

# Whale and krill hotspots in north-central California National Marine Sanctuaries

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Mechanistic understanding of the ecological drivers behind the distributions and habitat use of top marine predators and their prey is valuable for managing human impacts to those species. Developing spatial models facilitates this understanding and allows spatial and temporal management measures that can also be adapted to changes in environmental conditions.

We investigated environmental determinants of abundance and distribution of blue whales (*Balaenoptera musculus*), humpback whales (*Megaptera novaeangliae*) and their krill prey (*Euphausia pacifica* and *Thysanoessa spinifera*) in north-central California. Our goal was to provide insights into environmental drivers of the ecology and habitat use, model distributions, and determine coincident hotspots of whales and krill.

We found that both whale species had high overlap with krill hotspots. However, we found evidence of spatial and

trophic partitioning; blue whales utilized krill hotspots more intensively and consistently than humpbacks. Humpback whales also feed on forage fish, while blue whales are krill specialists.

Both whale species had high predicted densities adjacent to and north of Cordell Bank, where there are elevated krill concentrations. However, humpbacks had high trophic overlap in shallower waters while blue whales appeared to access krill in deeper waters off the continental shelf.

Though humpback and blue whales had different habitat hotspots and areas of high overlap with krill, the most important areas for both species overlap with the end of the northern shipping lane and the associated high vessel traffic. This interaction puts whales at risk of ship strikes and it may require additional speed limits or changes to the shipping lane configuration to reduce deaths.

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## Main Points

Both whales and krill heavily utilize the shelf break, especially Cordell Bank and the Farallon Escarpment.

Blue whale hotspots correspond strongly with krill hotspots while humpback whales co-occurred with krill to a lesser extent both spatially and seasonally.

The high co-occurrence areas north of Cordell Bank indicate important feeding areas that overlap with the shipping lanes, placing whales at elevated risk.

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