

**Annotated Atlas and Implications for the Conservation of Heron and Egret Nesting Colonies in
the San Francisco Bay Area**

Update for the San Pablo Bay Subregion

Prepared for Theresa Engle, Caltrans

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ACR Technical Report 90-3-22

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This update has been prepared in response to a request made by Caltrans, to aid the agency in addressing and mitigating for impacts to the nesting colony of herons and egrets near Shollenberger Marsh that may occur as a result of the planned Sonoma Marin Narrows Project. For a detailed description of the nest sites, monitoring protocols, and complete statistical methods, please see the original publication: Kelly, J. P., K. Etienne, C. Strong, M. McCaustland, and M. L. Parkes. 2006. Annotated atlas and implications for conservation of heron and egret nesting colonies in the San Francisco Bay area. ACR Technical Report 90-3-17, Audubon Canyon Ranch, P.O. Box 808, Marshall, CA 94940. 236 pp.

Annotations on the graphs are the same as in the original publication:

* $n < 10$ and $n < 50\%$ of total nests; ¹ $n = 1$.

Differences in the graphs from the original publication:

To simplify the creation of this report, each graph was generated to include all four species known to have nested in the Petaluma Napa Marsh. Therefore, a value or space for a value for each species appears on these graphs, even though *not all species have historically nested at all sites*.

In the original publication, “no data” was indicated on each graph with an “x.” In this update, no data is indicated by the absence of a bar. *This contrasts with data values of zero, which are indicated by a bar of no height, which is shown as a line.*

Statistical Analysis

Estimates of annual survivorship and productivity are based on the fates of individual heron and egret nests, which can be sampled only once each. Under these conditions, variance models based on sampling without replacement are more accurate than commonly used models that assume replacement, especially if a substantial proportion of the population is sampled (Thompson 1992). We sampled nest survivorship and productivity from a sampling universe equal to the number of nests (N) in a colony or group of colonies, with sample sizes (n) often accounting for a relatively large proportion of the total number of nests. Because of the conspicuousness of colonially nesting herons and egrets, the sampling population of nests could be confidently estimated by counting the peak number of active nests. Therefore, we used unbiased variance estimators for sampling nests without replacement. Nest monitoring programs based on such models benefit from standard errors that are substantially and appropriately reduced. We calculated the variance of the estimated mean pre fledging brood size (\hat{b}) by multiplying the estimator based on samples collected with replacement (s^2/n) by the finite population correction factor $1 - (n / N)$ (Thompson 1992):

$$\text{var}(\hat{b}) = (s^2 / n) \cdot (1 - n / N) .$$

Similarly, we estimated nest survivorship as the successful proportion (\hat{p}) of focal nests sampled without replacement (Thompson 1992), with an estimated variance of

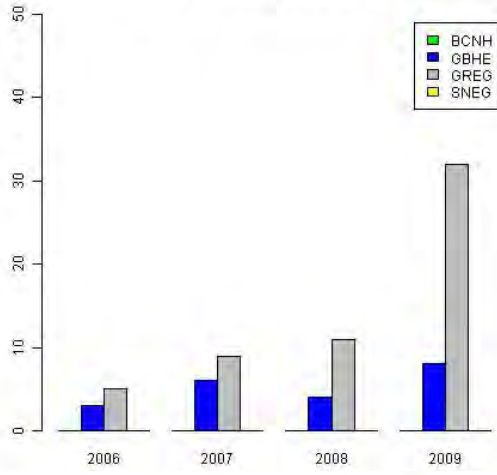
$$\text{var}(\hat{p}) = (\hat{p} \cdot (1 - \hat{p}) / n) \cdot (n / (n-1)) \cdot (1 - n / N) .$$

Literature Cited

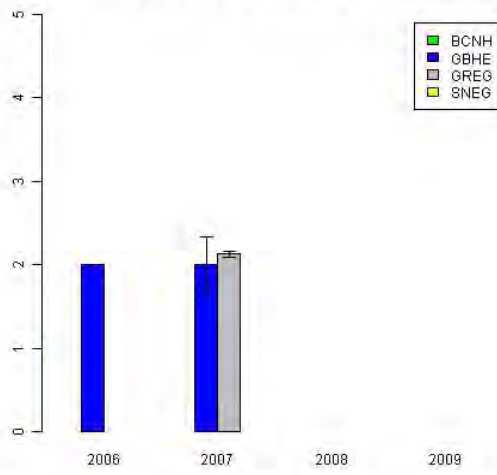
Thompson, S. K. 1992. Sampling. John Wiley & Sons, New York, NY.

Bel Marin Keys

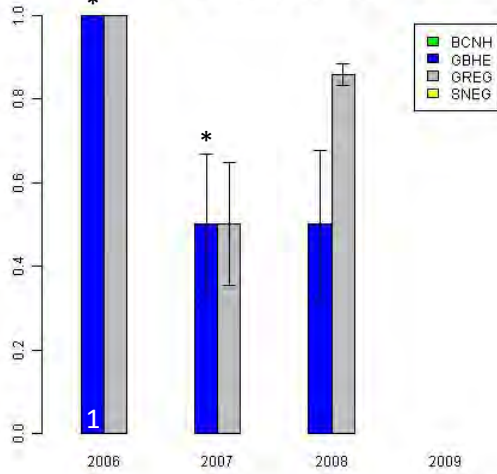
Peak number of active nests



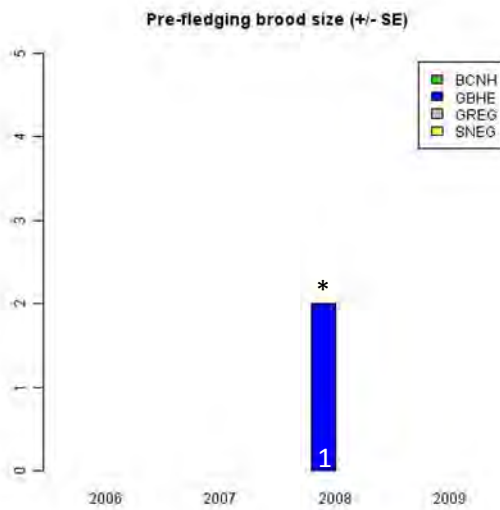
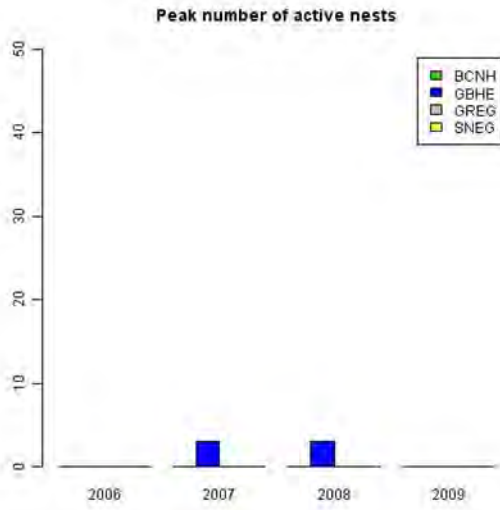
Pre-fledging brood size (+/- SE)



Nest survivorship (+/- SE)

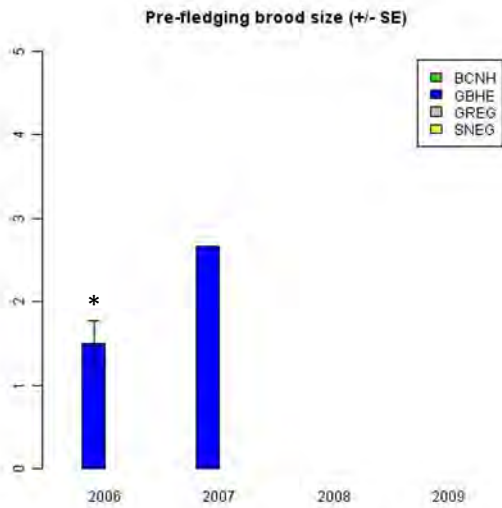
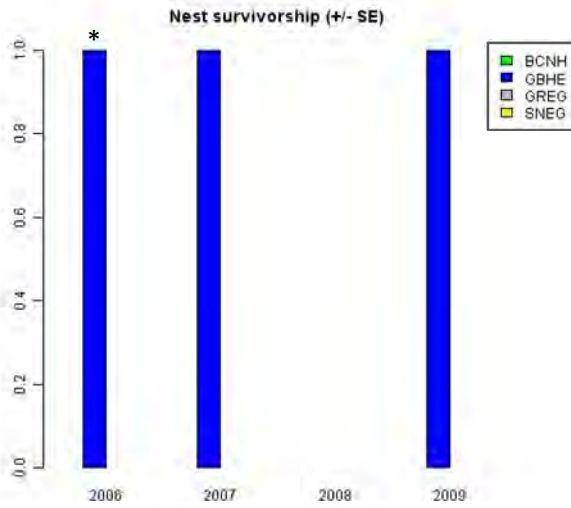
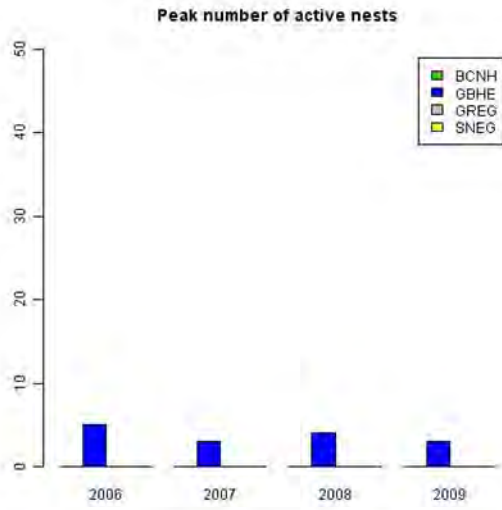


Black Point

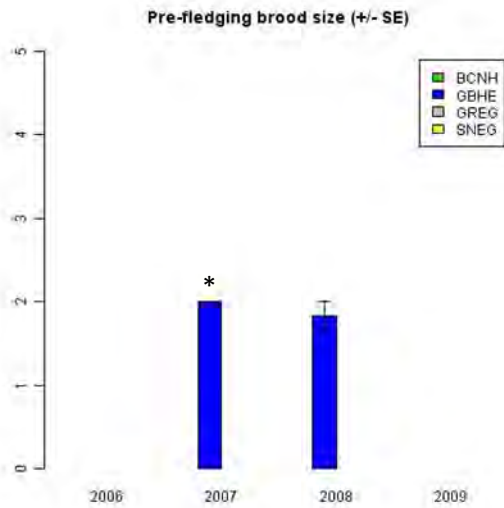
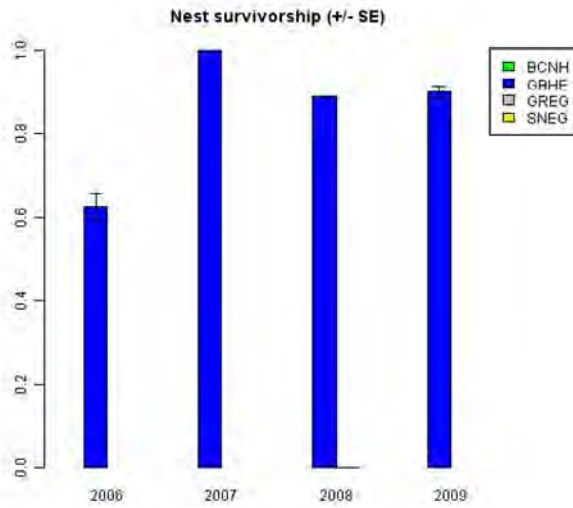
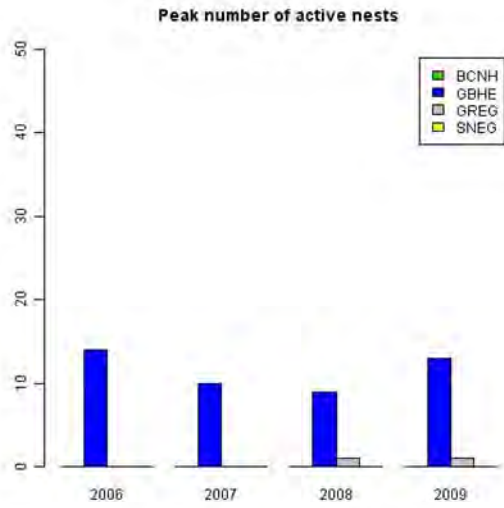


No data were available to estimate nest survivorship.

Channel Drive

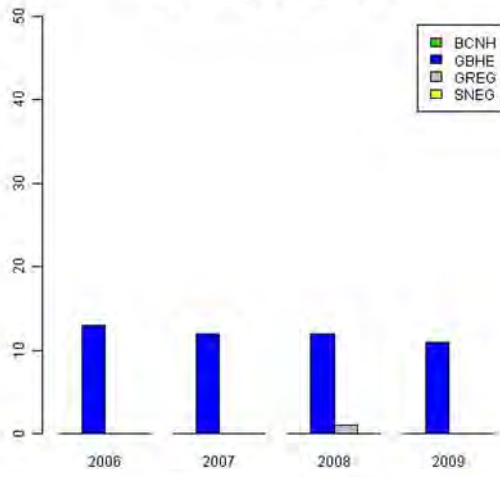


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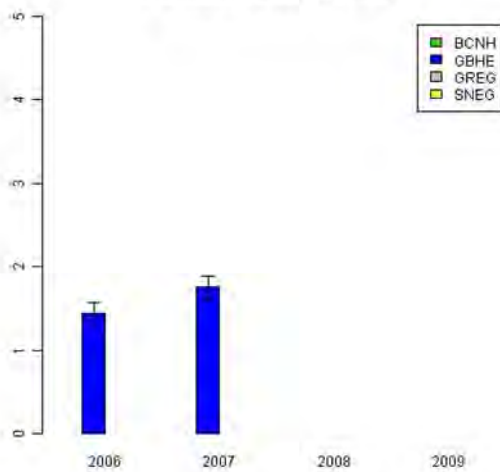
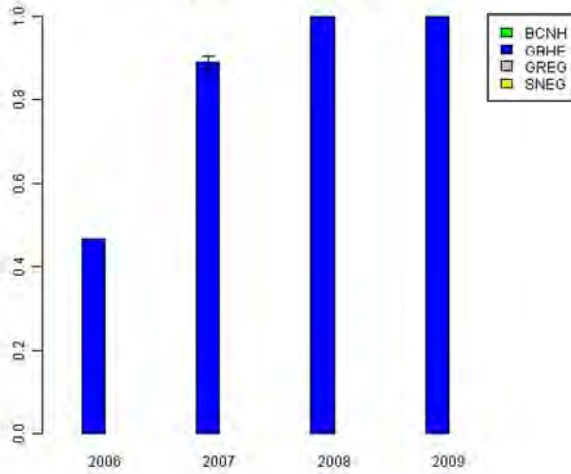


Hagen Road

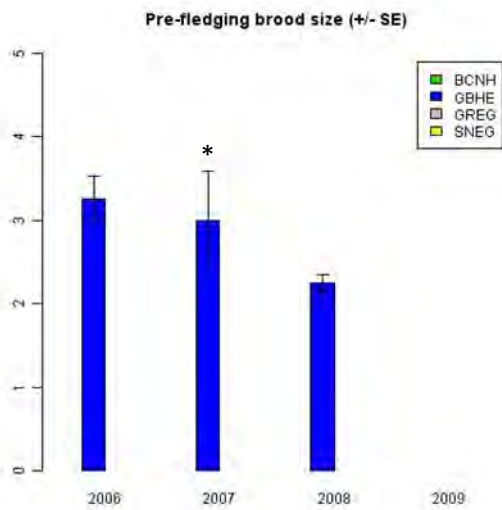
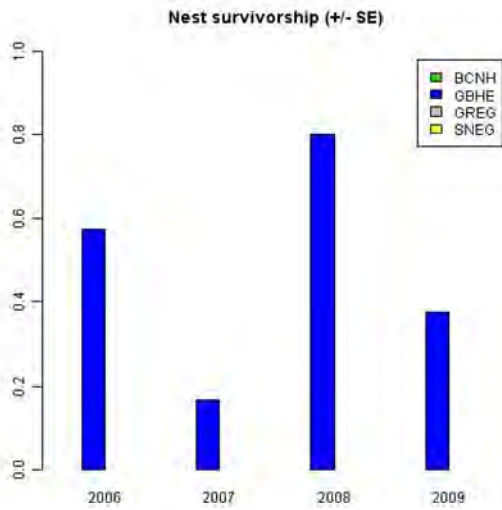
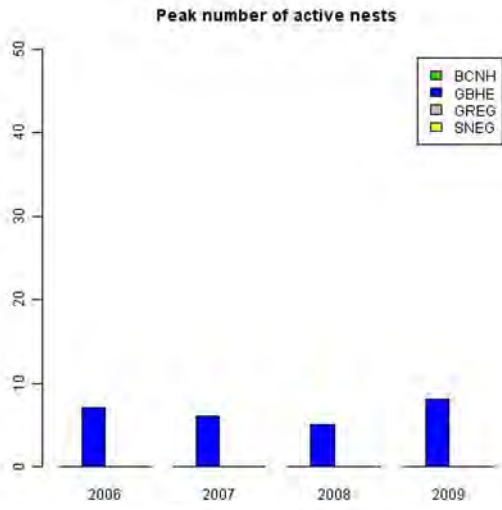
Peak number of active nests



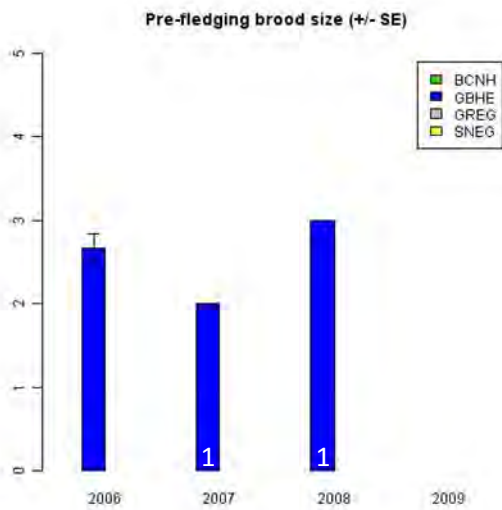
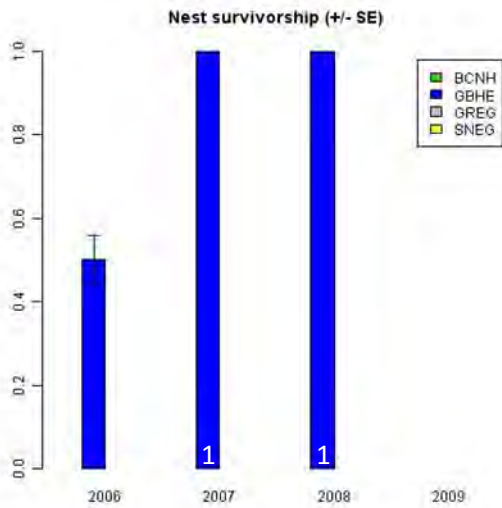
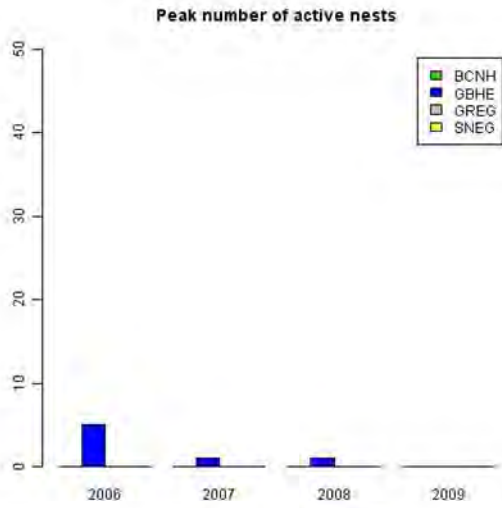
Nest survivorship (+/- SE)



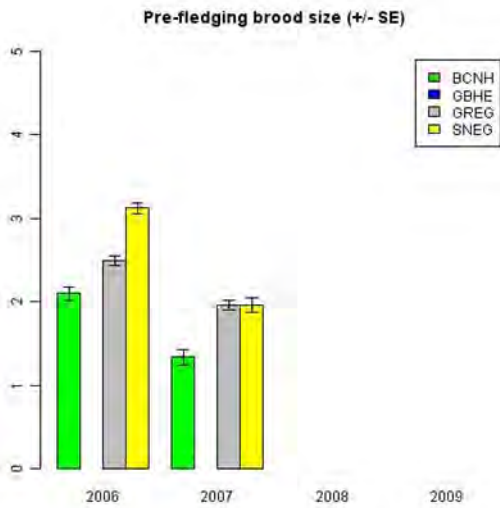
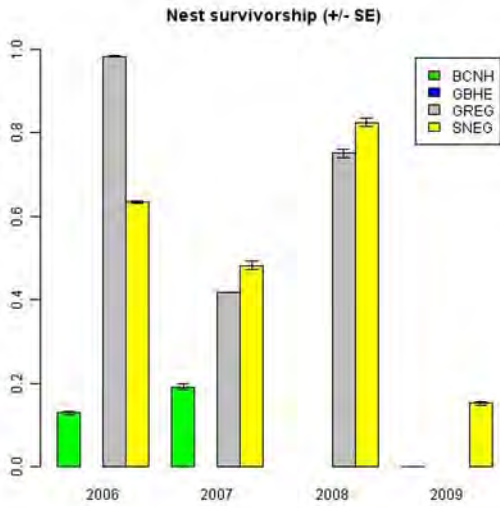
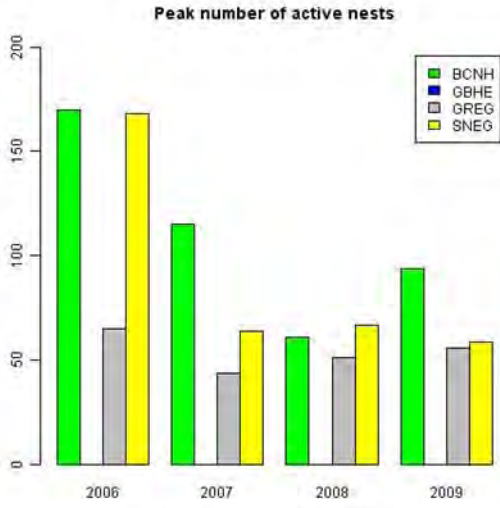
Mare Island



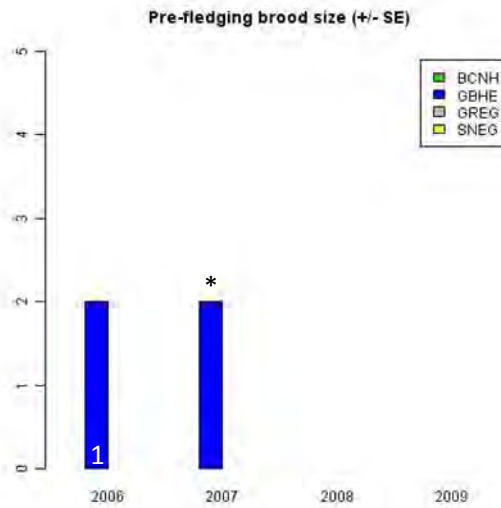
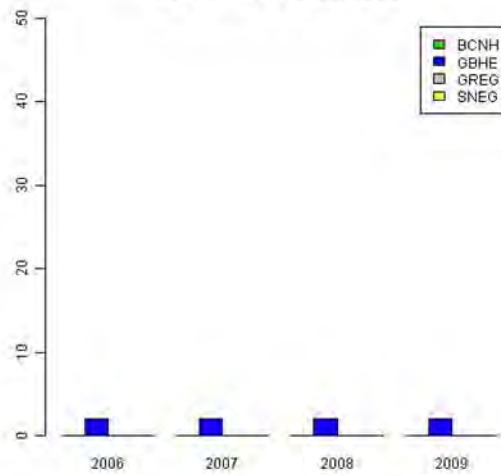
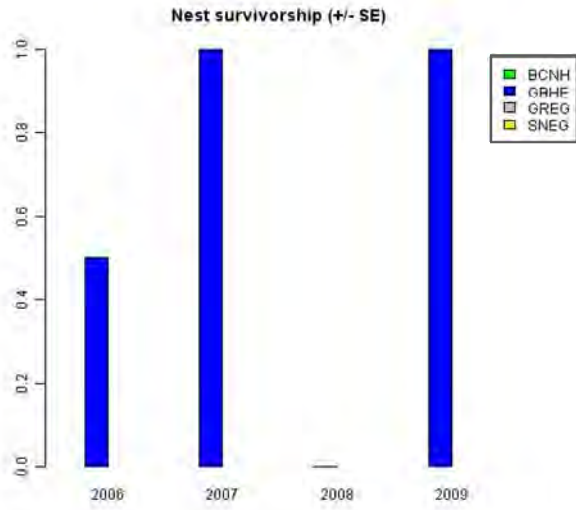
McNear Channel



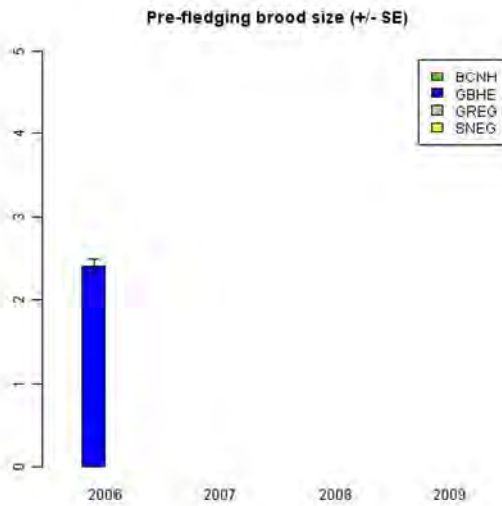
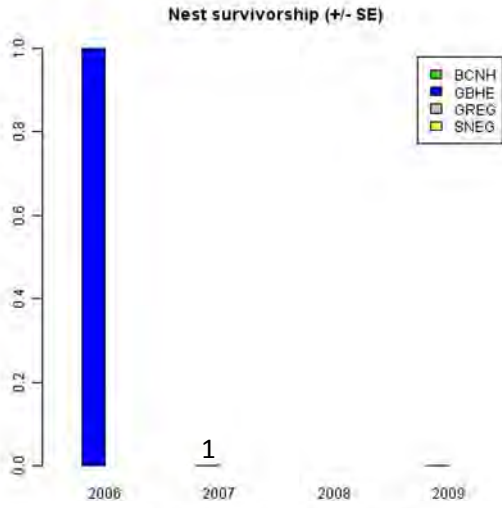
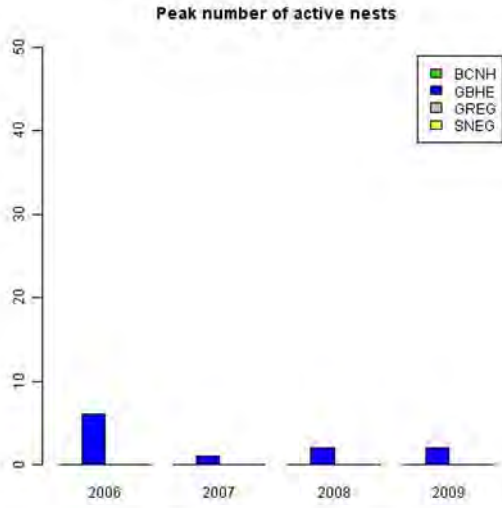
Napa State Hospital



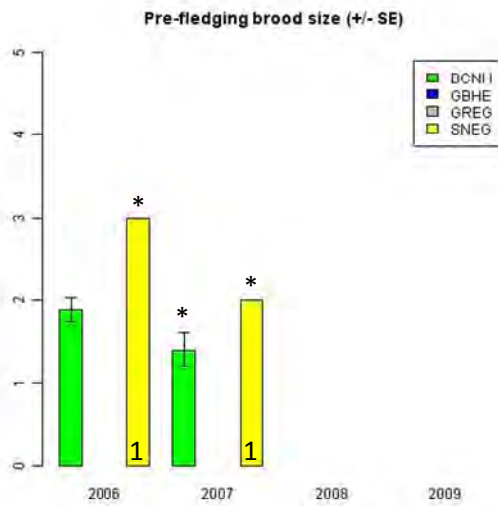
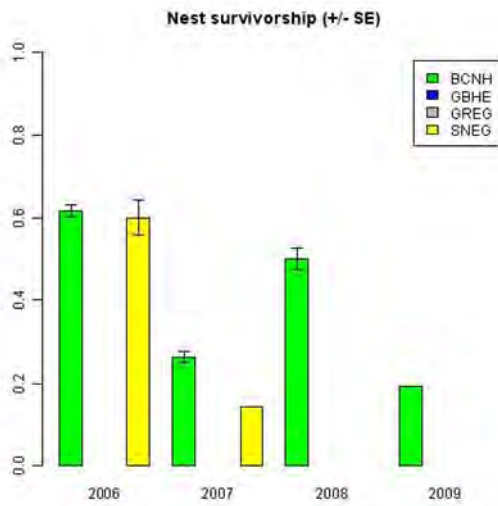
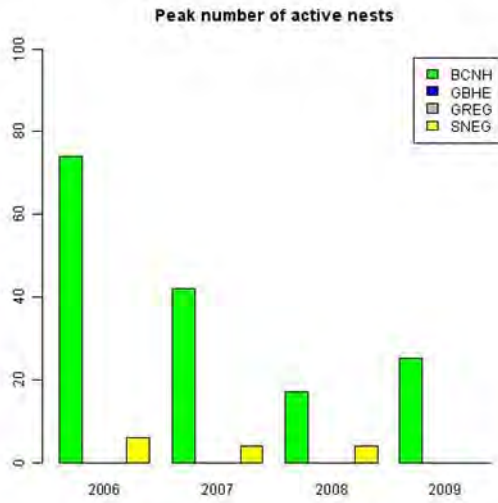
North San Pedro Road #2



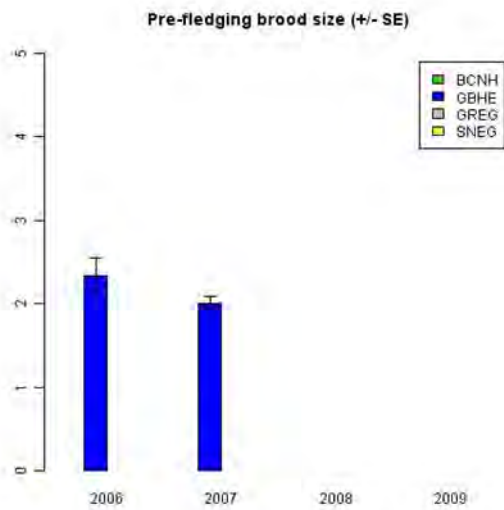
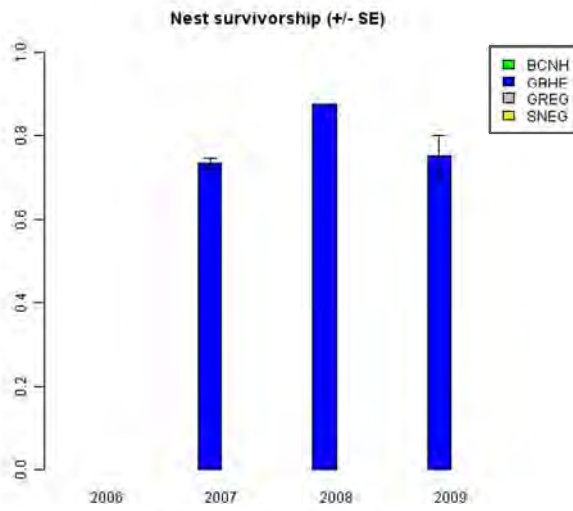
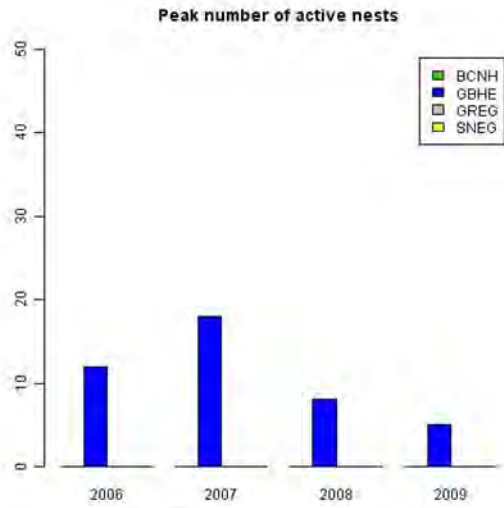
Old Lakeville Road #3



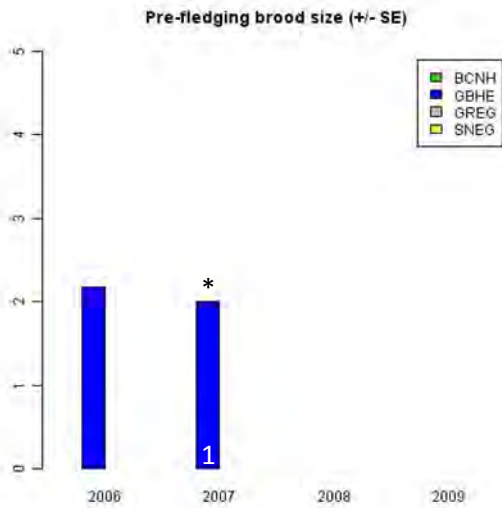
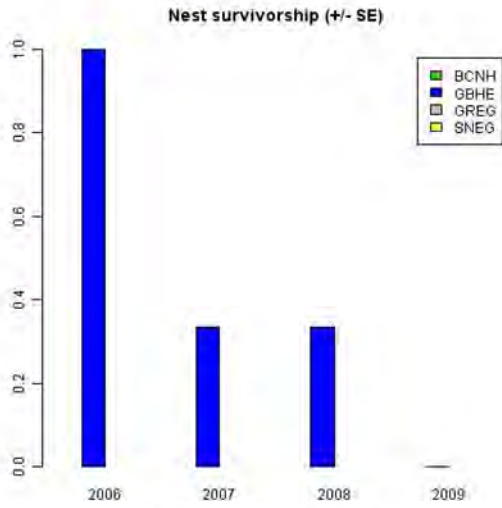
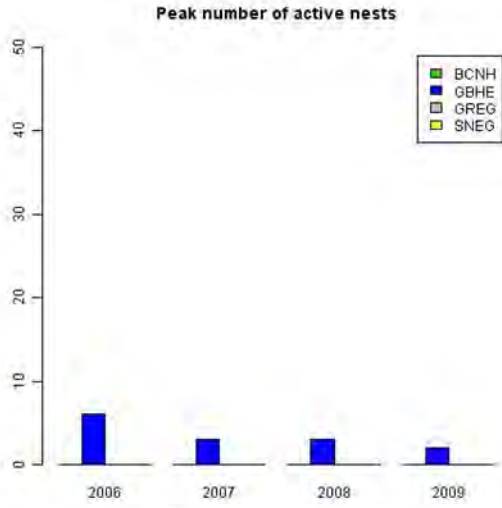
Penngrove



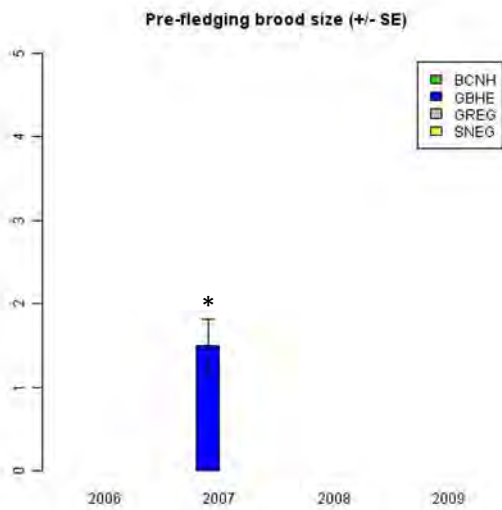
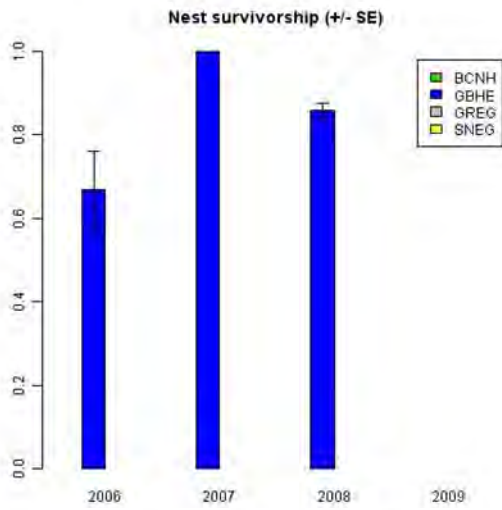
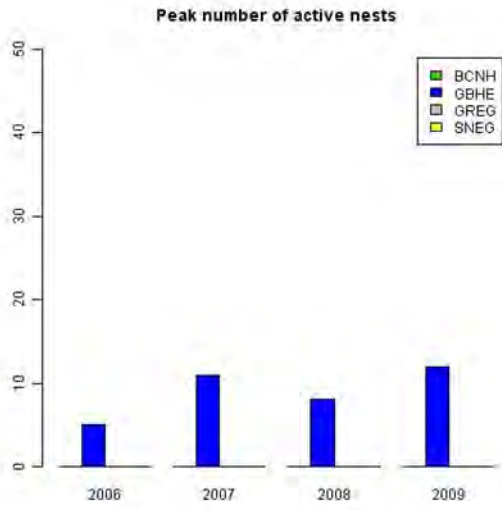
Petaluma Wastewater Plant



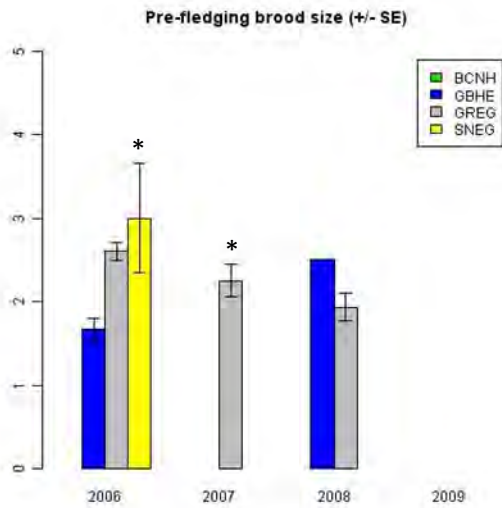
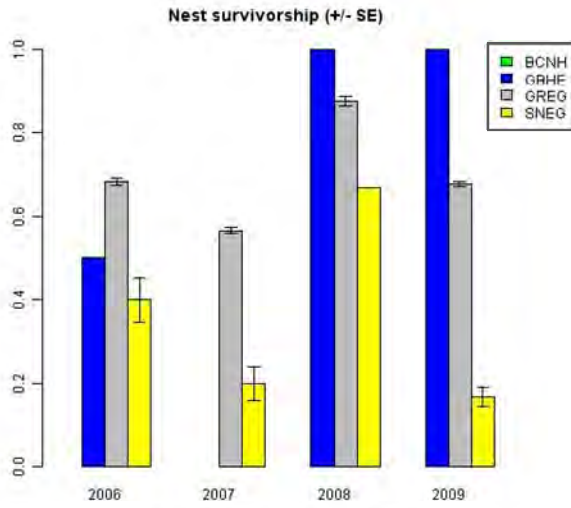
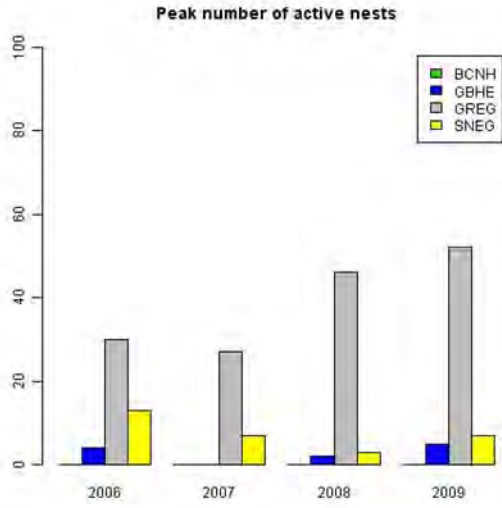
Redwood Landfill



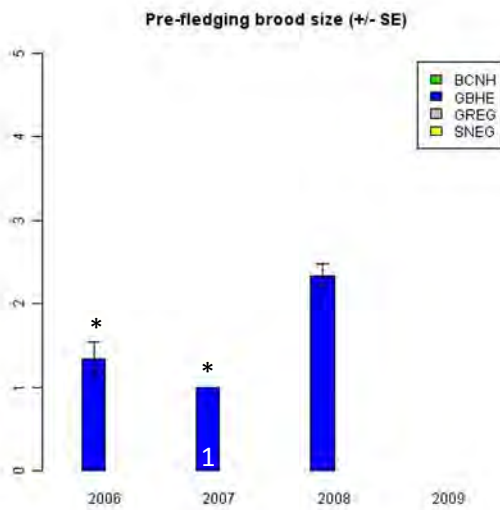
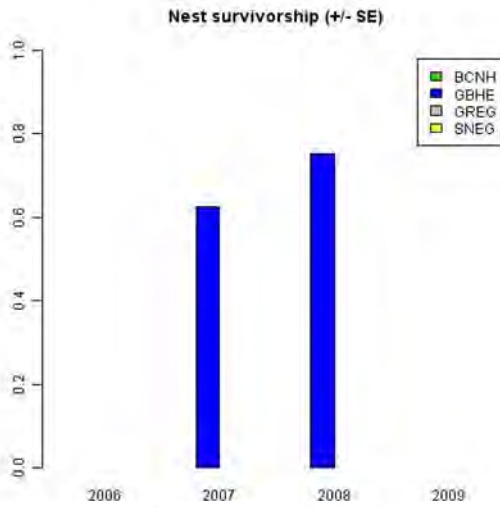
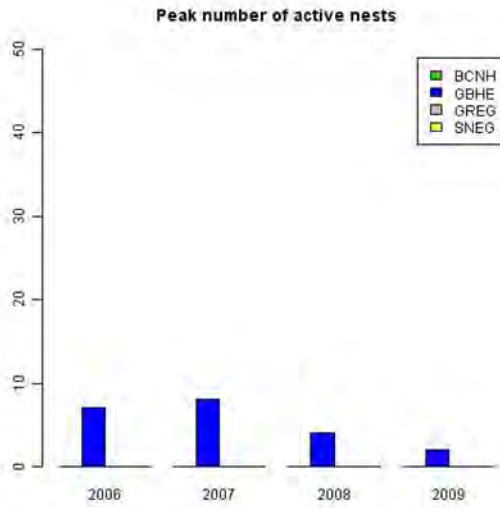
Russ Island



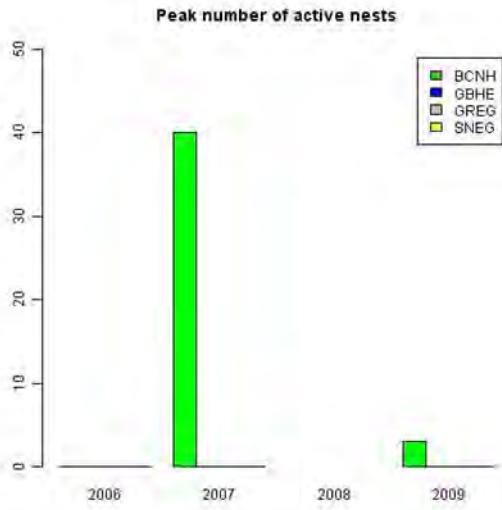
Shollenberger Park



Skaggs Island Eucalyptus

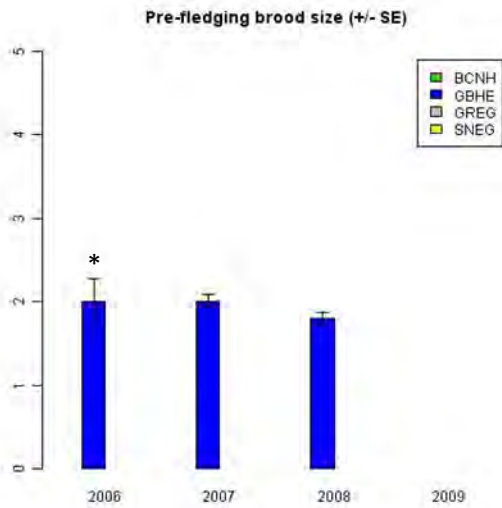
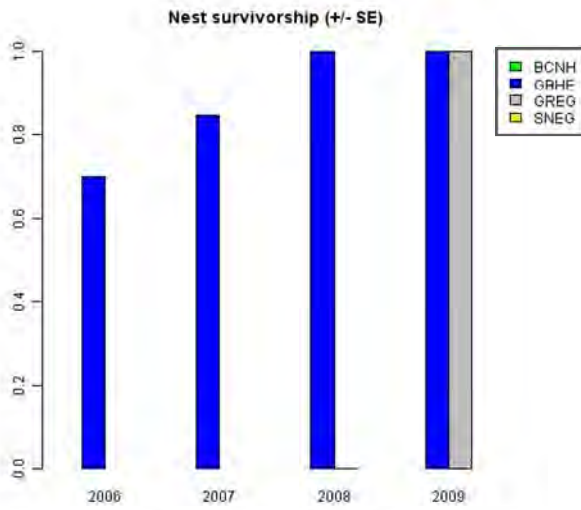
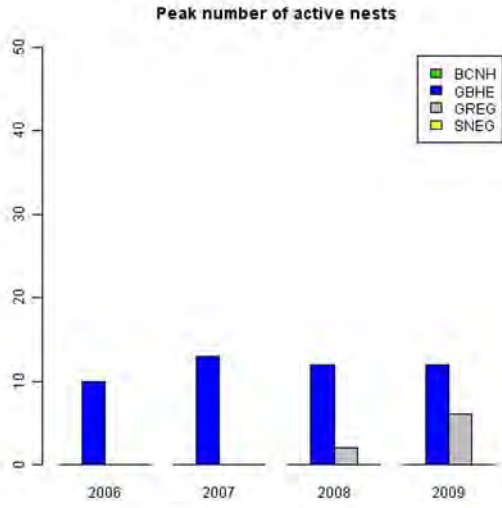


Skaggs Island Sewage Ponds

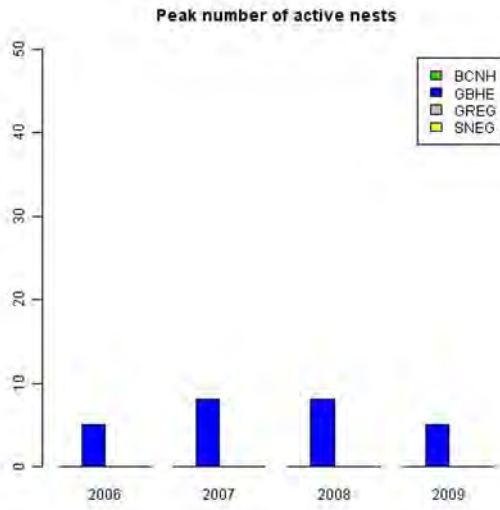


No data were available to calculate pre-fledging brood size and nest survivorship.

South Kelly



Vigilante Road



No data were available to calculate pre-fledging brood size and nest survivorship.

Colony Sites with Limited Activity

Please see the original publication for detailed nesting site histories.

<u>Site Name</u>	<u>Last Visited</u>	<u>Last Year Known Active</u>
Stanley Ranch	2009	2003
Mare Island Pier 35	2008	2005
Las Gallinas	2009	2005
Leslie Salt Pond	2007	1999
Leslie Salt Pond North	2008	2000
Fairview Terrace	2005	1997
North San Pedro Road #1	2009	2003
Schellville	2007	2004
Napa Marsh N-3	2005	1993
Schultz Slough	2005	2004
Stafford Lake	2005	1993