Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

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Marine tagging–elephant seals

A California Sea Lion with a time-depth recorder to keep track of dive patterns and also a satellite tag to radio its location.

Scientists opened the door to a marine world we had never seen before when they began to place electronic tags on marine mammals, fish, and seabirds. For the first time, they could follow the migration routes of these animals and track their movements beneath the sea surface.

Sophisticated tagging technology is central to a project called Tagging of Pacific Predators (TOPP), which began eight years ago and now involves dozens of scientists around the world, including groups at Long Marine Laboratory, Hopkins Marine Station and other labs around Monterey Bay.

Their discoveries include the record-breaking 40,000-mile annual migrations of sooty shearwaters described in my last column. By tagging more than 100 great white sharks off the central California coast, TOPP researchers have learned that a small group heads toward the Hawaiian Islands and another gathers in an area 1,300 miles offshore that has been dubbed the "white shark café."

Only recently have electronic tags become small and light enough to be worn by a small bird like the sooty shearwater. The earliest electronic tags were so big they could only be used on large animals such as seals, sharks and whales.

UCSC biologist and TOPP investigator Daniel Costa began using electronic data recorders to study the diving behavior of elephant seals in 1983. Those studies yielded astonishing results--elephant seals routinely dive to depths of 2,000 feet and can go as deep as one mile beneath the surface on dives that can last as long as two hours.

More recent studies show that elephant seals from Año Nuevo Island swim hundreds of miles offshore, in some cases as far as the Aleutian Islands, to feed in ocean "hot spots" where productivity is high and food is abundant. Repeat tagging of the same animals shows that they follow nearly identical paths year after year, across thousands of miles of ocean with no signs or maps.

The miniaturization of electronic components and sensors, plus advances in satellite technology, has led to dramatic improvements in the tags. Data loggers work like miniature flight recorders attached to an animal to record time, diving depths, heart rates and, more recently, water temperature and salinity. The information collected can be recorded and stored in the tag for later recovery, or it can be transmitted through satellite links to scientists in labs around the world.

This technology is a far cry from the first simple tags developed 125 years ago to track fish migrations. Those worked much like a note in a bottle--scientists knew where and when they tagged a fish and where and when it was caught, but nothing in between. Now, you can go to the TOPP web site (www.topp.org) and get a live update on the whereabouts of Penelope the elephant seal.

Each new tag deployed on a marine animal provides a glimpse into its life at sea. The challenge for scientists is to figure out why these animals follow the routes they do, how they know where they are going, and what they do when they get there. The TOPP program has now tagged over 4,000 animals, including seals, whales, tuna, turtles and albatrosses, with new information arriving daily.