

SEALS

in the service of science



by DANIEL COSTA

For more than a decade, our marine biology research unit of the University of California, Santa Cruz, has been conducting research on a variety of seals and sea lions in order to investigate the potential use of these large marine predators as ocean sensors. Wearing shedable tags developed by the Sea Mammal Research Unit in St. Andrews, Scotland, these animals are able to relay, via satellite, information on their location and diving behavior, as well as data on the temperature and salinity of the water through which they swim, data often otherwise difficult to collect. Such information is not only critical to understanding how a large marine predator like a seal uses the ocean environment to find food, but it also enables physical oceanographers to model the ocean currents and to understand the processes that are involved in climate change.

Our Tagging of Pacific Pelagics (TOPP) program—carried out under the aegis of the Census of Marine Life—is helping scientists to build a rich picture of key travel corridors and “ocean hot spots,” gathering zones where animals feed and breed. The data we have collected from northern elephant seals in the Año Nuevo State Reserve south of San Francisco—one of the best known and studied seal breeding colonies in the world; California sea lions foraging in the California current system; and southern elephant seals breeding in the Antarctica Peninsula, are already providing an extraordinary “organism’s eye” view of their world.

In April and May 2007, our TOPP team returned to Antarctica, this time as part of the International Polar Year program—Marine Mammals: Exploring the Oceans Pole to Pole. Our research goal was to build

on the information we had collected on crabeaters in 2001 and 2002 and on southern elephant seals in 2005 and 2006. Comparisons between the two species had been hampered by the fact that they were studied in different years. This time, we had an opportunity to collect data from both species, having successfully tagged 12 elephant seals in the South Shetland Islands a few months earlier. For this voyage, we would be focusing exclusively on crabeater and Weddell seals. Our base of operations for the expedition was the Antarctic Research Vessel, *L.M. Gould*, which is operated by the National Science Foundation. Joining me were Mike Goebel of the U.S. Antarctic Marine Living Resources Program; Mike Fedak from the Sea Mammal Research Unit; Dave Shuman, a veterinarian from Santa Cruz; and two UCSC graduate students, Birgitte McDonald and Luis Huckstadt.

Departing from Punta Arenas, Chile, we sailed north through the straits of Magellan and then south along the coast of Argentina through the infamous Drake Passage, and into the protection of the Antarctic Peninsula. There, we could see the snow and glacier covered South Shetland Islands; the outside temperature hovered at -2.0°C , with wind chill of -16°C . On our fifth day at sea, we journeyed south to Crystal Sound at the north end of Adelaide Island. We knew from previous tagging studies that crabeater seals favored this area, however, the sea ice had yet to form, providing few stable platforms upon which we could safely capture the seals and work with them. Sailing around the south end of the island, we came upon a medium-sized flow. In and among all of the fur seals on it we found five crabeaters. We mobilized our team and tagged our first seal as two other crabeaters and 15 fur seals looked on.

Within hours, the weather abruptly changed for the worse with heavy snow and wind. As night fell we took our captain's advice and moved the ship into the protected waters of Lalemand Fjord. The following morning, we woke up to a brilliant clear blue sky. In Lalemad Fjord we saw the effects of global warming as the region we operated in is listed on our nautical chart as a glacier. In other words, we were operating in 500 to 700 meters of water in an area that 20 to 30 years ago was frozen solid. We ultimately succeeded in finding ice floes upon which we could safely work, and over the course of three days, tagged two crabeaters as well as a Weddell seal, the latter giving us an opportunity to test our

satellite tags on this species. With our mission accomplished, we retraced our route back to Palmer Station, where we took the opportunity to look for crabeater seals in the vicinity. In the process, we encountered a variety of wildlife such as Gentoo penguins. We also saw many southern elephant seals—old friends as many of us have worked with elephant seals for many years. We timed our departure just right. After we left, a low-pressure cell moved in with winds at Palmer Station gusting to 60 knots.

We have now tracked the movements of our subjects for the past six months. Combining the data we collected with that from our earlier expeditions, we found that elephant seals dive deep and long—on average 24.3 minutes, 357 meters. They primarily are feeding offshore and along the outer reaches of the continental shelf. In contrast, crabeaters stay closer in and dive on average 3.8 minutes, 61 meters. The movements of crabeaters, which favor krill, are dictated by distribution and abundance of that food source, whereas elephant seals have more general diets and thus feed in a variety of habitats. Unlike the elephant or crabeater seals, the Weddells didn't move around, staying in the fjords and making dives that averaged 11.5 minutes, 91 meters. We have just begun our data analysis, but there is no question that we have gained significant information for understanding the different habitat preferences of these important Antarctic predators. Such information is becoming critically important as the Western Antarctic Peninsula is the most rapidly warming region in the world. ▲▼

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BIOGRAPHY

Daniel Costa is a Professor of Ecology and Evolutionary Biology at the University of California at Santa Cruz, where he was awarded a Ph.D. in 1978. That year, he made his first trip to the Antarctic as a postdoctoral researcher at the Scripps Institution of Oceanography. The Costa Spur, a promontory along the Victoria Land Coast in the Ross Sea, was named in recognition of his Antarctic research.