Two Decades of Change in a Coastal Scrub Community: Songbird Responses to Plant Succession[1]

Mary K. Chase,[2] Aaron L. Holmes,[2] Thomas Gardali,[2,3] Grant Ballard,[2] Geoffrey R. Geupel,[2] and Nadav Nur[2]

Coastal scrub habitats in California are threatened by habitat loss, fragmentation, and degradation. Local and statewide declines have been observed in several birds that breed in coastal scrub, most notably the California Gnatcatcher (*Polioptila californica*; Atwood 1993), but also include more common species such as the White-crowned Sparrow (*Zonotrichia leucophrys;* Trail and Baptista 1993; Sauer et al. 2001; Point Reyes Bird Observatory [PRBO], unpubl. data). While Breeding Bird Survey data can be used to track population trends over larger scales (Sauer et al. 2001), they are not always adequate to monitor trends of distinct breeding populations. Such populations include the *nuttalli* subspecies of the White-crowned Sparrow, which breeds only in the narrow, humid, coastal strip of central and northern California, and the Song Sparrows (*Melospiza melodia*) that breed in northern California coastal scrub habitat. On the other hand, while local monitoring programs have the advantage of being population- and habitat-specific, it is difficult to tell whether trends demonstrated in local study areas are associated with landscape-scale changes or are occurring primarily in response to local changes in habitat characteristics (Holmes and Sherry 2001). We monitored plant succession and associated changes in bird population density in a single study site in northern California coastal scrub habitat. Our objectives were to (1) describe plant succession in coastal scrub over 22 years, and (2) evaluate evidence for population responses to plant succession in three coastal scrub resident birds. Here, we report preliminary results concerning the changes in abundance of three species of coastal scrub-breeding birds.

Bird populations may change in a predictable way as plant succession occurs. However, many studies of this phenomenon have been cross-sectional surveys of multiple sites in various seral stages (Johnston and Odum 1956, Martin 1960, Shugart and James 1973, Morgan and Freedman 1986, Thompson and Capen 1988). A few studies have compared short-term snapshots of bird communities before and after a long period of habitat change (e.g., Kirk et al. 1997). Most rare are studies that have tracked bird populations over long periods (>20 years) as habitat change has occurred (Holmes and Sherry 2001). Holmes and Sherry (2001) found that several forest birds associated with early or midsuccessional forest declined on their study area while other species associated with mature forest increased in abundance. These changes occurred over a period of 30 years, during which the physical structure of the forest changed significantly. To our knowledge, no comparable analysis has been conducted for a shrubland bird community.

The suppression or ignition of fires by humans has a major influence on habitat characteristics throughout the range of coastal scrub habitats. Northern California scrublands may be replaced by forest vegetation in the absence of fire (Heady et al. 1988, Horton et al. 1999). Thus, the process of plant succession in the absence of fire is one possible cause of population changes in northern coastal scrub bird populations. In contrast, southern California coastal scrub has experienced increased fire frequency, which, together with livestock grazing, air pollution, and the invasion of exotic grasses and forbs, has led to the conversion of some scrub habitats into non-native grasslands (Keeley 1995, Minnich and Dezzani 1998). In this study, we tracked changes in plant and bird communities in a northern coastal scrub site in the absence of fire.

Bird responses to plant succession in northern California coastal scrub were monitored intensively for 22 years (1980-2001) at the Palomarin field station of the PRBO, located within the Point Reyes National Seashore. Much of the study site was cultivated until the early 1960's, after which passive regrowth of coastal scrub vegetation began. By 1980, when intensive nest monitoring and territory mapping of all species was initiated, the site supported many breeding pairs of coastal scrub species, including year-round resident Wrentits (*Chamaea fasciata*), Nuttall's White-crowned Sparrows, and Song Sparrows. Density of these three species was monitored by intensive spot mapping of

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[2]PRBO Conservation Science, 4990 Shoreline Hwy, Stinson Beach, CA, 94970.

[3]Corresponding author: tgardali@prbo.org.

color-banded individuals (March-July; for more details on methods, see Silkey et al. 1999). The number of females breeding on the study area in each year was used as a measure of density. Plant succession was monitored at 40-m line-intercept transects placed at 40 locations in 1981/1982 and 2000 (27 in formerly cultivated, disturbed habitat and 13 in undisturbed habitat). The cover and height of each shrub or tree along the transect was recorded. Plant characteristics were compared between the two sampling periods using two-tailed t-tests. Linear regression was used to analyze trends in bird density.

Vegetation on the study area changed dramatically between 1980 and 2001. Most notably, Douglas-fir (*Pseudotsuga menziesii*) cover and height increased significantly on the study plot (*fig. 1*). Results of territory mapping during this same period showed a large and significant decline in the breeding density of White-crowned Sparrows (*fig. 2A*). The density of Wrentits increased dramatically over most of the study period, but declined slightly in the last three years of the study (*fig. 2B*). Song Sparrow density showed only a weak trend over time (*fig. 2C*).

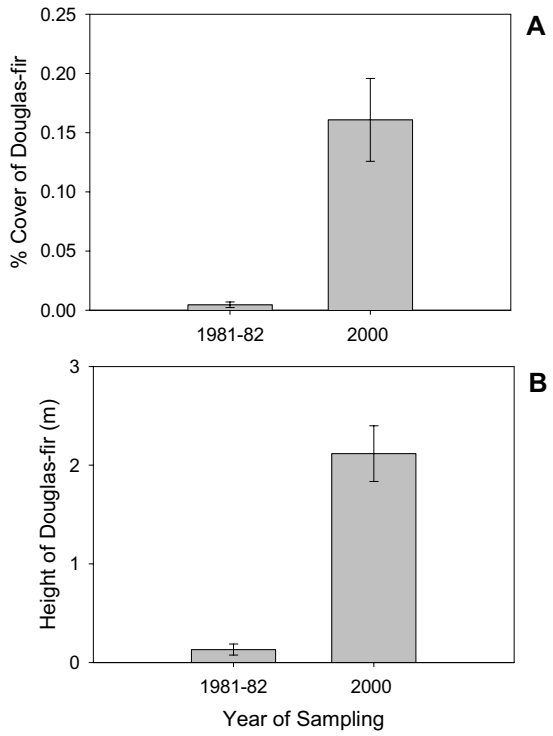

Figure 1— Mean and standard error of Douglas-fir cover (A) and height (B) at 40 transects in the Palomarin study area shortly after the beginning of the study and in 2000 (cover: t = -4.42, df = 78, P < 0.001; height: t = -6.90, df = 78, P < 0.001).

These local trends can be compared with Breeding Bird Survey results for the physiographic area in which our site is located (southern Pacific rainforests; Sauer et al. 2001). During the same period, declines were observed in both White-crowned Sparrows (-2.0 percent annual trend, P = 0.01, N = 56 routes) and Wrentits (-1.6 percent annual trend, P = 0.01, N = 40 routes), while Song Sparrows showed a weak declining trend (-0.7 percent annual trend, P = 0.11, N = 72). Thus, local trends appear to correspond to larger-scale trends for White-crowned Sparrows and Song Sparrows, but not for Wrentits.

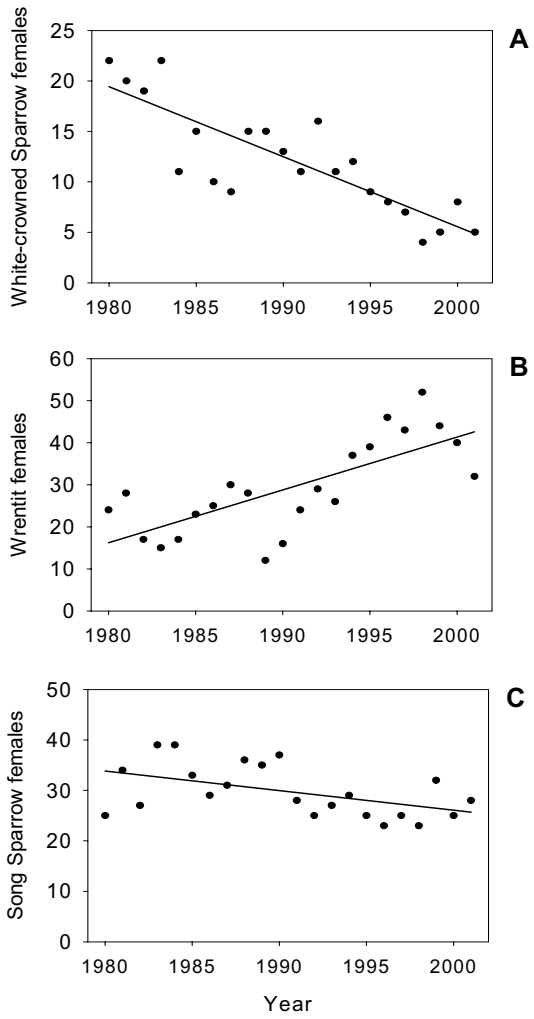

Figure 2— Population trends of three resident coastal scrub birds in the Palomarin study area, 1980-2001. White-crowned Sparrows declined significantly (r^2 = 0.71, F1,20 = 48.97, P < 0.001), Wrentits increased significantly (r^2 = 0.54, F1,20 = 23.54, P < 0.001) and Song Sparrows showed a weak declining trend (r^2 = 0.24, F1,20 = 6.42, P = 0.02). Note differences in scale on y-axes.

In conclusion, Wrentit and White-crowned Sparrow density may have responded to plant succession, while Song Sparrow density did not appear to do so. Although our results are correlational, they are consistent with what is known about the habitat associations of our study species:

- Wrentits are associated with dense shrub cover (Geupel and Ballard 2002) and thus may have responded to the increase in cover by shrubby young Douglas-fir;
- White-crowned Sparrows are associated with more open scrub habitats, containing grass and some bare ground for foraging (Chilton et al. 1995); and
- Song Sparrows are relative generalists, occurring in California in a variety of habitats that are typically moist, with low, dense cover or brushy, weedy edges (Small 1994).

In the future, we plan to evaluate population responses to succession in this site for the entire avian community and to model variation in bird population density in relation to changes in habitat characteristics and weather over time. Preliminary analyses suggest that changes in White-crowned Sparrow and Wrentit density paralleled vegetation change, while variation in Song Sparrow density was more closely related to weather (PRBO, unpubl. data). While plant succession in the absence of fire may have influenced our local populations, more study is needed to evaluate this process as a potential cause of larger-scale bird population trends in northern coastal scrub. However, given the dramatic invasion of trees into our study site, our results suggest that habitat reserves in northern coastal scrub may need active management to retain both early successional scrub habitat, for species such as White-crowned Sparrow, and more mature scrub, for species such as Wrentit.

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