Shorebirds, waterfowl, and waders of Elkhorn Slough- Quarterly surveys of migrants and residents

Overview and objectives
The tidal wetlands of Elkhorn Slough including its main channel, many side channels, and shallow lagoons with adjacent mudflats, provide a rich habitat for both migratory and resident shorebirds, waterfowl and waders. Birders keen to observe the spring and fall migratory events are sure to include Elkhorn Slough as a known hotspot to witness these migrations as well as enjoy the resident birds. Over there years, there has been some quantitative data collected on the birds of Elkhorn Slough, including annual Christmas bird counts and occasional Moss Landing Marine Laboratory student theses. Long time birders in the area often note differences between years, but these observations, since not consistently recorded, remain anecdotal.

In 2003, ESNERR began coordinating the first regular, quantitative, consistent monitoring of the Slough’s shorebirds, waterfowl, and waders over time. The objective of this monitoring effort is to track these migratory (and resident) birds using the tidal wetland of Elkhorn Slough. While this modest program will not be sufficient to detect subtle alterations, we will be able to detect dramatic changes. By comparing our results to those from other wetlands along the coast, we can determine whether the changes are due to local factors affecting only the Slough (loss of foraging areas due to tidal scour, elimination of prey due to oil spill, etc.) or regional processes affecting the whole coast (breeding failure, El Nino effects on prey recruitment, etc.). In addition to broad spatial comparisons, we can also compare the results of our surveys to those at similar times of year done by past MLML grads B. Ramer and S. Connors. This program will provide valuable information about how ESNERR is used by resident and migratory shorebirds, waterfowl, and waders. and is the beginning of a long term monitoring program. The results presented here are from the first six years of the study (2003-2009) unless otherwise noted.

Methods
Field censuses:
Twice each spring and fall volunteers carry out the monitoring protocol. Surveys will take place within 2 hours of low tides listed between +2.0 and -1.5 feet. Volunteers count birds at four census stations: South Marsh (Big Lagoon and Five Pans), Parsons Slough, North Harbor, and Elkhorn Slough main channel. An additional site, North Marsh is surveyed at high tide (data not included in this report). At each station, all birds actively using the area (swimming, wading, hunting from above) are included; birds just passing by overhead are not counted. Upon arriving at a station, the volunteers first identify all birds present. They then begin a timed watch and count the maximum number of birds present in the area during this period. Birds are counted only within a defined area (boundaries are shown on a map carried by the volunteers on their clipboard). Regular volunteer participants include: J. de la Torre, L. Jordan, S. Murphy, C. Rodgers, T. Newberry, R. Eby, K. Klein, S. Gaebelin, B. and B. Ramer, C. Eyster, C. Hodges, D. Dixon, D. Glasco, E. Ross, I. M. Laursen, J. Azevedo, J. Burke, J. Harvey, J. Morris, J. Moir, J. Hatfield, K. Raymundo, K. St. Clair, K. Wasson, L. Catterall and students, N. Zavinsky, P. Schuppert, R. Fournier, R. Ashbach, and U. Steiner.

Data analysis for this report:
Data were pooled by season (spring and fall) and bird group unless otherwise stated.
Seasons: Spring (April) and fall (September and November).
Years of surveys: Spring (2006-2009); Fall (2003-2008).
Bird groups: Loons and Grebes, Pelicans, Cormorants, Herons and Egrets, Waterfowl (ducks, buffleheads, wigeons, and scoters), Shorebirds (killdeer, godwits, curlews, sandpipers, sanderlings, plovers, avocets, stilts, dowitchers, yellowlegs, and dunlins), Gulls, and Terns.

Abundance and species richness: Total abundance and number of species (as well as averages) were compared across season and year.

Fall surveys: An ANOVA was carried out for the following datasets: total abundance, species richness, and individual bird groups, using September and November survey data as the “replicates”.

Results
Overall, total abundance and species richness were quite variable both between seasons and years (Fig. 1, 2). Maximum spring abundance was 10288 birds (April 2009), averaging 8300 birds, while in fall was as high as 21425 birds in November 2005 (averaging 13000 birds) (Fig. 1, 3a). The maximum number of species (i.e. species richness) observed in spring and fall was similar: 50 species in April (2009) (average 47 species) and 48 species in November (2007) (average 39 species) (Fig. 2, 4b). Species richness was most variable in fall ranging from a low of 31 species observed in September 2003 and 2005 to the 48 species tallied in November 2007 (Fig. 2). For fall-only surveys, species richness and abundance did not vary significantly between years (ANOVA) (Fig. 6; Table 1). Of individual bird groups, only Loons and Grebes varied significantly by year (ANOVA) (Table 1; Fig. 6 and 7).

Individual bird groups varied both seasonally and yearly (Fig. 4 and 5):
• LOONS AND GREBES: Peak abundances were similar for spring and fall surveys (206 birds in March 2009 and 193 birds in November 2008) (Fig. 4a).
• PELICANS: Maximum abundance was much lower in spring than in fall (107 birds in April 2007 vs. 1568 birds in September 2006) (Fig. 4b).
• CORMORANTS: Maximum spring abundance was 222 birds in April 2007 and in fall was 386 birds (November 2005) (Fig. 4c).
• HERONS AND EGRETS: Peak abundances were similar in both spring and fall surveys; 189 individuals were counted in April 2006 and 185 in November 2007 (Fig. 4d).
• WATERFOWL: Maximum abundance in spring was much greater than in fall (1932 birds in March 2009 vs. 425 birds in November 2007). Interestingly the September 2005 survey recorded only 2 waterfowl (mallards) (Fig. 5a).
• SHOREBIRDS: Peak abundance in spring was 9374 birds (April 2009) and 13026 birds in fall (September 2005) (Fig. 5b).
• GULLS: Maximum abundances between spring and fall were highly divergent, tallying 1168 birds in March 2009 and 9174 birds in November 2005 (Fig. 5c).
• TERNs: Maximum spring abundance was 164 birds in March 2009. Peak abundances were highly variable in fall (September), ranging from two birds in 2007 to 248 birds in 2006 (Fig. 5d).
Discussion
The results revealed that species richness and abundance have apparently been fairly stable at Elkhorn Slough during the period 2001-2008, although there are some seasonal differences. Bird abundance was greatest in fall, with nearly twice as many birds counted as opposed to spring surveys. The greatest abundance, with over 21,000 birds counted, was recorded in the November 2005 survey, while the April 2008 survey had the least, at only 6200 birds. The number of observed species was similar between spring and fall surveys, although fall was more variable.

These analyses from the first seven years provide a preliminary baseline of bird abundances and species data of Elkhorn slough and may help to contribute towards a greater understanding of Pacific Coast shorebird and waterfowl population dynamics. While this modest program will not be sufficient to detect subtle alterations, we will be able to detect dramatic changes. By comparing our results to those from other wetlands along the coast, we can determine whether the changes are due to local factors affecting only the Slough (loss of foraging areas due to tidal scour, elimination of prey due to oil spill, etc.) or regional processes affecting the whole coast (breeding failure, El Nino effects on prey recruitment, etc.).

Elkhorn Slough is, in fact, one of forty-six sites recognized by the Western Hemisphere Shorebird Research Network (WHSRN) as critically important because it provides essential wintering and migratory stopover habitat along the Pacific Flyway. As one of the largest estuaries on the California coast, Elkhorn Slough supports as many as 300 species of birds and 38 species of shorebirds (Senner and Howe 1984; Ramer, Page, and Yoklavich 1991; Page et al. 1992), making it among the most species-rich sites for birds in the state of California.

Literature Cited
