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ECOLOGY

Conservation in captivity

Zoos provide an opportunity to work on crucial issues of biodiversity while reaching out to the public.

BY AMANDA MASCARELLI

Barbara Durrant heard about San Diego Zoo's reproductive-research department while she was pursuing her doctorate in reproductive physiology in the late 1970s. "I wrote to the founder and got a wonderful letter back saying, 'Yes, we're starting this new

research effort here. When you finish your PhD, get back in touch with me,'" recalls Durrant. In 1979, she began a two-year postdoc at the zoo in California.

Looking for a second project towards the end of her stint, Durrant began collecting viable eggs, sperm and embryos from animals that had died, and storing them in the

facility's Frozen Zoo, one of the world's first major collections of cryopreserved cells from zoo animals. In 1980, she initiated the Germplasm Repository — a collection of frozen reproductive cells from endangered species that capture genetic diversity, allowing it to be reintroduced into gene pools. In so doing, she helped to launch the field of gamete research. After her postdoc ended later that year, the zoo offered Durrant a permanent research position. Now director of reproductive physiology at San Diego Zoo Global, the conservation organization that runs the zoo, Durrant heads a team that designs reproductive-research programmes for rare and endangered species including giant pandas, rhinoceroses and Przewalski's horses. "The greater scientific community is coming to understand the importance of genetic diversity," says Durrant. "And zoos harbour the greatest genetic diversity anywhere outside of the natural world."

In the past few decades, zoos and aquariums around the globe have transformed themselves. No longer just family destinations and collections of rare, threatened and endangered animals, they are also research institutions with conservation and science at the core of their mission. Zoos are well positioned to manage populations of animals whose numbers are rapidly dwindling in their natural habitat, and, in some cases, to reintroduce them into the wild. And although they have tended to emphasize captive-breeding programmes, zoos are becoming increasingly focused on field-based research and on saving species in the wild.

CALL OF THE WILD

Research positions involving conservation at zoos and aquariums are still relatively sparse. But many scientists find such jobs deeply satisfying. The research is mission-driven and aimed at solving immediate problems, so zoological facilities tend to attract scientists who embrace an applied approach, says Allison Alberts, chief conservation and research officer at San Diego Zoo Global.

"I always thought I was going to end up in the traditional academic environment," says Alberts. "I value academic research very much. But I wanted to do something more immediate. I saw a crisis in the world that needed to be addressed now. I felt like, 'I don't have the luxury to wait and see if my research is going to be relevant 30 years from now — I want to be doing something that's solving the conservation problem today.' And the zoo gave me the opportunity to do that." ►

► Like Durrant, Alberts joined the San Diego Zoo as a postdoc, and ended up forging her career there. Whereas some positions at zoos and aquariums involve only research, others may require engaging with the public and overseeing staff and projects. In addition to coordinating all of San Diego Zoo Global's research initiatives in areas such as sustainable populations, restoration biology and habitat conservation, Alberts helps to raise the funding that supports the zoo's conservation efforts. She misses hands-on research, but says that being part of the zoo's conservation initiatives provides a "whole different type of satisfaction".

With one of the largest zoological conservation programmes in the world, the San Diego Zoo employs more than 200 researchers, including 12 field-conservation postdocs. It has research projects in 38 countries and an annual conservation budget of US\$15 million, of which \$6 million comes from grants and government contracts, and the rest from donations and zoo operations.

Zoos that employ such large numbers of researchers are rare. However, many have robust conservation-science programmes; they include the Calgary Zoo in Canada, the Smithsonian Institution's National Zoo in Washington DC, Antwerp Zoo in Belgium and London Zoo. In addition to postdoc positions, researchers may find work as technicians, field and lab managers, educators or scientists leading their own research programmes at the zoo or in the field. Many, including Durrant and Alberts, are adjunct or full professors at nearby universities, enabling them to mentor students directly and to forge collaborations with academic researchers. And scientists with PhDs are sometimes employed as curators in a specific area such as reptiles or birds.

ALL CREATURES GREAT AND SMALL

Although in the past zoos have not tended to be seen as research centres, that is changing. "Within more traditional academia, I think it's quite easy to dismiss zoos and aquariums as a place where you could do real science," says Jackie Ogden, vice-president of animals, science and environment at Walt Disney Parks and Resorts, who is based at Disney's Animal Kingdom in Orlando, Florida. Ogden says that Disney researchers have been involved in more than 300 scientific articles in the past 15 years. Her team includes 14 PhD students, most of them active in conservation research, she says. In one project, researchers monitor sea-turtle nesting on the central Florida coast in collaboration with local universities and state wildlife agencies. Disney researchers have contributed to rehabilitation of more than 350 sea turtles over the past 20 years, says Ogden.

Aquariums have also grown into strong conservation-research centres. The Tennessee Aquarium Conservation Institute, the research arm of the Tennessee Aquarium in Chattanooga, is involved in restoration and

reintroduction of two imperilled fish species — lake sturgeon and southern Appalachian brook trout — to the Tennessee River system. Anna George, the institute's director and chief research scientist, says that the job gives her the opportunity to put conservation principles into practice. With a PhD in conservation genetics of freshwater species, she has a deep understanding of field-based genetic diversity. Her work lets her apply that knowledge while collaborating with others who have expertise in raising fish in captivity. "We can make sure that we're really recovering a species with the ability to adapt, not just putting individuals into a river," she says.

WALK WITH THE ANIMALS

As zoos and aquariums become more conservation-oriented, their research increasingly focuses on animals in their natural habitats. As a result, opportunities are growing for researchers to work with plants and animals in the field, says Ron Swaisgood, director of applied animal ecology at San Diego Zoo Institute for Conservation Research. "Zoos are in the process of reinventing themselves," he says. "People don't think of plant ecology as being a zoo research programme — but it is."

Swaisgood and others think that such jobs, including field research, will continue



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Jackie Ogden

to grow as zoos become focused on conservation, pooling resources from donations and external grants from local, state and federal regulatory agencies. In 2011, facilities accredited by the US Association of Zoos and Aquariums in Silver Spring, Maryland, spent US\$160 million on 2,670 research and conservation projects in more than 100 countries, up from US\$134 million in 2010, according to the association's most

recent annual report on conservation science.

In 2009, the European Association of Zoos and Aquaria (EAZA), based in Amsterdam, estimated that it provides €30 million (US\$39 million) per year in paid staff time and costs for zoological research. It also reported that 1,400–1,500 people conduct or facilitate research as part of their jobs in zoos and aquariums in Europe. This July, the EAZA will launch its own online, open-access publication, *The Journal of Zoo and Aquarium Research*, to provide more outlets for zoo-oriented science.

Research in zoos can be quite different from field research, says Lesley Dickie, executive director of the EAZA. For instance, she says,



A researcher from San Diego Zoo in California tracks a koala on St Bees Island, Australia.

zoo research might focus on animal behaviours that are not seen in the wild because they are very hard to observe. But if the research concentrates on a highly threatened species, sample sizes in both the wild and captivity might be very small, making zoo work that much more relevant to 'real-world' circumstances, and more valuable. "As the wild gets more and more pressurized, I think that some of the things we're learning about small-population management in zoos will be more and more applied to the wild," says Dickie.

HUMANS AND OTHER ANIMALS

Myriad skill sets can open doors to work in zoos and aquariums. Basic research in areas such as animal behaviour or reproductive biology continues to be important, says Durrant, and training in genetics, wildlife disease and conservation education is also valued. It is not necessary to have worked with exotic animals or in zoos previously, she notes: basic-research training with model species in universities is sufficient. "Get the strongest solid foundation you can get and that you can apply to conservation."

However, some experience at a zoo or aquarium, even as a volunteer, can make the transition easier. While doing her PhD at Saint Louis University in Missouri, George began working in the education department at Saint Louis Zoo, leading overnight and summer-camp education programmes. That experience was key to her being hired at the Tennessee Aquarium. "They knew I already understood the culture and goals of zoos and aquariums and the informal science-education part of that," she says. "So even if it's volunteering or serving as a keeper, that first step into it makes it a lot easier to get a job later."

Scientists interested in zoo work would do well to supplement their training with other skills related to conservation. Classes in non-profit management and fund-raising

can help. And George advises that researchers get comfortable with outreach, including the art of educating donors about their research.

"We need people who are limber enough to move between field and zoo," says John Fraser, a conservation psychologist who is president of the New Knowledge Organization, a social-science think tank based in New York. "It's the ability to have a foot in both worlds, with the authority of the field biologist and the access of the zoo biologist." He suggests pairing a field-biology degree with a minor in community organizing, organizational psychology or advocacy.

Regardless of the academic path, the ability to work with people — not just animals — is crucial. "The outreach I do ranges from elementary-school students to politicians to journalists and everything in between," says George. "Each programme is different. You have to be comfortable being flexible." Rachel Lowry, director of wildlife conservation and science at Zoos Victoria in Melbourne, Australia, finds that her most profound experiences come from engaging with audiences and helping to influence people's behaviour. "Zoos are really powerful conservation organizations because they have an enormous reach, and because they are entrusted with these incredible animals within their care," says Lowry. "To have an orang-utan stand behind you while you give a talk, and you say, 'Who here pledges to purchase only certified sustainable palm oil?' and an orang-utan raises its hand — it's very moving. Everyone standing in front of that orang-utan who has come to connect with it emotionally suddenly raises their hand and says, 'Yeah, I don't want that species to go extinct because of the food that I choose.' It's a really powerful role." ■

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EMPLOYMENT

On the job

US graduate-degree holders aged 30–54 with a background in life or physical sciences had an unemployment rate of 2.1% and a median salary of US\$90,000 in 2010–11, according to an analysis of census data. *Hard Times 2013: College Majors, Unemployment and Earnings*, released on 29 May by Georgetown University Center on Education and the Workforce in Washington DC, found that life- or physical-science graduates in the same age range with only a bachelor's degree had 4.8% unemployment and a median salary of \$60,000. With research jobs scarce, many science-graduate-degree holders work in secondary education, or in non-research posts in industries such as pharmaceuticals or aerospace, notes co-author Anthony Carnevale, the centre's director.

MEDICINE

Oncology burnout

Although 83% of US oncologists report career satisfaction, about 45% experience emotional exhaustion or other symptoms of burnout, says a study presented on 2 June at the meeting of the American Society of Clinical Oncology in Chicago, Illinois. The 2012–13 survey of about 1,500 oncologists found a link between burnout and high patient volume. Academic oncologists spend more time with patients and less on research than in the past, says lead author Tait Shanafelt, a haematologist and oncologist at the Mayo Clinic in Rochester, Minnesota. He suggests that early-career academic oncologists need to preserve their research time.

AWARDS

Prizes for the young

US researchers under the age of 42 will be able to vie for one of three annual unrestricted awards of US\$250,000 in life sciences, chemistry, and physical sciences and engineering, the Blavatnik Family Foundation in New York and the New York Academy of Sciences (NYAS) announced on 3 June. "We want to highlight young researchers who are doing such extraordinary and innovative work that it will incentivize other young researchers," says NYAS president Ellis Rubinstein. Nominations from US research universities and institutions, national labs and academic medical centres will be accepted from October to December 2013. NYAS council members may nominate industry researchers.