

Migrating blue whales rely on memory to find their feeding grounds

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Breakfast spots, coffee shops, and watering holes pepper the daily commutes of modern urban humans, but we try to remember the ones where we get the best food or drinks. If we do longer journeys routinely, we also keep track of the best grazing grounds—a diner, a gas station with the best snacks, and so on.

Blue whales, according to research published in *PNAS* this week, seem to make similar mental notes. On their annual migration, their path takes in the spots that have proven to be the most reliable feeding grounds over the years. In doing this, the whales may bypass hotspots that pop up and fade from one year to the next, suggesting that they rely heavily on memory to find a solid meal. But in a world where “normal” is shifting rapidly, the endangered whales may no longer be able to rely on the abundance of those old, faithful feeding grounds.

Why do whales go where they go?

Blue whales are the largest animal that we know to have lived, and that means they need colossal amounts of food. Despite

this, they're picky eaters, feeding almost exclusively on small crustaceans called krill, which they eat by lunging through a large swarm with an open mouth, trapping the animals in their mouths while the sea water filters back out. And they manage to find sources of food while migrating from a summer near the poles to a winter spent closer to the equator.

Briana Abrahms and her colleagues wanted to understand the food-finding habits of migrating blue whales—both to add to a growing picture about how migrating animals find their food and to better understand the kind of threat that climate change might pose to these whales. Focusing on the blue whales that live in the North Pacific, they looked at years of data on their migrations to try to get a handle on what was driving their decisions.

This was not a simple task. Radio tags can yield amazing data on the movements of the animals themselves, but who's to say why they chose to move where they did? To figure this out, Abrahms and her colleagues used chlorophyll, the pigment plants use to absorb energy from sunlight. A high concentration of chlorophyll in the ocean suggests that the spot is home to large amounts of plankton—and in turn, large amounts of the krill that feed on the plankton, which are fed on by the blue whales.

As springtime moves into the Northern Hemisphere, the bloom of plankton sweeps northward, beginning earlier in the season in the south and blooming later in the north. At the same time, the blue whales in the North Pacific undertake their annual springtime migration northward from their breeding grounds in the Gulf of California and off Costa Rica, moving all the way up the coast to British Columbia.

The best krill restaurant, every

year

The researchers wanted to see which of two different patterns would fit the movements of the migrating whales. If the whales were relying on sensory information to find the best krill spots, they would move to the most abundant spots wherever they were, changing the path of their migration from year to year. If they relied on memory, they should go instead to the most consistently productive spots year after year.

Memory, it turns out, was the behavior better supported by the data. Year after year, the whales were returning to the spots that had proven reliable in the past, with little difference in how much food they yielded from one year to the next.

The researchers, however, point out that there is definitely more to the picture than this. The memory of the best spots might drive the whales to general areas that have historically yielded the most krill. Once they get there, it's likely that the whales are still using sensory information to fine-tune their movements and find the best patches of krill within an area.

In a species as long-lived as blue whales, this reliance on memory isn't necessarily surprising—but it is important confirmation of a behavior that could help conservationists to better understand new threats to the already endangered species. Hunted nearly to oblivion for around a century until the 1960s, blue whale populations have recovered to an extent, but they now face a litany of new dangers: ship strikes, ocean noise, and rising ocean temperatures that may disrupt their temperature-sensitive migration habits.

Krill, which is abundant in cold northern waters, may also see its population drop as the oceans warm. This research suggests that the issue is not just how much krill is available but also where it is found from year to year—changes to that could cause problems for the long-lived blue whales. The memories

that lead them back to the same reliable spots every year may soon instead leave them at the mercy of newly capricious oceans.

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