BEST-BSIERP
Bering Sea PROJECT
UNDERSTANDING ECOSYSTEM PROCESSES IN THE BERING SEA 2007–2013

# Hot Spots in the Bering Sea

24-HOUR DINERS FOR SEABIRDS AND WHALES

If you have to hunt for your food in the cold and stormy Bering Sea, finding predictably dense patches, or persistent "hot spots" of your favorite prey saves you time and energy, and may make the difference between survival and starvation. But what happens if you are a seabird or a fur seal and changes in the ocean make these hot spots less predictable during a time when you have to regularly return to the place where you nurture your young? Would the change matter if you are a migratory whale that is not tied to one place, and is just in Alaska to take advantage of the ocean's summer bounty?

We know these ocean predators often exploit places where small fishes and zooplankton persist in large patches. But does the way these predators hunt, and whether they are tied to a breeding site, affect their ability to respond to these dense patches of prey or changes therein?

## How We Did It

At sea, we examined distributions of surface-feeding black-legged kittiwakes (*Rissa tridactyla*) and pursuit-diving thick-billed murres (*Uria lomvia*)) during their summer nesting period when their foraging range is limited. We also looked at free-ranging humpback (*Megaptera novaeangliae*) and fin whales (*Balaenoptera physalus*). We studied the distribution of all four species in relation to two of their key prey: age-1 walleye pollock

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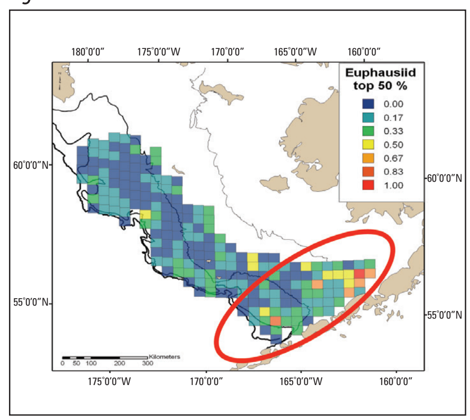
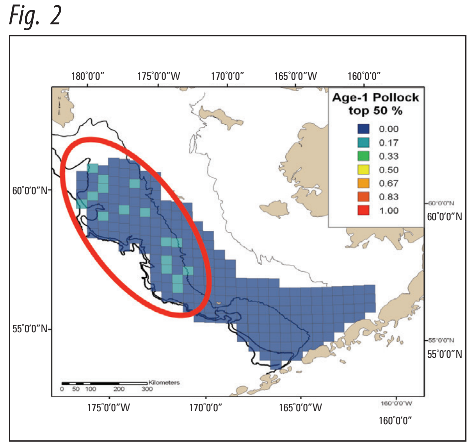
*Fig. 1*




*We found euphausiids all over the place, with persistent hot spots within specific 37 × 37 kilometer blocks*

*Fig. 2*




*Age-1 pollock were patchier and their hot spots persisted only on scales greater than 37 kilometers.*

## The Big Picture

In Alaska, seabirds, whales, fishes, and plankton are abundant on the Bering Sea shelf and slope, a productive ecosystem supplying food for millions of seabirds and tens of thousands of marine mammals. In this study, we tackled the Bering Sea Project hypothesis that climate and ocean conditions influencing circulation patterns and physical domain boundaries will affect the distribution, frequency and persistence of fronts and other oceanographic features that concentrate prey, and affect the foraging success of marine birds and mammals largely through bottom-up processes.

We quantified the distributions of open-ocean prey species and determined that marine predators often associated with areas where these "hot spots of prey" persist at certain times of the year for several years. But we also wanted to determine whether the hunt for food differed among species that were tied to a colony or not, or between animals built to dive for their food versus those that can fly long distances but must feed on the surface. Our conclusion: being tied to a central place matters, as does the way you look for food.

TOP PREDATOR HOTSPOT PERSISTENCE
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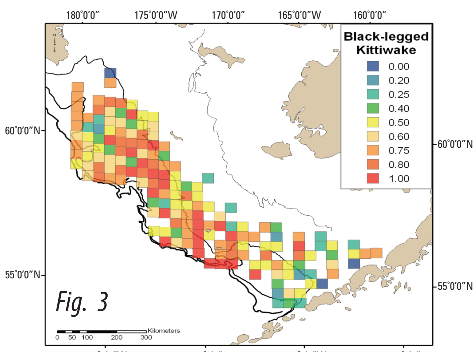
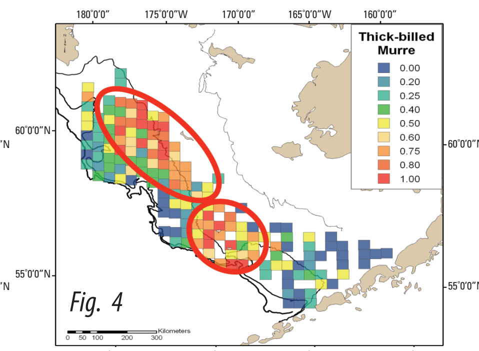
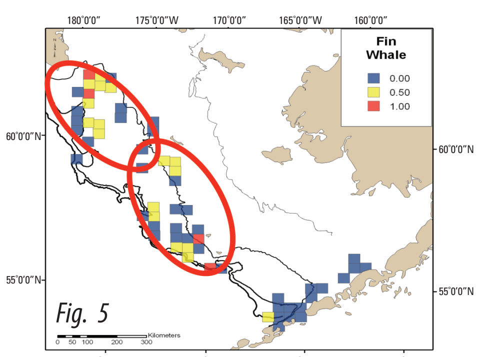
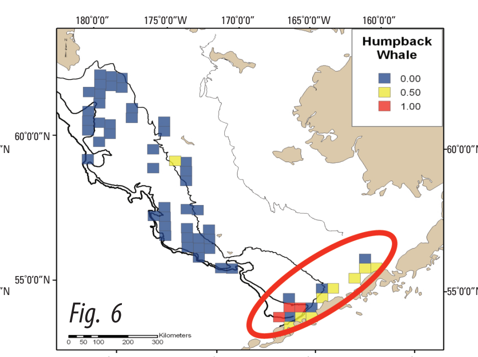
*Seabirds, whales and other ocean predators seek out persistent "hot spots" where small fishes and other prey gather in dense patches.*




*Both kittiwakes and murres, despite the difference in their feeding style, were consistently associated with age-1 pollock but not consistently with hot spots of euphausiids, even though the euphausiids hot spots were more persistent than those of the small fish. The diving thick-billed murres, which have greater travel costs than kittiwakes, foraged on prey concentrations nearer their island colonies than did the surface-feeding black-legged kittiwakes, which foraged widely.*




*Humpback and fin whales were not tied to a central place. We found humpback whales only where euphausiids were concentrated and where these concentrations were persistent. We observed fin whales where age-1 pollock were more likely to occur, similar to black-legged kittiwakes and thick-billed murres, but their association with euphausiids was unclear.*

(*Theragra chalcogramma*) and euphausiids (*zooplankton of the family Euphausiidae*).

We surveyed the prey once each year during 2004 and 2006-2010, and surveyed the seabirds in 2006-2010 and the whales in 2008 and 2010. We compared the seabird and whale locations to where age-1 pollock and euphausiids were concentrated and considered how long these concentrations were present in time and space on an annual scale. This allowed us to compare this measure of prey persistence among annual surveys.

## Why We Did It

The ability to remember the location of preferred prey is an important part of the foraging behavior of whales, seabirds, and other ocean predators. An important characteristic of these prey concentrations is their persistence in time and space, which allows predators to predict or remember their locations and concentrate search efforts accordingly. Predictable prey locations reduce search time and thus the energetic costs of foraging. Predators tied to a location to incubate and rear their young face the additional challenge of locating prey close enough to their colony to frequently feed their young.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