MARCH 2020 ISSUE 5

COASST

Science Update

An (un)Common Murre Mortality Event

Overview

Science Update is a special publication of the Coastal Observation and Seabird Survey Team (COASST) highlighting recent research and scientific publications.

In this issue, we look at a mass mortality event of Common Murres along the West Coast from California to Alaska, in winter 2015–16.

Photo: iStock.com/fallbrook5

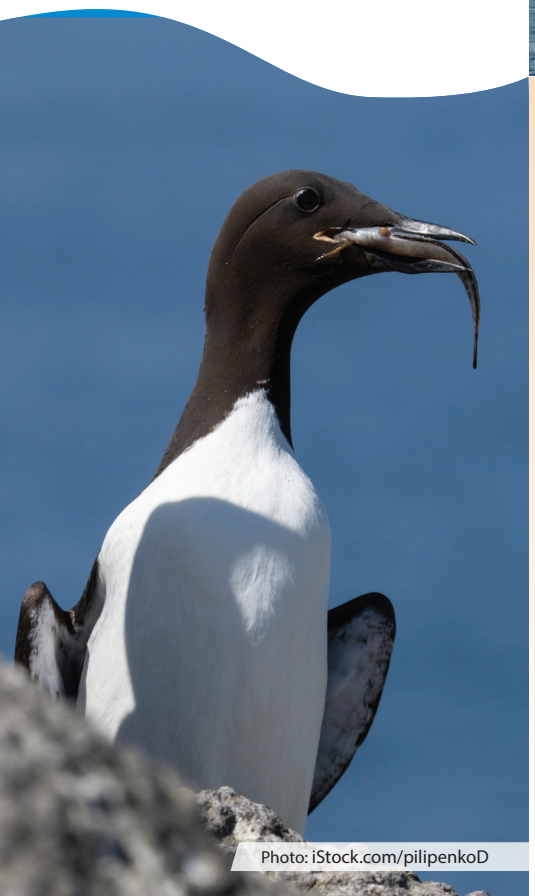


Photo: iStock.com/pilipenkoD

New Year's Surprise

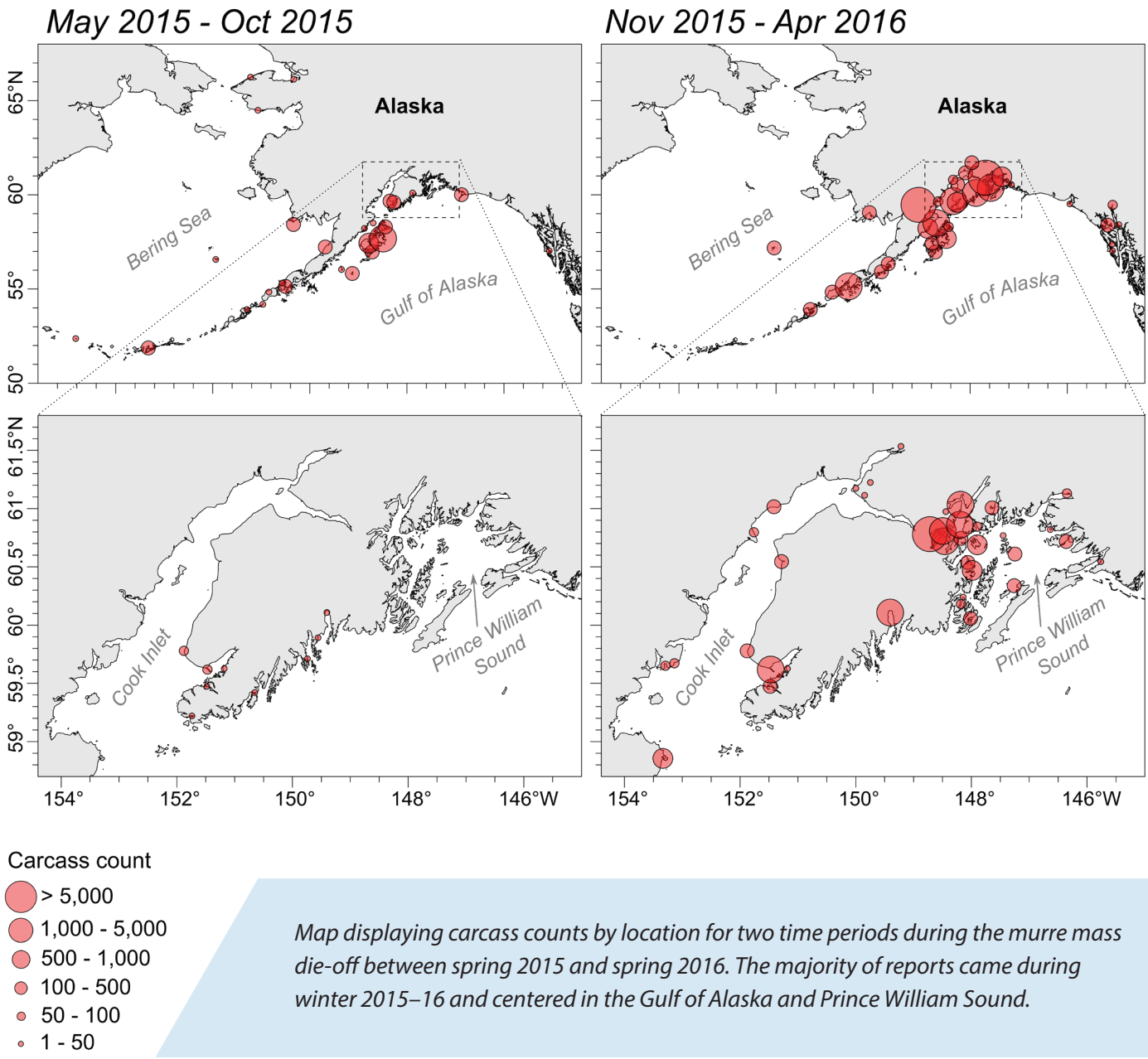
On New Year's Day, Dave Irons and his family piled into their car in Anchorage for a trip to Whittier. Sixty miles southeast down Turnagain Arm and along the Portage Glacier Road, Whittier harbor sits at the top of a long fjord on the western edge of Prince William Sound. They had planned a sailing trip. But even before they got to their boat, Dave noticed what he thought might be seabirds washed up on the adjacent beach. What he saw was, literally, murre devastation: 6,540 carcasses in just under 1.5 kilometers, piled up in the wrack zone and among the wood high up on the beach. Sailing was canceled. For the next two days, Dave and family counted birds, took photographs, and collected carcasses for sampling. Their efforts provided scientists with verifiable and quantifiable information on the highest encounter rate site of the entire Common Murre die-off: about 8,000 bodies per mile of beach.

A Murre Emergency

It started with an odd email. Bush pilot Paul Claus encountered a beach strewn with Common Murre carcasses on Wingham Island. He estimated seeing over 150 heavily scavenged birds in less than a mile.

Large numbers of beached birds almost anywhere in Alaska is unusual. But murres in early June—when adult breeders should be at their peak of weight and physical fitness as they head to the colonies to reproduce—is truly disturbing. After getting the word out to the Gulf of Alaska and Southeast COASSTers, all went quiet. The rest of June looked pretty normal. July—not so much. In fact, July was the start of a nine month run of higher to way higher than normal counts of beached murres throughout the Gulf of Alaska.

By September, COASSTers were seeing 100



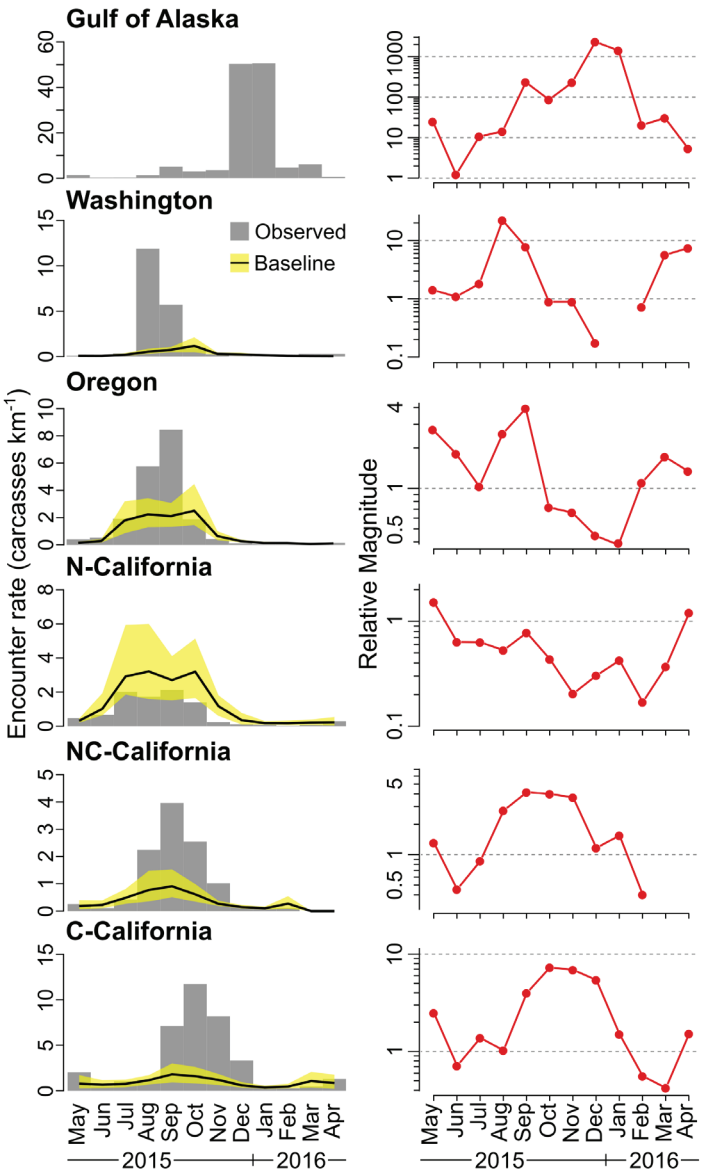
Map displaying carcass counts by location for two time periods during the murre mass die-off between spring 2015 and spring 2016. The majority of reports came during winter 2015–16 and centered in the Gulf of Alaska and Prince William Sound.

Photo: iStock.com/pilipenkoD

times the normal rate of murre deposition on their beaches. In December and January, that multiplier had climbed to 1,000 times normal. In total, Gulf of Alaska COASSTers reported a stunning 4,289 murre carcasses across 58 beaches. Much lower numbers, but still significantly above normal, were reported in the Aleutians-Bering-Chukchi (47 carcasses). Even in Southeast Alaska, land of hardly a beached bird ever, 11 murre carcasses were reported.

The duration and geographic extent of this wreck (another word for a mass mortality event) were unprecedented and triggered a huge amount of effort across tribal, state and federal agencies to count carcasses in remote locations. All told, more than 42,000 carcasses were counted across the Gulf of Alaska alone. Extrapolating to the months and the many thousands of kilometers in the Gulf creates a startling number: more than one million murres likely lost their lives during the mass mortality event.

While there were certainly more murres than usual washing ashore in the Lower 48 as well, especially in August (Washington) and September through December (central California), the main story was in Alaska. We confirmed this by partnering and comparing data with our sister beached bird programs in California: BeachCOMBERS centered in Monterey Bay and Beach Watch from San Francisco north to just south of Mendocino.



Left: Regional long-term average (black line) and variability (yellow wash) compared to the monthly encounter rate (birds per kilometer) during the year of the die-off. Note: The long-term average in the Gulf of Alaska was close to 0 birds per kilometer prior to the event. Right: The magnitude of difference between the observed encounter rate and the long-term average per month during the die-off. For example, in June in the Gulf of Alaska, the magnitude was close to 1—meaning nearly normal, whereas in December, it was over 1000 times the long-term average.

The Colony Story

As if widespread mortality wasn't enough, reports from biologists working for the Alaska Maritime National Wildlife Refuge began to notice a concerning lack of activity at the murre colonies. Cliffs that had been monitored for years were experiencing serious reproductive failure in the summer of 2015. Some had simply been abandoned by the breeders. The story was much the same in 2016—massive colony failures. Clearly, the birds that survived the die-off were too stressed to breed throughout much of their Alaskan range.

In fact, analysis of fresh intact carcasses suggested that the murres were painfully thin or emaciated. Necropsy results rang no alarms of disease or toxins, but the birds had no fat and empty stomachs. The birds had starved to death.

Sleuthing the Story

What happened?!? Biologist John Piatt with the U.S. Geological Service (USGS) has studied murres for years, including what makes murre populations grow, or decline. John assembled an impressive team of collaborators working on Common Murre colonies from California to northern Alaska and representing all of the U.S. Pacific Coast beached bird programs. Putting the data together not only allowed the geographic pattern of beaching and colony failures to emerge, it suggested potential reasons for this dire event.

A murre colony on East Amatuli Island on September 6, 2010 (top) and September 2, 2015 (bottom).

Photos: Arthur Kettle/USFWS

Just the year before, persistent warming of the northeast Pacific—a phenomena known as "The Blob" and referred to in the scientific literature as a marine heatwave—had reduced the size and food quality of zooplankton food (copepods and shrimp-like krill) for Cassin's Auklets, resulting in a similar mass mortality event of this fist-sized relative of the murre. And that warming pattern continued into 2015 and 2016, altering the food web, and in the process, affecting the abundance, composition and quality of forage fish—the primary food of murres. Smaller, less fatty fish and fish that had moved into deeper waters in response to surface warming all spelled more work for hungry murres. These "bottom-up" effects, so named because they travel upwards from the physics of the ocean into the lower levels of the food chain, eventually reaching top predators like murres, are commonly associated with climate variability, particularly unusual events such as marine heatwaves. Literally, a persistent change in the temperature of even a few degrees can shift who wins and who loses in coastal marine ecosystems.

But bottom-up effects are not the whole story. Turns out that when the ocean warms, so do all of the fish in it. Fish are "cold-blooded"—the temperature of the surrounding water. When the heatwave struck and stayed, all of the large predatory fish (in Alaska: halibut, flounder, pollock and cod) warmed up too. And warmer fish have higher

—continued on next page

The Murre-Man of USGS

John Piatt has been working on seabirds since his undergrad days in Newfoundland, when he had a chance to live in a lighthouse and take tourists to see the local gannet colony. No looking back for John; he's worked on the effects of oiling on Atlantic Puffins, spent thousands of hours on Tufted Puffin colonies throughout Alaska figuring out what they eat and how their diet can signal changes in the marine ecosystem, and—of course—plunged into murre (Common and Thick-billed) ecology and reproductive biology, starting on remote St. Lawrence Island in the northern Bering Sea. When he's not working on seabirds, John enjoys taking care of a veritable menagerie on the "Flying Auk Ranch," his family's home outside of Port Townsend, Washington. Five dogs, five horses, five cats, plus chickens, a cockatiel and a rabbit—all rescues.

John is holding a Tufted Puffin on a large puffin colony in the western Aleutian Islands of Alaska. He conducted surveys of puffin feeding ecology and breeding biology throughout the Aleutians and northwestern Gulf of Alaska during 2012-2014

Photo: Ajay Varma

COASST


Photo: H. Burgess

Rika and Sue survey Bishop's Beach in Homer, AK

COASST
University of Washington
Box 355020
Seattle, WA 98116
coasst@uw.edu
206-221-6893
www.coasst.org

—continued from page 5

metabolisms; they need more food to survive. What does a hungry predatory fish eat? Forage fish, of course.

Large and hungry predatory fish, which had greater access to what forage fish were available, became even greater competitors for the food that murres (who can only dive so deep) rely on. There simply wasn't enough to go around. Another way of saying this is that the ecosystem suddenly shifted and was unable to support all of the murres it had just a year prior. In fact, it couldn't support the cod stocks either, which crashed in 2017 and 2018.

Murres in a Warming World

This event suggests that a warmer ocean will have deleterious effects on fish-eating marine birds, and that with persistent warming, coastal ecosystems may no longer be able to support abundant and diverse populations.

Piatt JF, Parrish JK, Renner HM, Schoen SK, Jones TT, et al. (2020) Extreme mortality and reproductive failure of common murres resulting from the northeast Pacific marine heatwave of 2014-2016. PLOS ONE 15(1): e0226087. https://doi.org/10.1371/journal.pone.0226087

Mission

The Coastal Observation and Seabird Survey Team (COASST) is a citizen science project of the University of Washington in partnership with state, tribal and federal agencies, environmental organizations, and community groups. COASST believes citizens of coastal communities are essential scientific partners in monitoring marine ecosystem health. By collaborating with citizens, natural resource management agencies and environmental organizations, COASST works to translate long-term monitoring into effective marine conservation solutions.

Vision

Realizing the pressing needs of marine natural resource management and coastal conservation, and the twin benefits of increasing science literacy and an environmental stewardship ethic among citizens, COASST sees a future in which all coastal communities contribute directly to monitoring their local marine resources and ecosystem health through the establishment of a network of citizens engaging in science, where all collect rigorous and vital data. Through their collective efforts and the translation of their individual data into baselines against which any impact—from human or natural origins—can be assessed, nearshore ecosystems worldwide will be actively known, managed and protected.