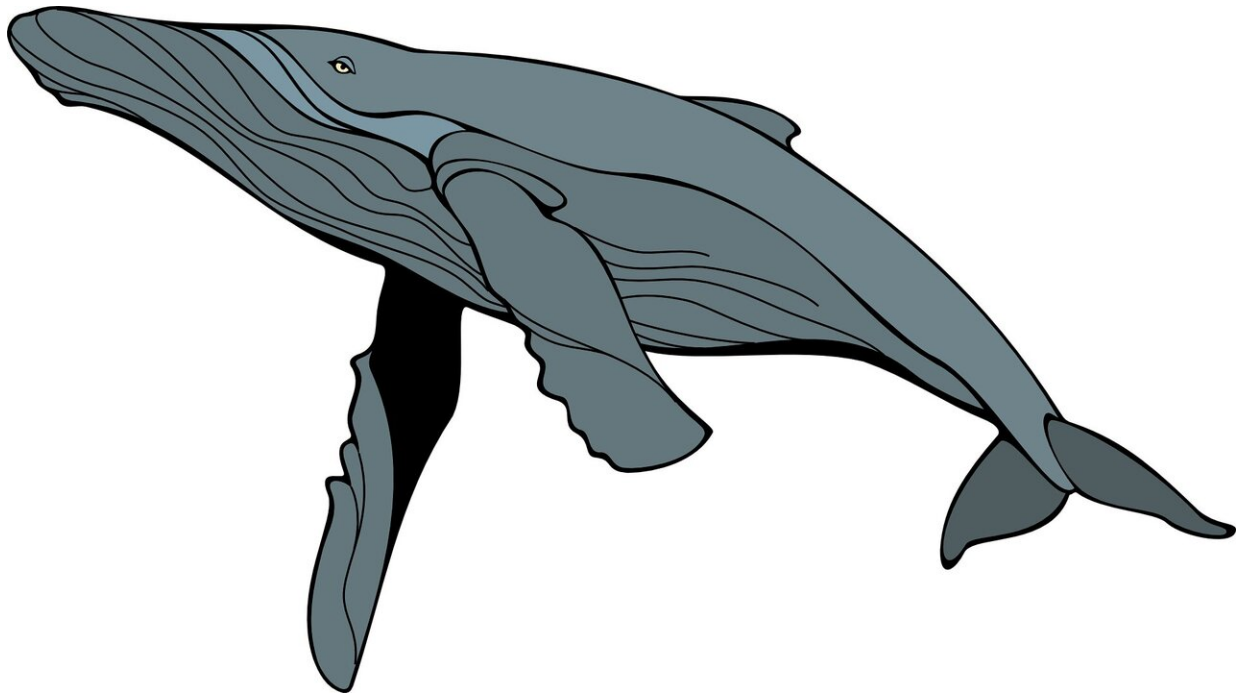
Solar storms may leave gray whales blind and stranded

February 24 2020



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A new study reported in the journal *Current Biology* on February 24 offers some of the first evidence that gray whales might depend on a magnetic sense to find their way through the ocean. This evidence comes from the discovery that whales are more likely to strand on days when there are more sunspots.

Sunspots are of interest because they are also linked to solar storms—sudden releases of high-energy particles from the sun that have the potential to disrupt magnetic orientation behavior when they interact with Earth's magnetosphere. But what's especially unique about the new study, according to the researchers, is that they were able to explore how a solar storm might cause whales to strand themselves.

"Is it that the solar storms are pushing the magnetic field around and giving the whales incorrect information—for example, the whale thinks it is on 4th Street, but it is actually on 8th?" asks Jesse Granger of Duke University. "Or is it that the solar storms are messing up the receptor itself—the whale thinks it is on 4th Street, but has just gone blind?

"We show that the mechanism behind the relationship between solar storms and gray whales, if it is an effect on a magnetic sensor, is likely caused by disruption to the sense itself, not inaccurate information. So, to put this back into the earlier metaphor, the big secondary finding of this paper is that it is possible that the reason the whales are stranding so much more often when there are solar storms is because they have gone blind, rather than that their internal GPS is giving them false information."

Granger says her interest in long-distance migrations stems in part from her own personal tendency to get lost, even on her way to the grocery store. She wanted to explore how some animals use magnetoreception to navigate by looking at incidents when navigation went terribly wrong.

"I hypothesized that by looking at patterns in the spacing and timing of incidents where an animal was unable to navigate properly, we could better understand the sense as a whole," Granger says.

She and her colleagues studied 186 live strandings of the gray whale (Eschrichtius robustus). The data showed those strandings occurred

significantly more often on days with high sunspot counts than on randomly chosen days. On days with a high sunspot count, the chance of a stranding more than doubled.

Further study showed that strandings happened more often on days with a high solar radio flux index, as measured from Earth, than on randomly chosen days. On days with high RF noise, the likelihood of strandings was more than four times greater than on randomly selected days.

Much to Granger's surprise, they found no significant increase in strandings on days with large deviations in the magnetic field. Altogether, the findings suggest that the increased incidence of strandings on days with more sunspots is explained by a disruption of whales' magnetoreceptive sensor, rather than distortion of the geomagnetic field itself.

"I really thought that the cause of the strandings was going to be inaccurate information," Granger said. "When those results came up negative, I was flummoxed. It wasn't until one of my co-authors mentioned that solar storms also produce high amounts of radio-frequency noise, and I remembered that radio-frequency noise can disrupt magnetic orientation, that things finally started to click together."

Granger says it's important to keep in mind that this isn't the only cause of strandings. There are still many other things that could cause a whale to strand, such as mid-frequency naval sonar.

Granger now plans to conduct a similar analysis for several other species of whales on several other continents to see if this pattern exists on a more global scale. She also hopes to see what sort of information this broader picture of strandings can offer for our understanding of whales' magnetic sense.

More information: *Current Biology*, Granger et al.: "Gray whales strand more often on days with increased levels of atmospheric radio-frequency noise" www.cell.com/current-biology/f … 0960-9822(20)30028-2 , DOI: 10.1016/j.cub.2020.01.028

Provided by Cell Press