Chemical profiles in whale blubber reveal changes in Antarctic food chain

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A long-term Griffith University-led study has for the first time used biochemical tracers in whale blubber to track the diet of humpback whales over 10 years.

Researchers from the Southern Ocean Persistent Organic Pollutants Program (SOPOPP) at the Environmental Futures Research Institute, together with CSIRO, were investigating whether southern hemisphere humpback whales diversified their food source in the rapidly changing Antarctic sea-ice ecosystem.

"There have been recent observations of humpback whales feeding on multiple food sources when migrating along the south-east coast of Australia," said Ph.D. Candidate at the Environmental Futures Research Institute Jasmin Groß

"These observations warranted a critical assessment of variability in diet of southern hemisphere humpback whales from year to year and their assumed classification as high-fidelity Antarctic krill consumers."

Each food source leaves a distinct chemical signature embedded in the animal's body tissue. By sampling the blubber of healthy, free swimming whales every year off North Stradbroke Island from 2008-2018, the researchers could extract those chemical signatures or fatty acid profiles and unlock any variability in their diet over time.

"Despite finding significant variability from one year to the next, our results confirmed that the whales were true to their classification as high-fidelity Antarctic krill consumers, feeding almost exclusively on krill," said Associate Professor Susan Bengtson Nash.

"The amount of two indicator fatty acids for Antarctic krill remained largely unchanged across the 10-year period, suggesting that the vast majority of the whales' energy comes from Antarctic krill, regardless of changing environmental conditions. This makes southern hemisphere humpback whales vulnerable to sudden crashes in the Antarctic krill population."

But while the whales didn't seem to alter their diet from year to year, surprisingly the results indicated that their principal prey, Antarctic krill, does.

"The observed variability in the chemical profile in whales from year to year likely arises from changes in the diet of krill rather than east coast of Australia migrating humpback whales," Ms Groβ said.

"Krill migrate both vertically and across regions and as their diet depends on the organic matter they encounter, their changing chemical profiles from year to year likely reflects climate induced changes in the phytoplankton assemblages they're eating, as well as changes in where they are feeding. The fact that Antarctic krill, the humpback's primary food and a crucial link in marine ecosystems, have a more varied diet could make krill populations more resilient to changing environmental conditions. These findings of the SOPOPP's Humpback Whale Sentinel Program are crucial for future Antarctic food web investigations and demonstrate the value of long-term biomonitoring programs for circum-polar surveillance of the Antarctic sea-ice ecosystem."

More information: Jasmin Groß et al. Interannual variability in the lipid and fatty acid profiles of east Australia-migrating humpback whales (Megaptera novaeangliae) across a 10-year timeline, *Scientific Reports* (2020). DOI: 10.1038/s41598-020-75370-5

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