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Effect of coastal hypoxia on harbor seal energetics

Individual-based energetic model suggests bottom up mechanisms for the impact of coastal hypoxia on Pacific harbor seal (Phoca vitulina richardii) foraging behavior

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ABSTRACT

Wind-driven coastal hypoxia represents an environmental stressor that has the potential to drive redistribution of gilled marine organisms, and thereby indirectly affect the foraging characteristics of air-breathing upper trophic-level predators. We used a conceptual individual-based model to simulate effects of coastal hypoxia on the spatial foraging behavior and efficiency of a marine mammal, the Pacific harbor seal (*Phoca vitulina richardii*) on the Oregon coast. Habitat compression of fish was simulated at varying intensities of hypoxia. Modeled hypoxia affected up to 80% of the water column and half of prey species' horizontal habitat. Pacific sand lance (*Ammodytes hexapterus*), Pacific herring (*Clupea pallasii*), and English sole (*Parophrys vetulus*) were selected as representative harbor seal prey species. Model outputs most affected by coastal hypoxia were seal travel distance to foraging sites, time spent at depth during foraging dives, and daily energy balance.

For larger seals, English sole was the most optimal prey during normoxia, however during moderate to severe hypoxia Pacific sand lance was the most beneficial prey. For smaller seals, Pacific herring was the most efficient prey species during normoxia, but sand lance became more efficient as hypoxia increased. Sand lance represented the highest increase in