Point Blue Publication Brief

Changes in seasonal abundance and timing of migration of whales in Central California

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We documented changes in the overall abundance and timing of migration of humpback (*Megaptera novaeangliae*), blue (*Balaenoptera musculus*), and gray (*Eschrichtius rob*ustus) whales observed from the Farallon Islands, California. These changes are exposing whales to pot and trap fishing gear off central California, increasing the risk of entanglements.

We hypothesized that changes in the number of whale sightings, timing of migration, and residency time off Central California were driven by both local oceanography and basin-scale climate. Wind-driven upwelling and overall productivity in the California Current System is driven by atmospheric circulation that is influenced by the El Niño Southern Oscillation, the Pacific Decadal Oscillation, and the North Pacific Gyre Oscillation.

Using 25 years of daily whale counts collected from Southeast Farallon Island, we developed general linear regression models to assess trends and identify environmental drivers of changes in whale sightings, timing of migration, and residency time. We then used these models to forecast whale sightings and timing of migration and compare these to observed whale entanglement rates.

Whale sightings have significantly increased over time for all species. Foraging migration (northward migration and arrival time) has been occurring earlier for all species, particularly for humpback and blue whales and was significantly influenced by El Niño. Breeding migration (southward migration and departure time) showed little to no change. Humpback entanglements were correlated with early arrival to Central California; however, gray whale entanglements were correlated with the number of sightings in a given year.

Actions to decrease the temporal overlap between whales and pot/trap fishing gear are encouraged to decrease the risk of entanglements, particularly during El Niño years.

Main Points

- Humpback, blue, and gray whale sightings have increased over time.
- Northward whale migration and arrival time to Central California is occurring earlier and influenced by El Niño.
- Entanglements for humpback whales are correlated with early arrival and for gray whales with number of sightings.

Ingman, K., E. Hines, P. Mazzini, C. Rockwood, N. Nur, J. Jahncke. 2018. Changes in seasonal abundance and timing of migration of whales in Central California. Publication in preparation. Last edit: 10/16/18

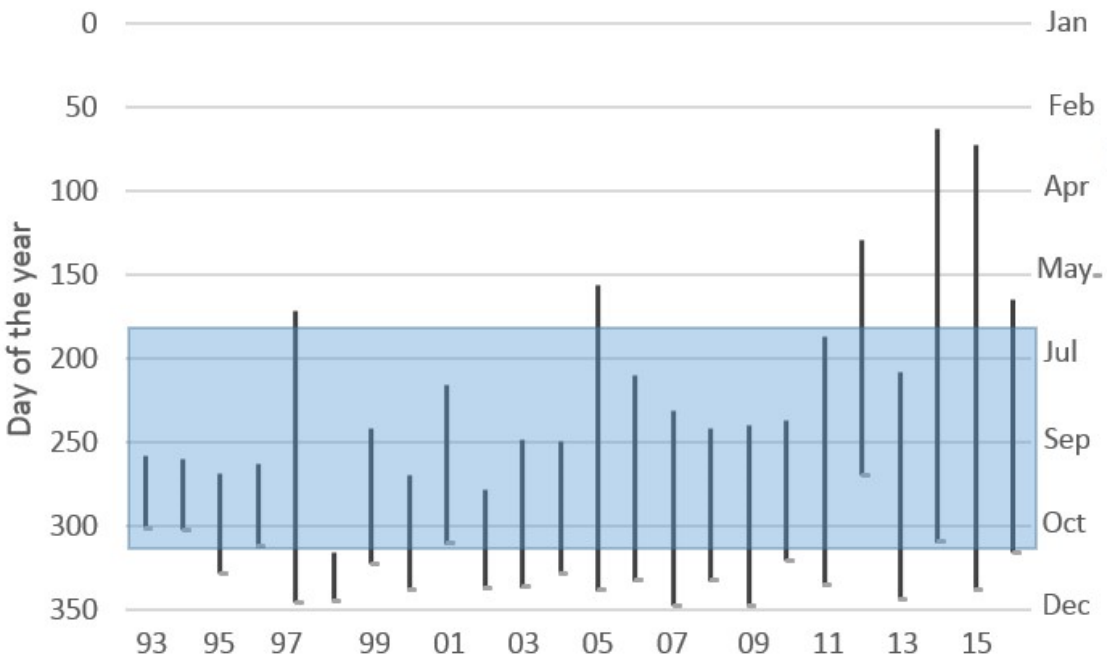

Figure 1. Timing of arrival and departure of humpback whales to Central California as observed from the Farallon Islands. The bars represent residency time measured from the 10th to the 90th percentile of total sightings for a given year. The shaded area represents the average duration of the Dungeness crab fishing season closure that extends from June 30 to November 15.