas. Our goal is to generate the critical information that will identify the most important animal corridors between protected areas. This will allow us to evaluate and mitigate the impact of these ever-increasing human activities on wildlife in the region. We hope this will lead to a long-term conservation strategy for one of the most biodiverse regions of the world.

Dr. Mathias Tobler fitting a radio collar on a tapir in Peru.



STUDYING ENDANGERED SNAKES IN BRAZIL

By Rogério Zacariotti, D.V.M., Ph.D., Reproductive Physiology

Dr. Rogério Zacariotti performing an ultrasound on a golden lancehead snake in Brazil.

My not-so-secret passion for snakes started long before my birth, when Dr. Afrânio do Amaral, then director of the Butantan Institute in Brazil, first described a new species of pit viper from the coastal Atlantic forest, the golden lancehead, in 1921. Six years later, Laurence Klauber, the San Diego Zoo's curator of reptiles, hosted a visit from Dr. Amaral to start a collaborative project with venomous snakes. Moving ahead a few decades, a 3-year-old boy (me!) watched with fascination as a snake crawled inside a glass tank at the Butantan Institute. I looked to my mother and said,

"Did you know that I will work with snakes when I grow up?"

Today, the golden lancehead is critically threatened with extinction and is the subject of my conservation project at the San Diego Zoo Institute for Conservation Research. In the Reproductive Physiology Division, we are developing innovative techniques using ultrasound, semen collection, and hormone monitoring to study the reproductive cycle of the golden lancehead and other endangered neotropical snakes. In the coastal Atlantic forest, interior Atlantic forest, and Brazilian savanna, we are investigating their habitat requirements, population estimates and trends, and health status. Another important component of our work is education within the local communities, because snakes are misunderstood and often thought to be dangerous. It's hard to conceive of a more perfect project for a little boy who once dreamed about working with snakes! 🌿



CONSERVATION RESEARCH GIFTS & GRANTS

The Institute for Conservation Research is grateful to the following for their investments in imperiled species conservation:

An **Anonymous Foundation** gave a grant in support of Andean bear recovery in Peru. A gift from **Cliff Bleszinski and Lauren Berggren** will support bioacoustic research in African cheetahs. The **Broadcom Foundation** gave a grant to purchase GPS tracking equipment for giant panda recovery in China, through the Applied Animal Ecology Division. The **Edyth Bush Charitable Foundation** gave a grant in memory of Mary Gretchen Belloff, a longtime friend of the Institute and San Diego Zoo Global, to the Wildlife Disease Labs Division for diagnostic equipment. A grant from the **Hattie Ettinger Conservation Fund** at the San Diego Foundation made possible the rewriting, redesign, and reprinting of the Institute's strategic overview booklet. The **Farrell Family Foundation** gave a grant to provide students with science field trips to the Conservation Education Lab. **Mr. and Mrs. John Gartman** gave a gift in support of mountain yellow-legged frog reintroduction. The **William H. and Mattie Wattis Harris Foundation** gave a grant to purchase equipment for the Desert Tortoise Conservation Center in Las Vegas. A grant from the **Max and Yetta Karasik Foundation** was given in support of the Hawaii Endangered Bird Conservation Program. Grants from the **Lakeside Foundation** and from the **Joan M. Stevens Fund** at the San Diego Foundation will make possible a chemical inventory system. A grant from the **McBeth Foundation** was given for the purchase of an automated coverslipper for the Wildlife Disease Labs. The **Offield Family Foundation** gave a grant for species recovery, protection, and diversity in the Ebo Forest region of Cameroon. A grant from the **Sonny Foundation** made possible the purchase of a thermocycler for the Molecular Diagnostics Laboratory. The **Don and Marie Van Ness Fund** at the San Diego Foundation will assist with the 2012 Summer Fellowship program for college students. A grant from the **Carl E. Wynn Foundation** will help provide school visits to the Conservation Education Lab.

CONSERVATION ACHIEVEMENTS

HONORS AND AWARDS

Dr. Chris Tubbs, Reproductive Physiology, was invited to serve as an Education Mentor in the Life Sciences at the National Academies/Howard Hughes Medical Institute Pacific Northwest Summer Institute on Undergraduate Education in Biology.

Dr. Oliver Ryder, Genetics, was invited to give a keynote presentation at the 57th Congress of the Brazilian Society of Genetics, held in São Paulo state.

Applied Plant Ecology received an award from the TransNet Environmental Mitigation Program to develop a habitat restoration and management plan to support long-term survival of coastal cactus wrens in the San Pasqual Valley.

THE SCIENCE OF SAVING SPECIES™

Chase, M. J., and C. R. Griffin. 2011. Elephants of south-east Angola in war and peace: their decline, re-colonization and recent status. *African Journal of Ecology* 49: 353-361.

This landmark study used extensive aerial surveys to document the return of satellite-collared elephants to Angola, mapped their subsequent range expansion, and made recommendations for future population enhancement.

Lopez-Toledo, L., M. Martinez-Ramos, and D. Perez-Salicrup. 2011. Demographic effects of legal timber harvesting on *Guaiacum sanctum* L., an endangered neotropical tree: Implications for conservation. *Interciencia* 36: 650-656.

This paper evaluates the effects of timber harvesting on population structure and conservation status of logged and unlogged tree populations across Central Campeche, Mexico.

Whytock, R. C., and **B. J. Morgan**. 2010. The avifauna of the Ebo Forest, Cameroon. *Malimbus* 32: 22-32.

More than 160 bird species were recorded from the lowland and submontane rain forest north of the Sanaga River in Cameroon, an area that serves as an important wildlife corridor.

CONSERVATION SHOWCASE 2012

We look forward to sharing our stories with you through Conservation Showcase in the coming year. From more than 120 projects proposed, 12 were selected for Conservation Showcase. These are chosen based on support of our mission, conservation impact, contribution to education and outreach that involves local people in the project, and opportunities for collaboration with other conservation organizations. They are compelling examples of our multifaceted conservation work, so each month we will highlight one of these dynamic research efforts through the San Diego Zoo Global Wildlife Conservancy website, www.sandiegozooglobal.org.

We are excited to kick off the Conservation Showcase with the **Hawaii Endangered Bird Conservation Program**. It plays a pivotal role in the restoration of endemic Hawaiian birds by preventing extinction and promoting the recovery of a number of endangered species (alala pictured). In 2012, we will focus on the propagation of four Hawaiian species at the Maui and Keauhou Bird Conservation Centers.



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WHAT'S NEW IN CONSERVATION RESEARCH



Thanks to Life Technologies, a state-of-the-art, next-generation DNA sequencer, the Ion Torrent Personal Genome Machine, was installed at the Beckman Center for use by our multidisciplinary science team.

In a record-breaking season, we hatched our 20th alala chick at the Keauhou Bird Conservation Center on Hawaii's Big Island, bringing the flock to an all-time high of 95 crows and setting the stage for future releases into the wild.



In support of Stephens' kangaroo rat conservation, our plant ecologists are propagating over 10,000 native grass seedlings for transplantation into habitat restoration sites this coming winter.



Following extensive health screening, we are repatriating 500 desert tortoises from the Desert Tortoise Conservation Center in Las Vegas to their native habitat in the Mojave Desert.



Our scientists recently returned from South Dakota, where they are studying the physiology of black bears, including genetic determinations of paternity and research into the timing of ovulation.

We recently shared our knowledge and expertise on maximizing animal welfare for lions, tigers, and cheetahs at the 10th International Conference on Environmental Enrichment.



CONSERVATION UPDATE

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Photos by Ken Bohn/SDZ

For more information about San Diego Zoo Global's conservation efforts and how you can help us in our fight against extinction, please visit www.sandiegozooglobal.org and join the San Diego Zoo Global Wildlife Conservancy!

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