ISLAND JEPSONIA (*JEPSONIA MALVIFOLIA)* DEMOGRAPHY ON SANTA ROSA AND SANTA CRUZ ISLANDS, CALIFORNIA

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RESEARCH NOTE

The California Channel Islands have a long history of grazing by introduced herbivores. Consequently, the population dynamics of island plants reflect the cumulative effects of historic and current trampling, browsing, grazing, and disturbance by these exotic herbivores. Island jepsonia (*Jepsonia malvifolia*) (Greene) was classified in the Catagory-2 Federal status while that designation existed, because of apparent population declines related to herbivore habitat use. It is a perennial herb in the Saxifrage family with a distribution on Guadalupe Island (Baja California) and all California Channel Islands except Anacapa, Santa Barbara, and San Miguel (Munz 1963, 1974; Ornduff 1969, 1970; Junak et al. 1995). It occurs on coastal bluffs and north-facing slopes in association with chaparral, coastal scrub, oak woodland, and pine forest (Munz 1974; Elvander 1993; Junak, et al. 1995). Island jepsonia plants develop leaves from a fleshy underground corm in the winter and spring months, but they flower when the leaves are dormant during fall and early winter. This species has two morphological flower types designated pin (short anthers and an exserted stigma) or thrum (exserted anthers and a short stigma).

Historic and current records for island jepsonia indicated populations were rare and apparently declining on the islands. The corm of island jepsonia is a food source likely favored by pigs. If this species is particularly threatened by pigs, populations should be recovering on Santa Rosa Island, where feral pigs were eliminated in 1992. In contrast, Santa Cruz Island populations should reflect the demographic effects of continuing pig predation. We initiated this research to compare population performance on the two islands, to evaluate populations in contrasting habitats on Santa Rosa Island, and to evaluate factors associated with population decline. Little was known about island jepsonia distribution on Santa Rosa Island, so mapping surveys were conducted there to document the range of habitats occupied by island jepsonia during the 1995 flowering season when the plants were easiest to see. Known locations (Junak pers. comm. 1995) were visited on Santa Cruz Island. Santa Rosa Island surveys found island jepsonia to be widely distributed in island chaparral and adjacent grasslands, and occasionally on canyon walls. On Santa Cruz, island jepsonia occurs primarily in grassy openings in island chaparral.

Permanent demography plots were established on Santa Rosa and Santa Cruz Islands in fall 1995 (McEachern et al. 1997). Six sites were selected for sampling on Santa Rosa and three on Santa Cruz. On Santa Rosa, two replicate sites were selected within each of the three major habitats occupied by island jepsonia. At each site, three plots were subjectively located in spots with at least five flowering plants per 50 x 50 cm plot; objectives were to sample at least 15 flowering plants per site. Since the number of sites was limited and island jepsonia plants were less dense on Santa Cruz than on Santa Rosa, three to eight plots were installed at each of three chaparral opening sites to ensure adequate sample size. Plant species frequency and vegetation cover data were collected in randomly placed belt transects during spring 1996, to characterize the community at each study site. The three community types sampled on Santa Rosa Island were mixed chaparral dominated by prostrate *Adenostoma fasciculatum* and *Quercus pacifica*; grassland dominated by exotic annual species of *Avena*, *Vulpia* and *Bromus*; and canyon walls dominated by various native shrubs and herbs, including *Dodecatheon clevelandii* ssp. *insulare*, with significant coverage of cryptobiotic crust. On Santa Cruz, exotic annual grasses (*Avena, Vulpia, Gastridium*, and *Bromus*) and other herbaceous species dominated the openings in *Arctostaphylos insularis*/*Quercus pacifica* chaparral.

Demographic data were collected during late fall for flowering plants, starting in November of 1995, and late winter for vegetative plants, starting February of 1996. Plants were mapped in permanent plots on a 1 x 1 cm grid system and remapped and measured annually to determine growth patterns, reproductive output and mortality. Flowering data collected included number of inflorescences per plant, number of flowers per inflorescence, inflorescence height, and morphological type of inflorescence (pin or thrum). Vegetative data collected were number of leaves, and length and width of leaves for calculating size indices for all established plants. Seedlings were counted, measured, and tallied in each

10 cm x 10 cm square within the plot to assess seedling recruitment. Seedlings surviving into the following year were mapped to the nearest 1cm and percent seedling survival was calculated each year. Mean numbers of plants per plot were calculated by life stage classes (vegetative and reproductive plants; small, non-reproductive, apparently one- or two-year old plants; seedlings; and flowering plants). Trends in population size were evaluated by plotting changes in numbers of vegetative plants counted in spring 1996, 1997 and 1998.

Populations on Santa Rosa Island are growing through recruitment of new plants from seed, with the highest population growth rates in grasslands. Excluding seedlings, the grassland community (n=6 plots) increased nearly 250% over three years, growing from a mean density of 26.8 ± 14.0 plants per plot in 1996 to 36.0 ± 17.9 in 1997 and 62.0 ± 42.3 in 1998. The mean number of plants per plot averaged over three years was 41.6. In the chaparral community (n=6 plots), established plant density increased nearly 40%. There were an average of 17.2 ± 5.9 plants per plot in 1996, 23.7 ± 8.1 in 1997 and 23.7 ± 7.2 in 1998, for a mean plot density over the three years of 21.4. The canyon sites averaged 25.8 ± 16.0 plants per plot in 1996 and 40.8 ± 25.4 in 1997. Vegetative plant data were not collected in canyons for spring 1998, so additional population growth cannot be reported. The mean number of plants per plot averaged over the two years was 33.3. For all life stages there is high variability in mean plant density among plots within sites for each sample year.

Results from Santa Cruz Island populations are mixed, even though the island jepsonia habitats are similar. Two of the three sites show a decreasing trend in population size. The third site, near the Christy pines, seems to be growing slightly, mainly through the appearance of established plants that were dormant in 1996, and recruitment in 1997 and 1998. Island jepsonia mortality is variable among sites on Santa Cruz Island. Pig predation is a major source of plant mortality at the two Santa Cruz Island sites with declining sample population sizes. At these two sites, pig rooting was observed in or near plots every season. Spring 1996 data indicate that pig rooting killed 67% of flowering plants present the previous fall in plots at these two sites. Pig predation continued, and in fall 1997, more plots were installed to increase sample size. Recruitment at these sites has been consistently low to nonexistent. The Christy pines site was affected to a much lesser extent by pig rooting until 1998, and is the site where recruitment occurred. Apparently pigs did not frequent this area nearly as much as the sites closer to the Main Ranch and Central Valley from 1995 to 1998 when the pig population was declining (Klinger unpublished data). The pig population increased during 1998, probably due to high rainfall and resulting increased food availability. During December 1998, and February 1999 sampling, pig rooting was recorded in or near all plots at the Christy pines site.

Overall, on Santa Cruz Island, the number of plants in plots increased between 1996 and 1997, but then decreased slightly between 1997 and 1998. The mean number of vegetative plants per plot, excluding seedlings, was 2.6 ± 2.5 (n=16 plots) in 1996, 4.2 ± 3.8 (n=16 plots) in 1997 and 4.0 ± 4.1(n=19 plots) in 1998 for an average of 3.6 plants per plot across three years. The large 1996-1997 increase was mainly driven by the appearance of small dormant individuals and seedlings at the Christy study site. Even though new reproductive and vegetative plants were observed in some plots over years, the overall proportion of plants that flower each year has decreased. During fall of 1995, a total of 57 flowering plants were sampled in plots. In 1996, only 10 flowering plants were present in plots, followed by only 9 in 1997 and 15 in 1998.

Some general trends are apparent as a result of this study. A majority of plants do not flower annually, and flowering is not always followed by vegetative growth. High recruitment and lowered mortality appears correlated with high rainfall in both the small and large plant size classes on both islands. On Santa Rosa Island, *Jepsonia* populations are growing with differential recovery rates in different plant communities. Populations on Santa Cruz Island are variable, with two sites showing signs of population decline, due largely to feral pig activity that kills plants and lowers seed production, while one site showed signs of slow growth until 1999. The elimination of feral pigs from Santa Rosa Island has apparently benefited island jepsonia, and possibly other fleshy-rooted species as well. Eradication of pigs from Santa Cruz Island could reverse the declining trends seen there, if the eradication is done before corm and seed banks are thoroughly depleted.

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