Population-level use of low-oxygen zones of a mesopelagic predator, the northern elephant seal

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Dissolved oxygen plays a major role in determining the composition and vertical distribution of mesopelagic prey that are of global ecological importance. Air-breathing megafauna can pursue sluggish prey seeking refuge from water-breathing predators in deep, low-oxygen waters. Recent work that documented prey capture events at >800 m suggested that the oxygen minimum zone (OMZ) provides important foraging habitat for northern elephant seals (*Mirounga angustirostris*). To assess their population-level use of OMZs, we combined tracking, diving, mass, and jaw acceleration data from up to 364 adult female northern elephant seals with modeled dissolved oxygen data from Copernicus Marine Service and examined their diving and foraging behavior relative to the OMZ and oxygen limited zone (OLZ) across their two annual foraging migrations. We found that, at a population level, seals primarily used the OLZ, but diel, regional, and seasonal differences exist. The greatest use of the OMZ occurred in the California Current (38% of dives vs. 2% elsewhere), where the OMZ is shallower, and during the post-breeding trip (17% vs. 7% post-molt), when seals performed deeper daytime dives. Elsewhere in the North Pacific, daytime foraging occurred in the OLZ while most nighttime foraging remained in high-oxygen waters. Seals that spent more time in OLZ-only regions (where no OMZ exists) had higher foraging success. During the longer post-molt trip, seals travelled further from the colony, thus reaching the OLZ-OMZ boundary and spending more of their trip in OLZ-only regions (53% vs. 25% post-breeding). To compensate for less time spent in OLZ-only regions during the shorter trip, post-breeding seals exhibited greater foraging effort to regain energy stores for the molting fast. Given that our results indicate elephant seals are more successful in OLZ regions, elephant seals can serve as a sentinel species for monitoring ecosystem-level impacts of OMZ expansion associated with climate change.