



The impact of small vertebrate consumers on community assembly in degraded California sage scrub

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Introduction

- Herbivores and granivores influence plant community assembly by consuming preferred species (1,5). One hypothesis predicts that consumers increase community diversity if they prefer to eat dominant species (2).
- A limited number of studies have focused on preferred functional traits of small mammals or their effects on community functional trait composition (3,4).
- In California sage scrub, small mammals *and* birds may affect plant community assembly. Understanding consumer preference is necessary to determine how these animals affect dominant species and competition between native and invasive species.



The goal of this study is to determine the influence of small mammals and birds on community assembly in a restored coastal sage scrub plant community.

Specific objectives:

- 1) Understand the effect of consumers on native and invasive species recruitment.
- 2) Understand how consumer preference for common or rare plant species affects community functional composition.

Experimental Design

Treatments

- Cage treatment:** “caged” and “open” 1 m X 1 m restoration plots were established in the Voorhis Ecological Reserve (VER) on the Cal Poly Pomona campus in Pomona, California. Covered hardware cloth cages were designed to exclude small mammals and birds.
- Seed treatment:** plots were seeded with thirteen native species. Three different seed mixes included 1) dominated by a preferred species (*Stipa pulchra*), 2) dominated by a less preferred species (*Salvia mellifera*), or 3) species included in equal abundance (“equal”). A fourth control treatment received no native seeds.
- Each experimental block consisted of eight plots total, combining the cage treatment and seed treatment in a randomized design. Five blocks were replicated throughout the VER in areas dominated by invasive grasses (*Bromus spp.*) and forbs (*Hirschfeldia incana*, *Centaurea melitensis*).



Caged plot (front) and open plot (rear). “Open” plots were covered with cages elevated ~20 cm above the ground in order to allow animal access while controlling for any effects of the cage material.

Consumer Activity

- Motion activated Bushnell trail cameras were placed at each block to record daily visitation rates of consumers.

Measurements

- Species recruitment** was measured using a 0.5 m X 0.5 m subplot in each plot center.
- Abundance** was measured using the point-intercept method and a 1 m x 1 m gridded quadrat.
- Functional traits** of dominant species were measured on individuals across blocks. Traits included: specific leaf area (SLA), growth rate, maximum height, and seed mass.

Abundance of native species was greater in caged plots.

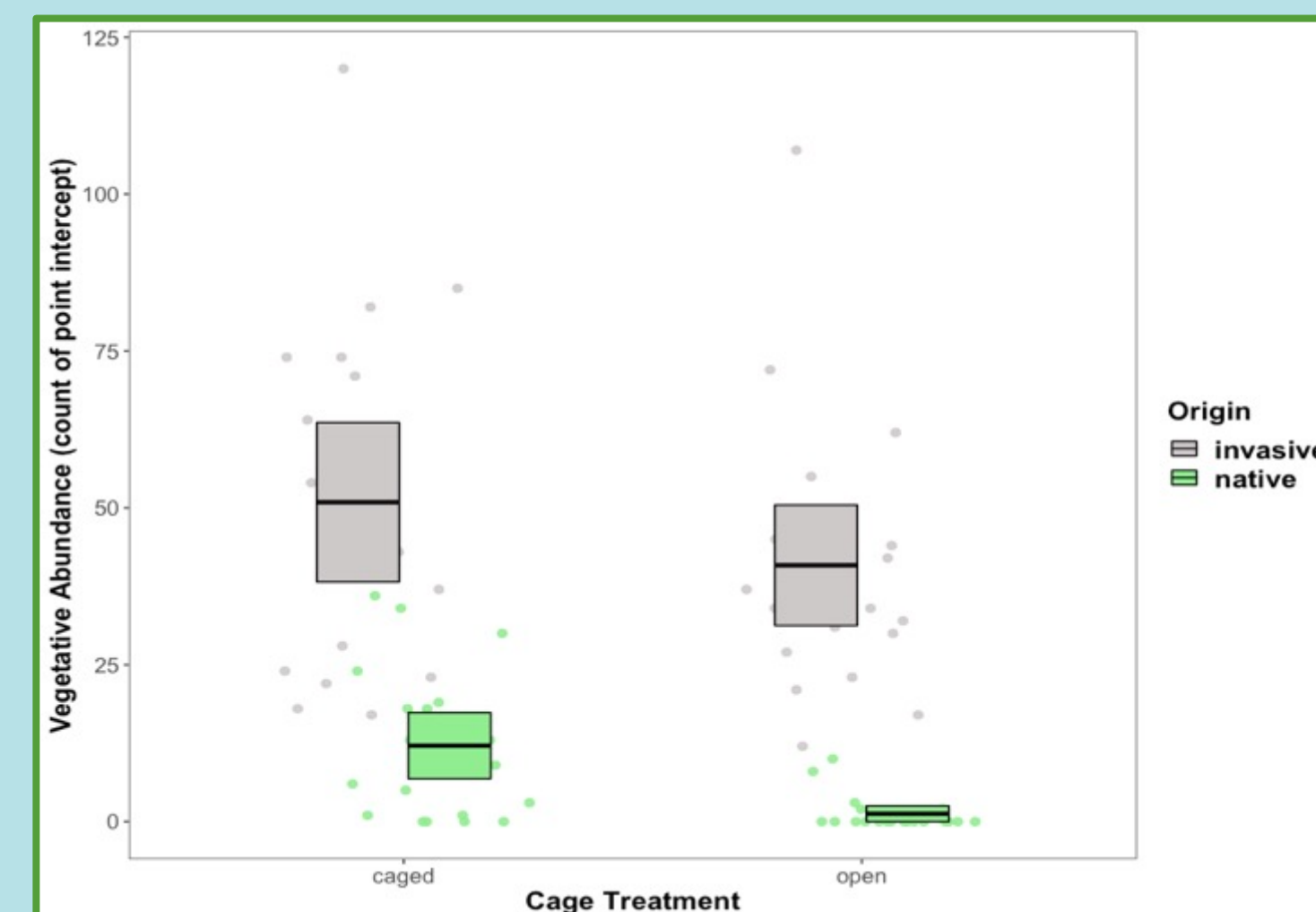


Figure 1. Total abundance (mean \pm 95% CI) of native and invasive species by cage treatment. Native species abundance was higher in the caged plots, while invasive species cover was not significantly affected by the cage treatment (native $F_{1,39} = 22.6$, $P < 0.0001$; invasive $F_{1,39} = 2.28$, $P = 0.14$).

Results



Comparison of caged and open communities that received the “equal” seed treatment.

Native abundance was highest in caged plots across all seed treatments.

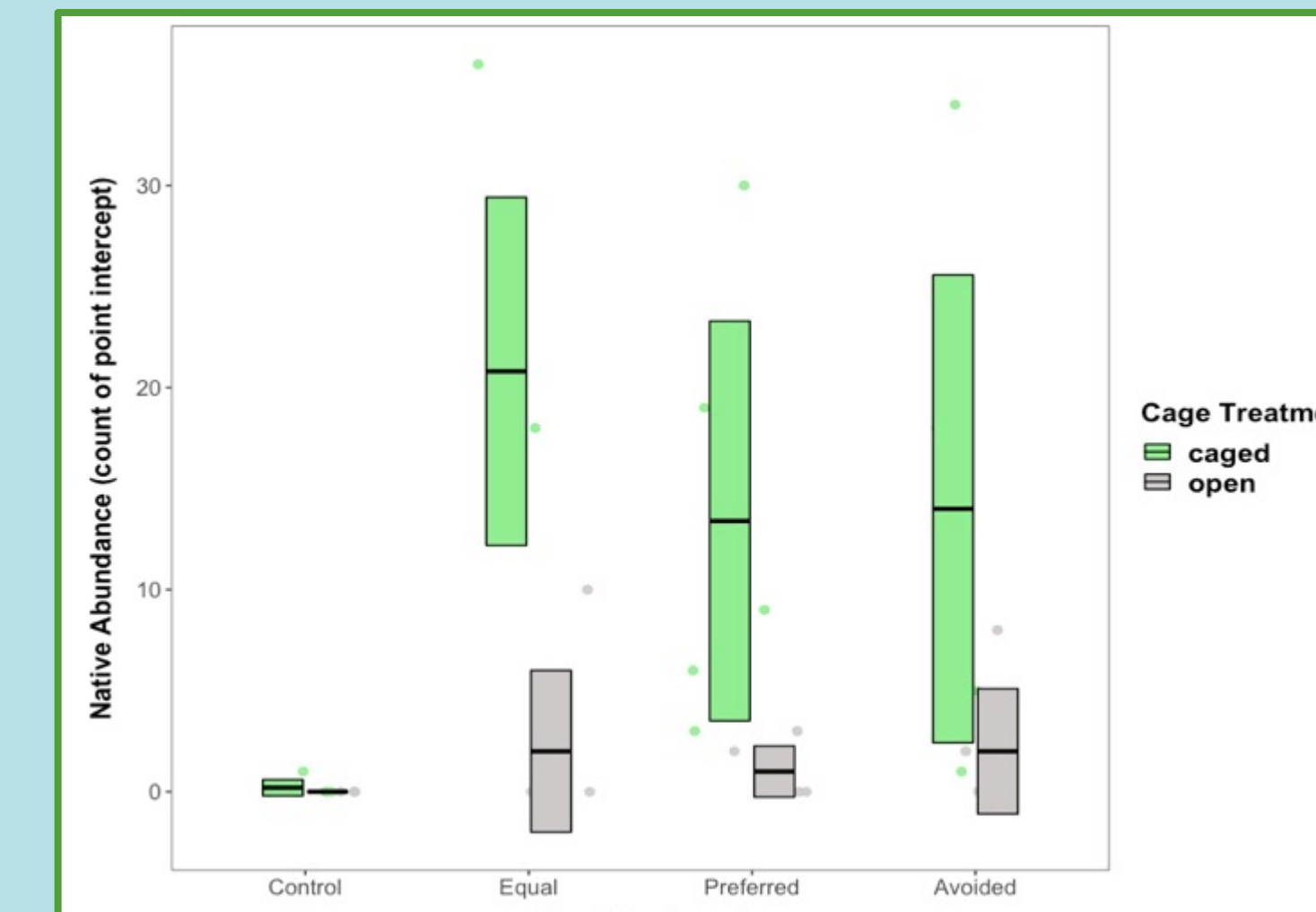


Figure 2. Native abundance (mean \pm 95% CI) by cage and seed treatment. Differences in native species cover were statistically significant among both the cage ($F_{1,39} = 22.6$, $P < 0.0001$) and seed treatments ($F_{3,39} = 4.32$, $P < 0.05$).

Species Recruitment

Species	Growth habit	Origin	Number of caged plots	Number of open plots
<i>Amsinckia intermedia</i>	Annual forb	native	15	6
<i>Bromus diandrus</i>	Annual grass	invasive	9	8
<i>Bromus madritensis</i>	Annual grass	invasive	12	11
<i>Centaurea melitensis</i>	Annual forb	invasive	15	17
<i>Clarkia purpurea</i>	Annual forb	native	15	6
<i>Cryptantha intermedia</i>	Annual forb	native	5	5
<i>Festuca microstachys</i> *	Annual grass	native	10	0
<i>Hirschfeldia incana</i>	Annual forb	invasive	14	12
<i>Lupinus bicolor</i> *	Annual forb	native	12	1
<i>Lupinus hirsutissimus</i> *	Annual forb	native	15	0

Table 1. Number of caged and open plots where common species occurred.
*Significant results of Fisher's exact test ($p < 0.05$).

Functional Traits: Seed Mass

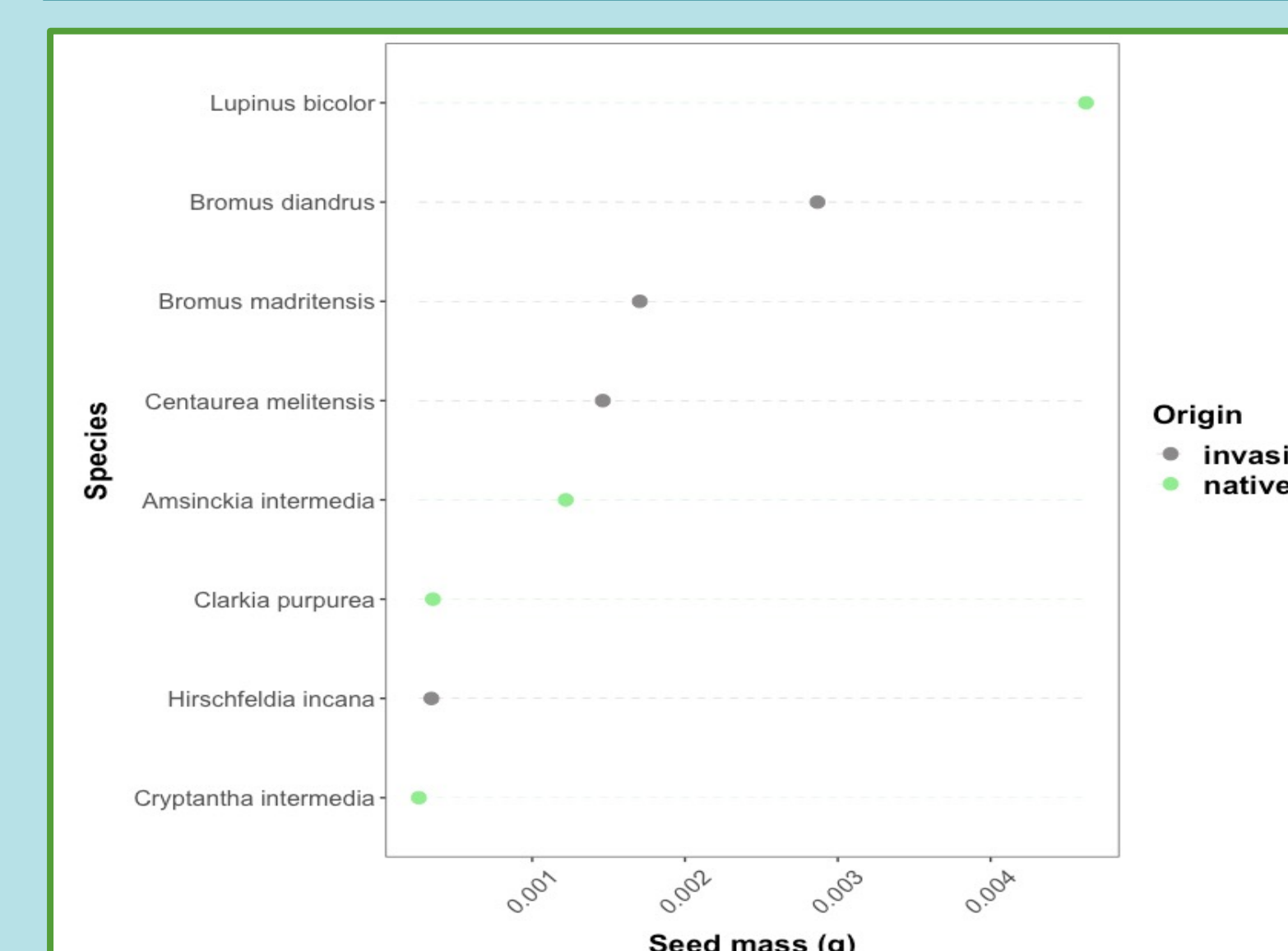


Figure 3. Mean seed mass of dominant species. Seeds of five individuals were measured. The largest seeded species (*Lupinus bicolor*) was significantly inhibited by consumers (Table 1).

Consumer Visitations

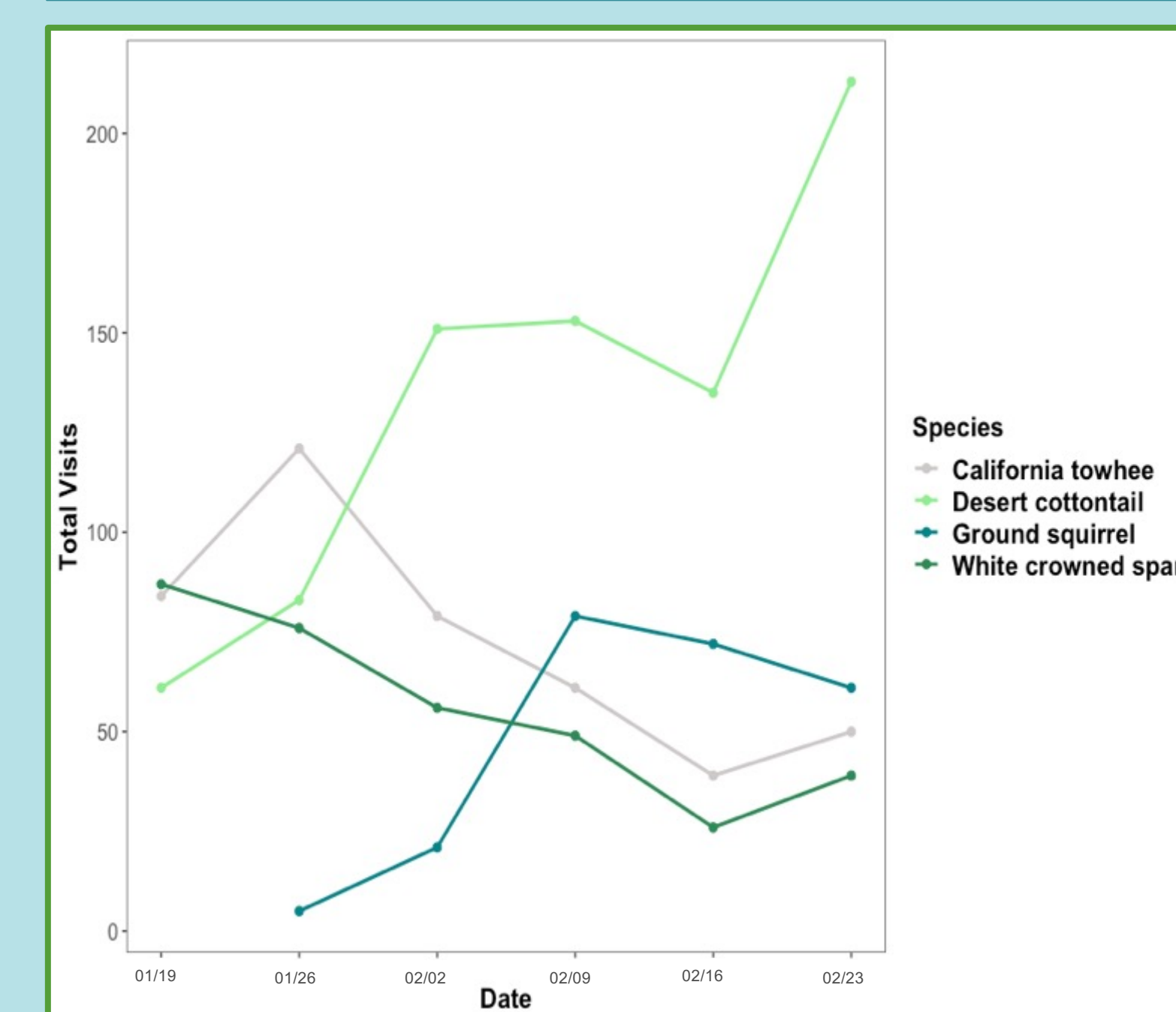


Figure 4. Preliminary data showing total weekly visitations of dominant consumers during the first month following seeding. Data will be collected continuously throughout the study.

Discussion

- Consumer exclosures had a positive effect on native species recruitment but did not significantly affect invasive establishment.
- Native cover was highest in “caged” communities across all seed treatments, suggesting an influence of consumers on native establishment.
- Granivorous birds, such as *Melospiza crissalis* (California towhee), were the dominant animals present after seeding, followed by *Sylvilagus audubonii* (desert cottontail).
- Preliminary analysis of functional traits showed that a large seeded native annual, *Lupinus bicolor*, was favored by consumers.

Future Directions

- All 40 research plots will be seeded for a second field season.
- After year two of the study, community diversity and functional composition will be examined.
- Additional elements of the project include:

- 1) Seedling preference trials:** seedlings of dominant species will be offered to herbivores at all five blocks in a “cafeteria-style” array. Wildlife cameras will be used to record video of the consumers that eat the individuals.
- 2) Seed preference trials:** seeds of dominant species will be offered to granivores and observed using video recordings.
- 3) Functional traits** will be analyzed, including leaf C:N ratio and trichome density. Traits will be collected for a second season.



Experimental setup of seed preference trials. Caged and open dishes containing 20 seeds of each species are offered to granivores.

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