



# Where have all the otters gone?

By Lily Dayton



Sarah Chinn, an intern for the joint UCSC-USGS project featured in this article, tracking sea otters in the Cambria area with a radio receiver and a telescope.

Decimated by the fur trade of past centuries, the southern sea otter population has never fully recovered. UCSC scientists are piecing together the reasons why.

Wildlife biologist Gena Bentall stands on a sandy bluff above the central coast of California, sweeping a radio antenna in a wide arc across the bay. She's trying to catch the signal of a radio-tagged sea otter hidden somewhere amidst the bull kelp that mottles the water's surface. Her receiver emits a "blip-blip," but as quickly as it appears the sound vanishes in the shush of wind.

"This otter is a notorious pain in the rear," jokes Bentall, as the signal returns, then fades away again before she has a chance

to glimpse the animal through her telescope. "Watching day in, day out, you become familiar with each of them. It's really helpful because if you hear a signal, you know where that particular otter tends to forage—so you know where to look."

Except this rambunctious otter has disappeared beneath the water, where her radio signal can't transmit to the surface. So for now, Bentall waits.

An alumna of UCSC's graduate program in ecology and evolutionary biology (EEB),

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**social leadership and in its commitment to justice and sustainability that permeates all aspects of work on campus and in the lives of graduates.**

Bentall is the team leader on this joint U.S. Geological Survey-UCSC project, trying to tease apart the factors that hinder the recovery of the southern sea otter. The study area encompasses 56 miles of coastline from Piedras Blancas to Oceano Dunes. Bentall and her crew are monitoring 45 animals along this wind-blown stretch of coast, recording what and where they eat, how deep they dive and how far they travel, whether they reproduce, and, if they die, what caused their demise.

## Population plunge

Historically, sea otters were plentiful along the entire coast of California, with numbers estimated at 15,000-16,000. After fur hunters depleted them to near extinction in the 18th and 19th centuries, southern sea otters began to recover slowly—though never reaching historical numbers or refilling their former range. When the southern sea otter was listed as a Threatened Subspecies in 1977, the population comprised less than 2,000 animals. Today, the population lingers around 2,800, and otters still haven't regained a foothold south of Point Conception or north of Pigeon Point.

"Between the late 1980s and the present, especially in the central part of the range, the population has not grown appreciably," says Tim Tinker, adjunct professor in UCSC's EEB Department, and principal investigator in the Central Coast study.

Initially, scientists were mystified by the southern sea otter's sluggish recovery. But as they continue to study sea otter biology and the role otters play in their nearshore ecosystem, a clearer picture has begun to emerge—albeit a complex one that involves a multifaceted combination of different factors.

Tinker explains that it all boils down to death rates. Otters in their reproductive prime are dying at a higher rate in the southern sea otter population than in populations that continue to grow. "We know that elevated mortality limits population growth," he says, "but trying to understand the relative importance of the many different sources of mortality is a challenge."

## Environmental sentinels

Sea otters are the smallest cold-water marine mammal, which means they're highly susceptible to heat loss in their aquatic environment. In addition, unlike other marine mammals, they lack a layer of blubber to keep them warm. To survive in cold Pacific waters, they rely on their thick fur coat as well as the heat generated from their extremely high metabolism.

"On a mass-specific basis, sea otters have one of the highest metabolic rates of any other marine mammal," explains Nicole Thometz, an EEB Ph.D. candidate who is studying the energetic demands of sea otters. "Adult sea otters must eat 25-30 percent of their body weight in food each day."

Their high caloric need alone causes sea otters to live near the brink of survival. Adding to their vulnerability, sea otters' main food source comes from shellfish—filter feeders that often accumulate marine contaminants.

Melissa Miller, a veterinary pathologist with the state Department of Fish and Wildlife who is affiliated with UCSC's Institute of Marine Sciences, examines virtually every dead otter that gets picked up on California's Central Coast—and a large percentage die from parasites, pathogens, or toxins. Land animals such as cats and opossums often transmit disease to sea otters through waterways that carry their feces. Fueled by agricultural runoff, freshwater algal blooms release toxins into streams that run into the ocean. In many areas, California sea otters carry a high load of industrial pollutants and pesticides in their tissues.

"Otters are the single best environmental sentinel I've ever seen for land to sea pollution," says Miller. Though otters are undoubtedly assaulted by human-caused pollution, most ecologists believe that the high rate of death from infectious disease in the southern sea otter is also the reflection of another underlying problem: otters on the central coast of California are not getting enough food to eat.

"The more data we collect across the population, the clearer we see behaviors that

scream out food limitation," says Bentall. Otters in the densely populated center of the range are scrawnier and spend more time foraging than their more robust counterparts in sparsely populated areas. Many females on the Central Coast die as they wean their pups. Others simply abandon their young, unable to consume enough calories to maintain the elevated energy demands of motherhood.

Living on the edge of what the environment can sustain, southern sea otters are energy-depleted and stressed, and thus more vulnerable to disease, proposes Tinker.

## Why not move?

The question is obvious: If sea otters are limited by food in the center of their range, why don't they simply move into the northern and southern peripheries, where otter densities are low and food resources are relatively abundant?

One answer, at least in recent years, is shark bite mortality. Scientists began to notice an increase in shark-bitten sea otters in 2000. By 2010, 20 percent of sea otters found dead on the shore were afflicted by shark wounds. Since then, the rate has grown to 30 percent across the southern sea otter range, with rates as high as 50 percent in the area from Morro Bay to Point Conception.

Sharks aren't actually eating sea otters—they simply taste them, then spit them out. And scientists aren't sure why this behavior is on the rise. Some suggest the population of white sharks has increased, so there is an influx of subadult sharks that haven't yet developed a good search image for the seals and sea lions they prefer. Others suggest sharks have changed their distribution to areas where elephant seals have become more abundant in recent years—the same areas that coincide with a higher incidence of shark-bitten sea otters.

Though shark bite is currently the southern sea otter's single largest cause of mortality, Tinker emphasizes the importance of addressing human-caused stressors, such as pollution, the alteration of natural waterways, and destruction of wetlands—all of which decrease water quality, potentially bringing sea

otters in contact with harmful substances.

"Human-caused factors may not have as big an impact as shark bites, but they are not negligible," he explains. "Combined, they make a substantial contribution to sea otter mortality—and these are factors we can do something about."

Trying to untangle these various stressors and figure out how they inhibit sea otter recovery, Bentall and her team continue to go out day after day, following the study animals

in their nearshore ecosystem.

"Patience and endurance—those are two things that are critical for an otter tracker," says Bentall, bracing herself against the wind that whips up from the bay. "The other critical thing is that you have to really care. Part of what makes you able to watch an otter for six hours is engagement. I've been tracking otters for 12 years and I still get excited to go out and see otters every day." As if on cue, the radio receiver picks up

the signal of the otter she's spent the better part of the morning looking for. Peering into her telescope, she lets out a whoop as the female otter comes into view: The otter successfully weaned her pup—and she's still in good condition.

Bentall's joy is short-lived, however. As soon as she's finished inputting data into her mobile PC, she packs her equipment and heads up the coast, in search of another sea otter.

## DEEPER POOLS, DEEPER RESEARCH

**Coastal Sustainability** Coastal Sustainability is a signature initiative in The Campaign for UC Santa Cruz. Projects include rebuilding and expanding the nearly 35-year-old outdoor marine mammal pools and research facilities at Long Marine Lab. | Plans are being developed and private funding sought for the project, which will allow important new study of dolphins, sea otters, seals, and sea lions such as Ronan, the famous beat-keeping sea lion. | Among improvements: making the pools deeper so marine animals have room to dive—and researchers can study how they do it. | To learn more, call (831) 459-4240, or write to [sciences@ucsc.edu](mailto:sciences@ucsc.edu).

## CO“OTTER”ATIVE RESEARCH

The federal agency with primary responsibility for research on threatened sea otter populations is the U.S. Geological Survey's Santa Cruz Field Station, a cooperative unit of UCSC and the USGS based at UCSC's Long Marine Laboratory and run by Tim Tinker, a USGS wildlife biologist, and Jim Estes, professor of ecology and evolutionary biology. | They work closely with a number of partner agencies, including the California Department of Fish and Wildlife (DFW), Monterey Bay Aquarium, UC Davis Veterinary School, and others. Next to Long Marine Lab is the DFW's Marine Wildlife Veterinary Care and Research Center, where wildlife veterinarian Melissa Miller conducts post-mortem examinations of sea otters and other marine wildlife. | The results of this collaborative research are used by the U.S. Fish and Wildlife Service to guide management decisions.

# ‘I felt a great sense of responsibility’



Carson Watts (Oakes '13, sociology)

Young alum’s experience in a Ghanaian slum confirmed his career path of sustainable development

Black smoke from burning e-waste and the acrid smell of sewage filled the air as Carson Watts (Oakes '13, sociology) strode through the slums of Old Fadama in the capital city of Ghana.

Home to nearly 100,000 people, the shantytown is a collection of dusty alleys, wooden shacks, and a sanitation system that consisted of trash haulers and latrine operators dumping their loads of waste into a fetid lagoon at the edge of the slum. A nearby e-waste disposal site was the reason for the black smoke.

Watts, who hopes to get a Ph.D. in sustainable development, was soon talking to residents and government officials in an attempt to understand why such unhealthy conditions existed and what could be done to improve them.

Old Fadama's residents said trash bins and public toilets would solve much of the problem—but the government only wanted the slum to be erased. Make something happen, the residents implored Watts.

"I felt a great sense of responsibility," said the 24-year-old alum, a community college transfer student who went to Ghana through UCSC's Education Abroad Program.

Watts not only wrote his senior thesis from research gathered during the five-month trip but he is also writing a position paper to send to Ghanaian officials outlining what he discovered.

"It was eye-opening to see the poverty there," Watts said of his time in the slums, "but it also confirmed my career path."

One day, Watts hopes to work in the sustainable development field both at home and abroad. He's arranged a future fellowship with the Center for Global, International and Regional Studies, a center for the study of international affairs at UCSC. Meanwhile, he is working for a grassroots campaign that fundraises for environmental and social justice issues.

—Peggy Townsend