Beaked Whales and El Niño: Evidence for ENSO Effects on Blainville's Beaked and Goose-Beaked Whale Space Use in Hawaiian Waters

Daniel Barrios[1], Robin Baird[1], Michaela Kratofil[2]

[1]Cascadia Research Collective, Olympia, WA, [2]Cascadia Research Collective, Oregon State University

Large-scale climatic phenomena, such as the El Niño-Southern Oscillation (ENSO) cycle, influence marine systems across the Pacific and beyond. The effects of these cycles on Hawaiian cetaceans are largely unknown. Using location data from satellite tags deployed on Blainville's beaked (*Mesoplodon densirostris*; n=10) and goose-beaked (*Ziphius cavirostris*, n=10) whales, alongside sightings and effort data from 21 years of surveys off the west coast of Hawai'i Island, we examined the effects of ENSO on their space use and sighting rates. Every month of effort during Central Pacific-flavored El Niño conditions yielded sightings of both species. There was a linear relationship between sighting rates (sightings/100 hours of effort) and ENSO phase, with rates during El Niño periods (median Md=1.6, Zc=3.3) more than double those during La Niña periods (median Md=0.6, Zc=1.1). Moreover, variation in space use from tagged whales between phases was found, with goose-beaked whales displaying a higher propensity for the island's windward side after extended La Niña conditions. Tagged goose-beaked whales also exhibited more extensive ranging behavior during La Niña periods (grand mean weekly range-use ratios: La Niña=0.14, El Niño=0.06). Although information on prey and predator activity is limited, shifts in prey availability or predator presence in relation to ENSO events may be the primary drivers behind these findings. Still, the absence of sightings of either species for two years following strong Eastern Pacific-flavored El Niño conditions demonstrates the need for additional tagging and sighting effort to clarify the responses of both these species and their prey to lagged and real-time ENSO-driven ocean dynamics, including current magnitude and salinity. Our results provide valuable insights for the potential of climate change to influence the space use of beaked whales and other odontocetes, and offer an approach for studying the impacts of these phenomena on marine mammals using long-term datasets.