Mortality anomalies in the north central California ecosystem 2014-2015

During 2014-2015, anomalous warm water years, Beach Watch coastal monitoring surveys documented three unusual mortality events indicating affects among multiple trophic levels.

Background

The Beach Watch ecosystem monitoring project is a partnership of Greater Farallones National Marine Sanctuary and Farallones Marine Sanctuary Association. Established in 1993, Beach Watch (BW) engages scientists and citizen scientists in bi-monthly surveys for live and beach cast birds and mammals on sanctuary beaches from Año Nuevo State Reserve, San Mateo County to Bodega Bay, Sonoma County (Figure 1). In November 2014, additional surveys were added to the project, extending north to Manchester Beach, Mendocino County. Currently, over 1300 surveys are performed annually, spanning 280 km of coastline. The BW project provides over 22 years of status and trend data of coastal wildlife. The most abundant beach cast species are Common Murre (*Uria aalge*), Northern Fulmar *(Fulmarus glacialis)*, Western Gull *(Larus occidentalis)*, Brandt's Cormorant *(Phalacrocorax penicillatus)* and California sea lion (*Zalophus californianus*). All beach cast birds and mammals are documented with measurements and photographs. Species identification, age, and sex are reviewed and confirmed by seabird and marine mammal experts on staff. We compare 22 year baseline rates of three beach cast coastal species to rates that occurred during anomalous water water event in 2014 -2015 (Figure 2.)

Figure 1. Beach Watch survey region, Point Arena to Año Nuevo, California.

Results

In 2014 and 2015 BW surveys documented unusual mortality events (UME) in two seabird species, Cassin's Auklet *(Ptychoramphus aleuticus)* and Common Murre and one pinniped species, the threatened Guadalupe Fur Seal (*Arctocephalus townsendi*). Cassin's Auklets are zooplanktivores feeding primarily on krill. Murres and Fur Seals are piscavores. Cassin's Auklets, a small resident pelagic species, are historically rare on BW surveys with baseline deposition for November and December of 1994-2013 of 0.0087 birds/km surveyed. During November and December 2014 Cassin's were observed at a rate of of 2.82 birds/km an increase of over 320 times above baseline rates (Figure 3). Seventy-five percent of aged Cassin's were hatch year birds or young of the year. Guadalupe Fur Seals are an uncommon migrant in the north central coast of CA with baseline deposition during March through July 1994-2014 of only 0.0005 mammals/km. In March through July 2015 Guadalupe Fur Seals were documented at a rate of 0.025 mammals/km, an increase 46 times above baseline (Figure 4). All fur seals were pups. Common Murres are the most common species of beach cast bird documented on BW surveys, with a baseline rate for September through November 1994-2014 of 0.497 birds/km. In September through November of 2015 Common Murres during this UME were observed at a rate of 5.95 birds/km for these months, an increase of 12 times above baseline (Figure 5). Seventy percent of aged Murres were hatch year.

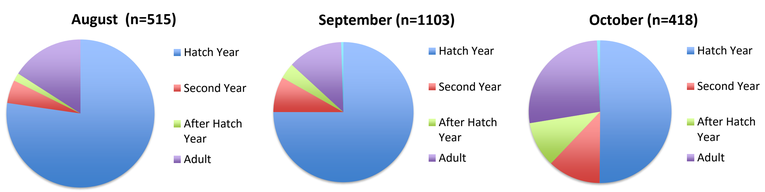

Figure 2. Age class of beach cast Common Murres, Sept.-Oct., 2015 mortality event. After hatch year birds are second year or adult. N equals total number of birds.

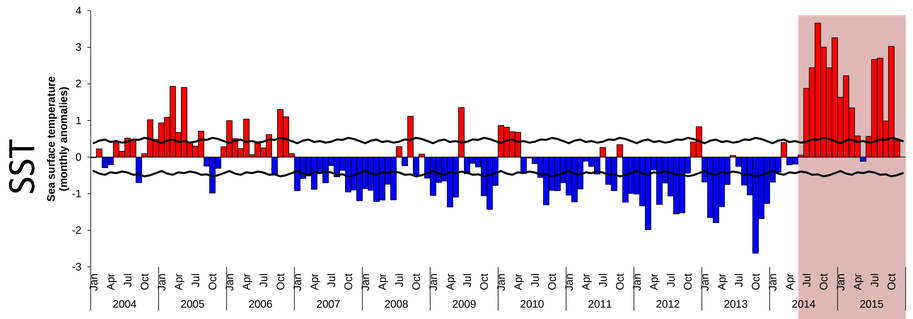

Figure 2. Normalized sea surface temperature (SST) from the Bodega Bay buoy, NOAA data, graph courtesy of Point Blue Conservation Science. Red shaded area highlights the anomalous warm water and El Niño period.

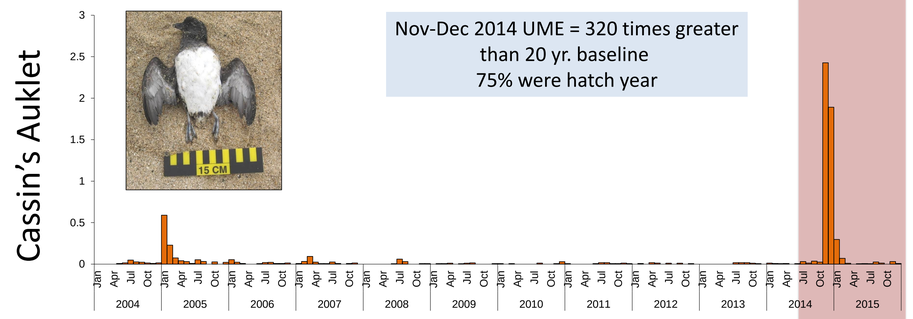

Figure 3. Cassin's Auklet beach cast mortality rate (per km), 2004-2015. Red shaded area highlights the anomalous warm water and El Niño period.

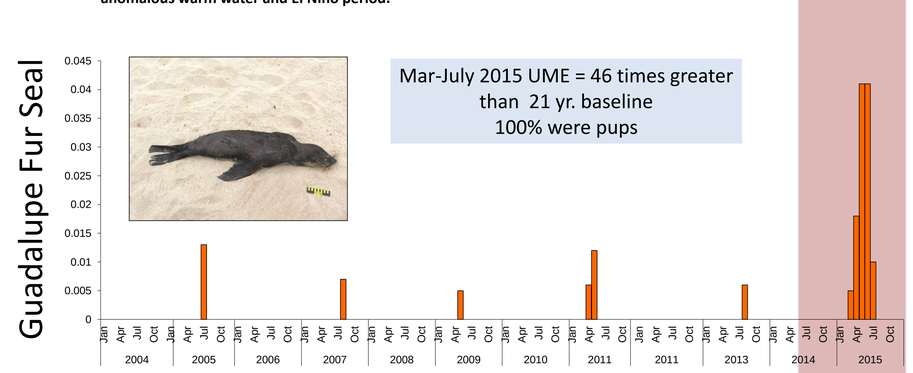

Figure 4. Guadalupe fur seal beach cast mortality rate (per km), 2004-2015. Red shaded area highlights the anomalous warm water and El Niño period.

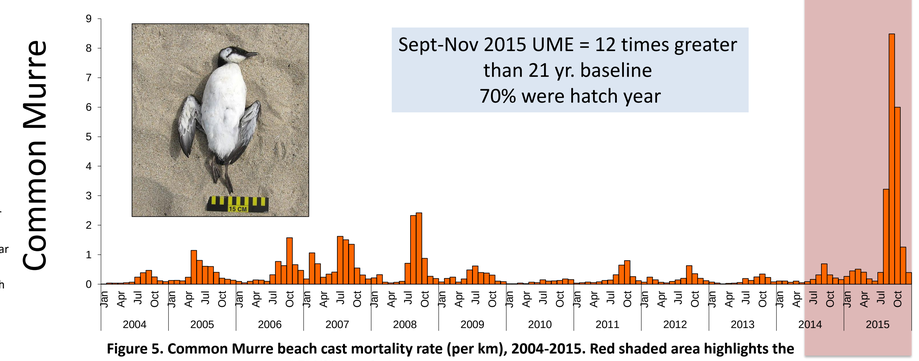

Figure 5. Common Murre beach cast mortality rate (per km), 2004-2015. Red shaded area highlights the anomalous warm water and El Niño period.

Summary

Beach Watch data have provided counts, geographic impact, age and sex of the events during 2014-2015. Beached cast mortality data are one piece of the story. Environmental conditions and additional wildlife observations surrounding these mortality events provide a broader regional perspective (no correlations have been tested):

- Anomalously warm water arrived in the eastern north Pacific in July 2014 (Figure 2) and has persisted through present (January 2016). The mean seasonal SST for 2015 was the warmest since 1992 and joins 1992, 1998 and 2014 as the only years in which the seasonal mean was greater than 13°C. (NOAA and Warzybok 2015);
- 2014 Cassin's Auklet breeding season had above average productivity in early to mid-season on Farallon Islands with declines in second brood productivity (Warzybok 2015);
- July 2014 krill abundance was normal but declined sharply by September 2014 (Elliott et al. 2015);
- The Cassin's Auklet UME during winter 2014-15 included unprecedented mortality of hatch-year and and second-year birds (Henkel et al. 2015);
- The Guadalupe fur seal UME during summer 2015 included unprecedented mortality of pups. 80 Guadalupe fur seals were removed from survey region beaches by the Marine Mammal Stranding Network or TMMC, 85% of these were not captured on BW surveys. Guadalupe rates presented here are artificially low (*unpublished data* Lindquist and Roletto 2015);
- California sea lion UME occurred south of BW range in summer 2015. This event was observed primarily in southern CA (*unpublished data* NMFS 2015);
- Observations from Farallon Islands indicated productivity and breeding observations from Southeast Farallon Island show depressed Common Murre breeding in 2015. Late breeding season diet shifts were apparent starting in July (Warzybok 2015);
- UME late summer and fall affect Common Murres included unprecedented mortality (*unpublished data* Lindquist and Roletto 2015);
- Age class of beach cast Common Murres shifted from the beginning of the event, which affected more YOY birds, to end of the event, which affected more of the older, second-year birds. We speculate that the YOY that died of starvation in August-September due to limited prey. Fewer YOY surviving into October, thus reducing the proportion of YOY in the population. In October we documented more second year birds and adults, which also died of starvation when they were molting flight feathers. We suspect that the physiological stress of molting flight feathers was compounded by the additional stresses of foraging deeper and/or further from their normal foraging areas (*unpublished data* Lindquist and Roletto 2015);
- Necropsies, performed by multiple agencies, indicate emaciation as the cause of death for all three species. Environmental conditions appear to have affected prey availability to young and inexperienced forging Cassin's Auklets, Common Murres and Guadalupe Fur Seals diminished prey availability, directly leading to the UME events (NOAA and Henkel et al. 2015).

Citations:

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Henkel, et al. 2015. Investigation of Cassin's auklet mortality in the Eastern Pacific during the 2014 post-breeding season. *In* Proceedings of the Pacific Seabird Group 42nd Annual Meeting, San Jose, CA

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Acknowledgements:

Many thanks to over 350 Beach Watch volunteers since 1993. Rich Stallcup (posthumously) and Peter Pyle for expert review of Beach Watch species and age data. And to our funders Resources Legacy Fund, MacArthur Family Trust, Firedoll Foundation, and Greater Farallones National Marine Sanctuary.

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