



Release:

May 23, 2012

www.prbo.org

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Avian Demographic Response to Climate Change

A Multi-Species and Multi-Landscape Approach to Synthesizing Risk Factors

Understanding the effects of environmental variables on avian demographic parameters provides a sound foundation for natural resource management, the prediction of future species distributions and population viability. We evaluated how demographic parameters have been influenced by climate variables (i.e., temperature and precipitation) in the past, and how are they likely to respond to future scenarios, using long-term datasets on songbirds from the Palomarin Field Station (Song Sparrow and Wrentit nest survival, date-of-arrival trends for 15 migratory species) and five locations in the San Francisco Bay tidal marshes (Song Sparrow nest survival), and on waterfowl (Mallard and Gadwall nest survival) from two sites in the Central Valley of California. We provide a web-based tool to visualize and understand the specific effects of environmental variables on avian demographic parameters and potential future climate impacts.

Waterfowl nest survival and hatching success declined with increased mean daily temperature. Gadwall clutch sizes declined with increased late spring temperatures. Effects may not be as marked in the Bay area – in Suisun marsh Mallards initiated nests when spring temperatures were warmer.

Fall-winter precipitation (October-March) positively affected nest survival of Wrentits and Song Sparrows. Higher hatch-month precipitation reduced nest survival for tidal marsh Song Sparrows due to increased risks of flooding, but was positively correlated with Wrentit nest survival at Palomarin. Similarly, hatch-month temperature positively affected Wrentit nest survival at Palomarin, but negatively affected Song Sparrow nests in the tidal marshes.

Barn Swallow showed later arrival dates, and Black-headed Grosbeak showed earlier arrival dates, during El Niño years; Pacific-slope Flycatcher arrived later during warmer North Pacific years. No significant trends were observed in other species studied.

Main Points:

- Climate models for the Central Valley suggest a decline in hatching success, a decline in clutch sizes and an especially sharp shortening of the breeding season for Mallards and Gadwalls.
- Mallard and Gadwall nesting season lengths are expected to shorten and nest success is projected to decrease at all sites.
- Song Sparrow and Wrentit nest survival may increase with future climate conditions.
- Arrival dates for songbirds may change in the future, setting the stage for mismatches between timing of availability of resources and nesting phenology.
- Managers and researchers should develop a long-term plan to track trends in breeding success as well as assess the efficacy of possible management actions to enhance nest survival.

Ackerman, J. T., M. P. Herzog, L. Salas, T. Gardali, G. Ballard, D. Loughman, G. Yarris, and J.M. Eadie. 2011. Avian Breeding Demographic Response to Climate Change: A Multi-Species and Multi-Landscape Approach to Synthesizing Risk Factors. Summary Report, U. S. Geological Survey, Western Ecological Research Center, Davis, CA; PRBO Conservation Science, Petaluma, CA; California Waterfowl Association, Sacramento, CA; University of California, Davis, CA. 133 pp. <http://data.prbo.org/apps/aviandemog/>