

## 'The blob,' food supply squeeze to blame for largest seabird die-off

January 15 2020

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Adult common murres return to island and sea stack colonies from California to Alaska, spending three months during each summer to breed. A single chick takes two parents to hunt for fish, such as the rockfish -- a staple of the California murre diet -- pictured here. Credit: Jane Dolliver

The common murre is a self-sufficient, resilient bird.

Though the seabird must eat about half of its body weight in prey each day, common murre are experts at catching the small "forage fish" they need to survive. Herring, sardines, anchovies and even juvenile salmon are no match for a hungry murre.

So when nearly one million common murre died at sea and washed ashore from California to Alaska in 2015 and 2016, it was unprecedented—both for murre, and across all [bird species](#) worldwide. Scientists from the University of Washington, the U.S. Geological Survey and others blame an unexpected squeeze on the ecosystem's food supply, brought on by a severe and long-lasting marine heat wave known as "the blob."

Their findings were published Jan. 15 in the journal *PLOS ONE*.

"Think of it as a run on the [grocery stores](#) at the same time that the delivery trucks to the stores stopped coming so often," explained second author Julia Parrish, a UW professor in the School of Aquatic and Fishery Sciences. "We believe that the smoking gun for common murre—beyond the marine heat wave itself—was an ecosystem squeeze: fewer forage fish and smaller prey in general, at the same time that competition from big fish predators like walleye, pollock and Pacific cod greatly increased."



Common murrens washing onto beaches in the Homer, Alaska, area were so abundant in early 2016 that volunteer beach surveyors were forced to collect and photograph them in batches. Credit: COASST

Common murrens nest in colonies along cliffs and rocky ledges overlooking the ocean. The adult birds, about one foot in length, are mostly black with white bellies, and can dive more than two football fields below the ocean's surface in search of prey.

Warmer surface water temperatures off the Pacific coast—a phenomenon known as "the blob"—first occurred in the fall and winter of 2013, and persisted through 2014 and 2015. Warming increased with

the arrival of a powerful El Niño in 2015-2016. A number of other species experienced mass die-offs during this period, including tufted puffins, Cassin's auklets, sea lions and baleen whales. But the common murre die-off was by far the largest any way you measure it.

From May 2015 to April 2016, about 62,000 murre carcasses were found on beaches from central California north through Alaska. Citizen scientists in Alaska monitoring long-term sites counted numbers that reached 1,000 times more than normal for their beaches. Scientists estimate that the actual number of deaths was likely close to one million, since only a fraction of birds that die will wash to shore, and only a fraction of those will be in places that people can access.

Many of the birds that died were breeding-age adults. With massive shifts in food availability, murre breeding colonies across the entire region failed to produce chicks for the years during and after the marine heat wave event, the authors found.

"The magnitude and scale of this failure has no precedent," said lead author John Piatt, a research biologist at the U.S. Geological Survey's Alaska Science Center and an affiliate professor in the UW School of Aquatic and Fishery Sciences. "It was astonishing and alarming, and a red-flag warning about the tremendous impact sustained ocean warming can have on the marine ecosystem."



On Jan. 1 and 2, 2016, 6,540 common murre carcasses were found washed ashore near Whitter, Alaska, translating into about 8,000 bodies per mile of shoreline -- one of the highest beaching rates recorded during the mass mortality event. Credit: David B. Irons

From a review of fisheries studies conducted during the heat wave period, the research team concluded that persistent warm ocean temperatures associated with "the blob" increased the metabolism of cold-blooded organisms from zooplankton and small forage fish up through larger predatory fish like salmon and pollock. With predatory fish eating more than usual, the demand for food at the top of the food chain was unsustainable. As a result, the once-plentiful schools of forage fish that murrens rely on became harder to find.

"Food demands of large commercial groundfish like cod, pollock, halibut and hake were predicted to increase dramatically with the level of warming observed with the blob, and since they eat many of the same prey as murrens, this competition likely compounded the [food supply](#) problem for murrens, leading to mass mortality events from starvation," Piatt said.

As the largest mass die-off of seabirds in recorded history, the common murre event may help explain the other die-offs that occurred during the northeast Pacific marine heat wave, and also serve as a warning for what could happen during future marine heat waves, the authors said. UW scientists recently identified another marine heatwave forming off the Washington coast and up into the Gulf of Alaska.

"All of this—as with the Cassin's auklet mass mortality and the tufted puffin mass mortality—demonstrates that a warmer ocean world is a very different environment and a very different coastal ecosystem for

many marine species," said Parrish, who is also the executive director of the Coastal Observation and Seabird Survey Team, known as COASST. "Seabirds, as highly visible members of that system, are bellwethers of that change."

**More information:** Piatt JF, Parrish JK, Renner HM, Schoen SK, Jones TT, Arimitsu ML, et al. (2020) Extreme mortality and reproductive failure of common murrelets resulting from the northeast Pacific marine heatwave of 2014-2016. *PLOS ONE* (2020). [DOI: 10.1371/journal.pone.0226087](https://doi.org/10.1371/journal.pone.0226087)

Provided by University of Washington

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