

# Sea turtles might

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Green sea turtles may stop basking on Hawaii's shores as early as 2039 if climate change continues at its current rate, a new study concludes.

The Hawaii-based study by scientists with the National Oceanic and Atmospheric Administration also suggests that green sea turtle basking may come to an end globally by about 2100 if oceans continue to warm as projected.

As part of the study, researchers analyzed six years of turtle count data collected daily by volunteers at Laniakea Beach, along with 24 years of satellite data, to conclude that turtles bask more often when sea surface temperatures drop.

Turns out turtles tend not to bask when local winter sea surface temperatures rise above 73.4 degrees, according to the study.

The peer-reviewed findings of Kyle Van Houtan and Wendy Marks of NOAA's Turtle Research Program in Honolulu and John M. Halley of the University of Ioannina in Greece were published last month in the journal *Biology Letters*.

Basking on sun-warmed beaches helps to regulate body temperatures and may boost immune systems and digestion, according to the study. Others believe the behavior may also provide refuge from predators and

offer a period of rest.

More research is needed to better grasp the importance of basking and the effect climate change will have on sea turtles, said Van Houtan, who is also an adjunct associate professor at Duke University.

In conducting the study, Van Houtan and his colleagues used turtle count data from the nonprofit Malama na Honu, which has been protecting basking turtles on Laniakea Beach on Oahu's North Shore since at least 2007.

The Malama na Honu data show regular, seasonal fluctuations in the number of turtles basking on the beach, with turtles basking more often when waters are cooler.

The scientists also compared the temperature fluctuations and basking with growth marks in the humerus bone of several turtles, discovering that they occurred from February and April — the time of year when turtles bask more.

According to Van Houtan, such growth lines are like tree rings in that they indicate periods of stress. In trees, growth rings reflect different seasons and times of drought.

In sea turtles the marks appear to indicate periods when seas are cooler, body temperatures are lower and turtles are more likely to haul out of the ocean to warm in the sun.

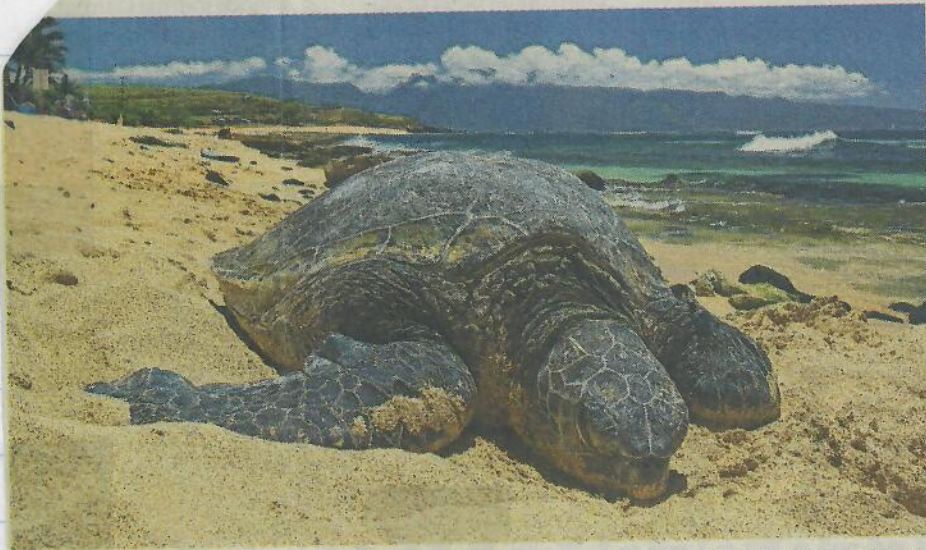
Not all green sea turtles bask on land. While the turtles are found in tropical and subtropical oceans globally beach basking has been seen only in Hawaii, the Galapagos Islands and Australia.

Adding to the problem is that sea surface temperatures in these areas have been warming at three times the global average, the study said.

It's unclear whether turtles that currently bask on land will adapt to warming seas and begin to bask exclusively in the water like some other populations around the world.

"When looking at climate change, which is this vast geopolitical issue, you have

# stop basking as sea warms



COURTESY CHRIS STANKIS

**Data from the nonprofit group Malama na Honu show Hawaiian green sea turtles bask on the beach more often when waters are cooler. A turtle basks on the sand in Paia, Maui.**

to drill down to specific climate variables impacting specific aspects of an organism's life," Van Houtan said in a news release. "The next step for us is to look at how turtles are storing climate data in their bodies — in their tissues, shells and bones — and how we can tease that out."

In the main Hawaiian Islands, basking behavior was extremely rare during the 1970s, '80s and '90s due to overharvesting of green sea turtles for meat and shell. State and federal regulations were established banning the harassment and harvesting of green turtles, and it wasn't until 1999 that a single adult was observed regularly visiting Laniakea Beach.

On Maui, turtles started showing up in 2008. Since then some 160 individual turtles have been identified basking on Valley Isle beaches, and more than 60 were seen on one north shore beach at one time, according to officials with the Hawaii Wildlife Fund, whose volunteers have been guarding turtles on the island daily with help from a Hawaii Tourism Authority grant.

Cheryl King, the nonprofit's Maui research coordinator, said turtle basking numbers have been on the rise substantially on Maui, both during the day and the night.

"It's very noticeable," she said.

King said observers don't know exactly why this phenomenon is happening, but it could be there's a growing number of protected turtles that are behaving as their ancestors did before the species was diminished by hunting.

Hawaii Wildlife Fund President Hannah Bernard said it would be a shame if the turtles didn't come ashore in the future, but that the greater concern might be sea level rise and the associated loss of beaches.

"The bottom line for now is that we're lucky have so many turtles starting to bask all around the Hawaiian Islands," she said, adding that kupuna have told her they remember basking turtles in the past.

Jim Kennedy, president of Malama na Honu, was philosophical as he pondered the possibility that his beloved sea turtles might not visit Laniakea by 2039.

"It will be sad, yes, but nature will survive," he said.

Kennedy said many people around the world have not had the privilege to witness a basking sea turtle.

"We've enjoyed seeing these beautiful creatures for the past 15 or 16 years," he said. "We would welcome another 24 years and consider it a gift."