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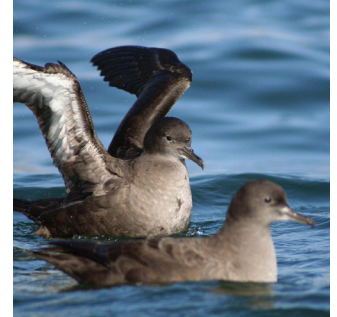


Photo: J. Adams/USGS

### SUMMARY

Scientists tracked sooty shearwaters (*Puffinus griseus*) within the California Current ecosystem during their summer-time feeding period and used the data to locate aggregations of prey species such as anchovy, sardine, krill and squid. Findings are assisting in identifying critical at-sea habitats for the shearwaters and are of direct relevance to developing ecosystem-based management plans of forage species, upon which seabirds and other marine species rely.

### PROJECT

In 2008-09, 57 birds were captured in the Santa Barbara Channel, Monterey Bay and Columbia River plume off Washington, outfitted with small transmitters, and tracked via satellite telemetry as they fed and molted from April to October. The tracking data were analyzed to: 1) identify foraging hotspots, 2) calculate residency times within different habitats, and 3) characterize inter-regional movements. As part of this work, scientists documented the birds' residency within the West Coast's five NOAA National Marine Sanctuaries.

The Sea Grant project complements a tracking study begun in 2004 by the scientists that has, among other things, documented the shearwaters' large-scale migration routes—the longest in the animal kingdom. This migration begins in the birds' breeding grounds in New Zealand, Chile and other parts of the south Pacific and south Atlantic oceans and ends in the historically highly productive waters around Japan, southeastern Alaska and the western coast of North America.

### FORAGING HOTSPOTS

The new tracking data provide further evidence for the existence of foraging hotspots and their highly variable locations from year to year.

In 2008, for example, feeding appeared concentrated north of the Columbia River plume, and in Monterey and San Luis bays. In 2009, it moved to nearshore waters of the Southern California Bight, perhaps in response to a shift in the location of sardines. The birds' distribution was also more dispersed in 2009.

### RESIDENCY PERIODS

During the study, the birds ranged from southeastern Alaska to southern Baja California, Mexico. They spent 83% of their time within the U.S. Exclusive Economic Zone (EEZ), which extends 200 nautical miles from the coast; 57% of their time over the shelf (in waters less than 200-meters deep); 35% over the slope (200-1,000 meters), and 8% over the continental rise (depths greater than 1,000 meters).



Photo: J. Polken-pbase.com/jpkln



Photo: G. Tepke-pbase.com/gtepke

Based on the tracking data, an individual bird typically utilized habitat within more than one of the sanctuaries. In total, however, within the EEZ, the 57 birds spent only a quarter of their residency within the sanctuaries. Of the five sanctuaries, the Monterey Bay National Marine Sanctuary and Channel Islands National Marine Sanctuary were the most heavily used by the birds.

## APPLICATIONS

The algorithms for filtering, interpolating and analyzing the telemetry data are being, or will be, applied to the tracking of the gray-faced petrel, Adélie penguin, Hawaiian petrel, pink-footed shearwater, black-footed albatross, Galapagos petrel and Kittlitz's murrelet. Besides identifying critical seabird habitats, the research may, in some cases, be used to reduce fishing impacts—especially from longlining—to seabirds.

The high demand for forage species (for human consumption, aquaculture/livestock production and the omega-3 supplement industry) places added pressure on food resources and habitats for marine species, scientists say. Findings from this project can assist in ensuring that adequate biomasses of forage species are left in the ocean to sustain marine life.

Last but not least, findings may offer insights into the causes of observed recent declines in sooty shearwaters in the California Current and at their breeding colonies in New Zealand. The researchers note that other highly abundant bird species have been driven to extinction in the past, and that science such as theirs can be used to protect shearwaters from a similar fate by, for example, providing information on where seabird conservation zones might be most effective.

## STUDENT

Melinda Nakagawa, M.S.

## PUBLICATIONS

Adams, J. and S. Flora. Correlating seabird movements with ocean winds: linking satellite telemetry with ocean scatterometry. *Marine Biology*. 2010. DOI 10.1007/s00227-009-1367-y

Nevins, H. M., J. Adams, H. Moller, J. Newman, M. Hester, and K. D. Hyrenbach. International and cross-cultural management in conservation of migratory species. *Journal of the Royal Society of New Zealand*. 2009. 39(4):183–185.

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