New maps may reduce tourism impacts on Hawaiian dolphins

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Photo courtesy of David Johnstoт

Over-eager eco-tourists intent on seeing spinner dolphins up close may inadvertently be disturbing the charismatic animals' daytime rest periods and driving them out of safe habitats in bays along Hawaii's coast.

Scientists at Duke and Stony Brook universities have developed a promising new tool that may help to limit repeated human disturbances and help reduce their negative impacts on the dolphins.

"Using the maps produced through this study we can identify the bays where the effects of human activities on spinner dolphins should be monitored most closely, and where immediate conservation actions are required," said David W. Johnston, research scientist at Duke's Nicholas School of the Environment.

The researchers' tool shows that only a small number of bays – 21 out of 99 – in a study area along the western coastlines of the main Hawaiian islands were suitable habitats for resting dolphins. Knowing this, "conservation efforts can be focused on specific areas of importance," Johnston said,

"We may be able to minimize detrimental effects on dolphins by putting restrictions or preventative measures into place in a relatively small number of bays, rather than limiting access to dolphins along the entire coast," said the study's lead author, Lesley H. Thorne, a lecturer in marine science at Stony Brook University, who received her PhD from Duke in 2010. "That benefits tourists and tourism operators as well as the dolphins."

In the study, the researchers used the geographic coordinates and key environmental factors – such as water depth and calmness, the size and proportions of the bays and distances from deep-water foraging grounds – for hundreds of spinner dolphin sightings made in the study area between 2000 and 2010. The results appear August 27 in the online, open-access peer-reviewed journal PLoS ONE. It's available at http://bit.ly/PMtBGp

Spinners are small dolphins famed for their graceful aerial movements and balletic spins. They are found in tropical and subtropical oceans around the world and some divide their time between daytime rest periods in shallow, protected bays and nighttime foraging in more exposed waters.

Distinguishing between sightings of resting and active dolphins was key to defining critical habitats, Thorne said. While socially active spinner dolphins are more tolerant of humans' presence, resting dolphins will leave the safety of a bay and retreat to less suitable open waters if humans repeatedly disturb them.

"Sleep is essential for most animals," added Johnston. "When deprived of their necessary 'zzzz's,' they gradually show a decreased ability to process information and remain attentive to environmental stimuli. In technical lingo, we call this a 'vigilance decrement'."

Spinner dolphins are no exception to the rule. The researchers say dolphins that experience human harassment every day during their rest periods never fully recover their vigilance decrement. Their ability to forage successfully and detect the presence of nearby predators is also degraded, and their ability to produce sounds to communicate and navigate may also be impaired, he said.

Scientists and conservationists have long worried that spinners' popularity with tourists – and overlap of their resting habitats with popular ocean recreation destinations – may be placing them at risk. Reports of interactions have increased sharply in recent years, but few published studies have examined the detrimental impacts these interruptions may have on the animals, especially at the population level.

"It would be next to impossible to survey spinner populations and human activities in every bay that might be a resting habitat," Thorne said. "We're talking about hundreds of bays in the Hawaiian islands alone."

"Using predictive models, such as the maximum entropy spatial modeling approaches we've produced, is a much more cost-effective method," she said. "This type of modeling has only recently been applied to the study of marine mammals, but our study suggests it may be especially useful."

Thorne and Johnston plan to test their models by conducting similar studies of spinner dolphin distributions and habitat use in the Northwestern Hawaiian Islands and other sites in the Pacific islands region. Results from those studies, they said, could confirm the new

models' usefulness.

Johnston and Thorne's co-authors on the *PLoS ONE* study include Dean L. Urban, professor of landscape ecology at Duke's Nicholas School, and Lars Bejdar, associate professor at Murdoch University, Australia, and adjunct assistant professor at Duke.

The data on spinner dolphin sightings used to develop the models in the study were provided by a team of eight additional co-authors from Murdoch University, the Pacific Islands Photo-Identification Network, the Cascadia Research Collective, the Hawai'i Marine Mammal Consortium, the Hawai'i Association for Marine Education and Research, the Dolphin Institute, the University of Hawai'i (UH) at Hilo, UH at Mānoa, and Marine Mammal Research Consultants.

More information: "Predictive modeling of spinner dolphin (Stenella longirostris) resting habitat in the main Hawaiian Islands," L.H. Thorne, D.W. Johnston, D.L. Urban, J. Tyne, L. Bejder, R.W. Baird, S. Yin, S.H. Rickards, M.H. Beakos, J.R. Mobely Jr., A.A. Pack, M.C. Hill. *PLoS ONE*, August 24, 2012. DOI: 10.1371/journal.pone.0043167

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