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Can Ocean Modeling Help Predict Where Cold-Stunned Sea Turtles Wash Up?

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Physical properties of the ocean may help scientists better prepare for cold-stunning events and help conserve endangered species of sea turtles.

SOURCE: PLOS ONE
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As with many reptiles, sea turtles are ectotherms and they rely on external sources of heat to help regulate their body temperature. Sea turtles can be found in almost every ocean basin throughout the world, including the waters of the North Atlantic during the summer and early fall. These waters are warm and productive enough for sea turtles to forage, but by late fall water temperatures begin to drop significantly. Usually, sea turtles migrate towards warmer waters when temperatures begin to drop, but some do not leave early enough despite the presences of colder temperatures.

According to the National Ocean and Atmospheric Administration (NOAA), “Cold Stunning” refers to the hypothermic reaction that occurs when cold-blooded sea turtles become lethargic and disoriented, often resulting in turtles washing ashore and dying. Cold-stunned strandings are particularly common in Cape Cod, Massachusetts, and many marine biologists believe this is closely related to the shape of the Cape Cod Peninsula.

Shaped like a gigantic fish hook, Cape Cod isolates waters within Cape Cod Bay from the open Atlantic Ocean just outside the bay. Waters outside of the cape cool faster than inside meaning that by the time turtles in Cape Cod Bay begin to leave, the open ocean is already much colder. Shortly after entering these chilly waters, many turtles become cold-stunned and wind up washing ashore on the outer edge of Cape Cod. Being able to predict where these stranding events occur is a valuable tool for rescuers.

In 2018, Liu et al set out to find where cold-stunned sea turtles started their journey. The researchers used a Finite Volume Community Ocean Model to predict where strandings are likely to occur. This type of model incorporates the interactions between ocean circulation, surface water temperatures, tides, thermohaline processes, and animal behavior. Comparisons to stranding observations and data from satellite-tracked surface drifters demonstrated that the model was accurate in predicting sea turtle strandings. The authors found that there are two major oceanographic factors that increased cold-stunned stranding events: temperatures below 10.5 ºC and wind stress greater than 0.4 Pa. Additionally, most physical oceanic processes had some sort of an effect on sea turtle strandings.

While this study improved our predictions slightly about where cold-stunned sea turtles end up, more research needs to be done. The model discussed above only predicts movement on or near the surface and does not account for turtles that swim at greater depth. This is vital because depth within the body of water changes how oceanographic processes impact a turtle’s path. Ideally future models will be able to account for these depth changes, and future research may even involve tagging turtles in warmer months which would allow for scientists to track the actual path of cold-stunned individuals. Research like this is vital in helping biologists better understand and conserve endangered sea turtle populations.

Citation: Liu, X. (2019), On simulating cold-stunned sea turtle strandings on Cape Cod, Massachusetts, PLoS ONE, https://doi.org/10.1371/journal.pone.0204717. Published on 4 December 2019.