

# Study maps human impacts on top ocean predators along US west coast

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Laysan albatross is one of eight protected predator species included in the study of human impacts on marine predators in the California Current ecosystem.

Credit: Dan Costa, UC Santa Cruz

The California Current System along the U.S. west coast is among the richest ecosystems in the world, driven by nutrient input from coastal upwelling and supporting a great diversity of marine life. Like coastal regions in general, it is also heavily impacted by human activities. A new study led by scientists at the University of California, Santa Cruz, reveals areas along the west coast where human impacts are highest on marine predators such as whales, seals, seabirds, and turtles.

The study, published October 28 in *Nature Communications*, found that many of the high impact areas are within the boundaries of National Marine Sanctuaries. This means there are good opportunities for improving management strategies, according to first author Sara Maxwell, who led the study as a graduate student in ocean sciences at UC Santa Cruz and is now a postdoctoral scholar at Stanford University's Hopkins Marine Station.

"The sanctuaries are located close to the coast in areas where there are a lot of [human](#) activities and a lot of [marine life](#), so it's not surprising that we see a lot of impacts there," Maxwell said, noting that oil spills were a big concern when the sanctuaries were established, and many do not limit activities such as fishing, although they are actively engaged in managing industries such as shipping.

"With the sanctuaries already in place, we have an opportunity to increase protections. The results of this study allow us to be more specific in where we focus management efforts so that we can minimize the economic impact on people," she said.

There are five National Marine Sanctuaries along the west coast, covering nearly 15,000 square miles. A proposed expansion of the Gulf of the Farallones and Cordell Bank National Marine Sanctuaries would extend protections north to Point Arena, a key area identified in the study.



California sea lions are among 23 species whose movements have been tracked since 2000 as part of the Tagging of Pacific Predators (TOPP) program. Credit: Dan Costa, UC Santa Cruz

Marine mammals and other predators are critical to the health of marine ecosystems. The study used tracking data for eight species of [marine predators](#): blue whales, humpback whales, northern elephant seals, California sea lions, black-footed and Laysan albatrosses, sooty shearwaters, and leatherback sea turtles. These are among the 23 species whose movements have been tracked since 2000 as part of the Tagging of Pacific Predators (TOPP) program. The eight species included in the new study are ecologically important but are not commercially exploited, Maxwell said.

The TOPP studies showed that many marine predators travel thousands of miles every year, yet often concentrate within small-scale "hotspots" to breed or feed on fish and other prey. Many such hotspots are found within the California Current System.



A dolphin is dwarfed by a massive container ship. Impacts of shipping on marine mammals include ship strikes, a particular concern for large whales. Credit: Elliott Hazen, NOAA Southwest Fisheries Science Center

Maxwell and her coauthors combined the TOPP tracking data with a database of human impacts in the California Current System that was developed by a group led by coauthor Benjamin Halpern at UC Santa Barbara. The relative impact on each species was determined for each of 24 stressors associated with human activities, such as fishing, shipping,

climate change, and pollution. The analysis yielded maps showing where the greatest impacts on each species are likely to be.

"Areas where key habitats and human impacts overlap represent important areas for conservation efforts," Maxwell said. "In other cases, areas of high human activities are not key habitats for predators. As a result, we can maximize both conservation of marine predators and human uses that our coastal communities depend on."

The study suggests that protecting key habitat without considering human uses may result in missed opportunities for sustainable resource use. "Having this detailed spatial information will help us move toward a more sustainable management approach," said coauthor Elliott Hazen, a research biologist at UCSC and the NOAA Southwest Fisheries Science Center.

Providing information to support management and policy decisions was one of the goals of the TOPP program, which was conceived by coauthors Dan Costa at UC Santa Cruz, Steven Bograd at NOAA, and Barbara Block at Stanford. TOPP researchers used sophisticated tags with satellite- or light-based geolocation capabilities to track the movements of top predators throughout the Pacific Ocean.

"A major component of the TOPP program was to identify important conservation areas of the North Pacific Ocean. This paper is a significant step forward in increasing our awareness of the 'blue Serengeti' that lies just off the [west coast](#) of the U.S.," Costa said.

Provided by University of California - Santa Cruz

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