

## Effects of Population Size on the Reproductive Fitness of *Holocarpha macradenia*



### Project Overview

- Project began for an undergraduate thesis requirement while attending school in Rhode Island
- Met with Grey, applied for a permit, explored the populations with the help of Grey, Sue Bainbridge, Val Haley, CDFG survey team in Wildcat Canyon
- Using the GPS data on CNDDDB looked for other populations both extant and extirpated

### Populations

Project focused on nine populations :

- Watsonville Airport
- Porter Ranch
- Apple Hill
- Graham Hill
- '5' Experimental Populations in Wildcat Canyon
- Some data also taken from Arana Gulch and Twin Lakes, but nothing removed

### Data Collection

Summer of 2000:

- Seed heads collected from nine populations
- Individual seeds counted, weighed, and germinated
- Physical plant data taken (number of heads, number of florets, plant height, ect....)
- Some environmental data taken (neighboring plant species composition, ect..)
- Non-dormant seeds were sprouted and grown in a randomized greenhouse trial
- Similar seed and plant data taken from greenhouse plants, some pollination experiments conducted

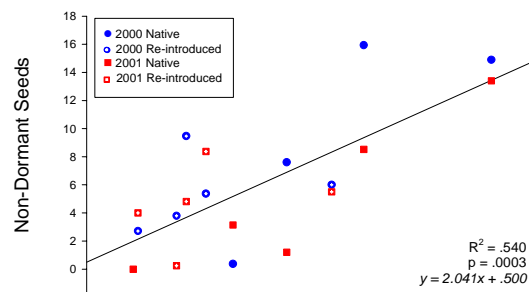
Summer of 2001:

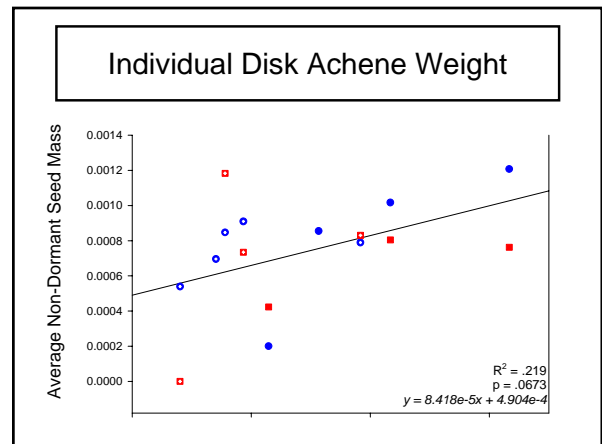
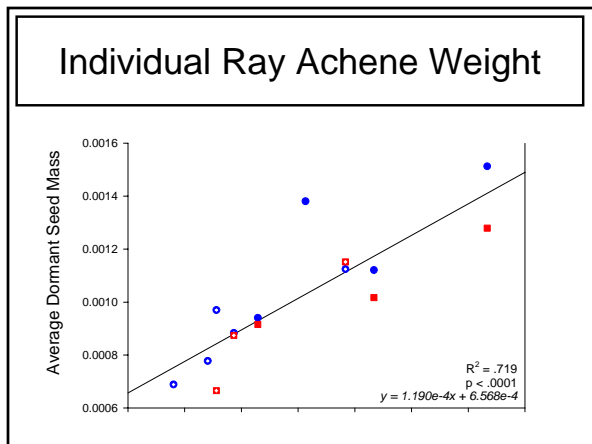
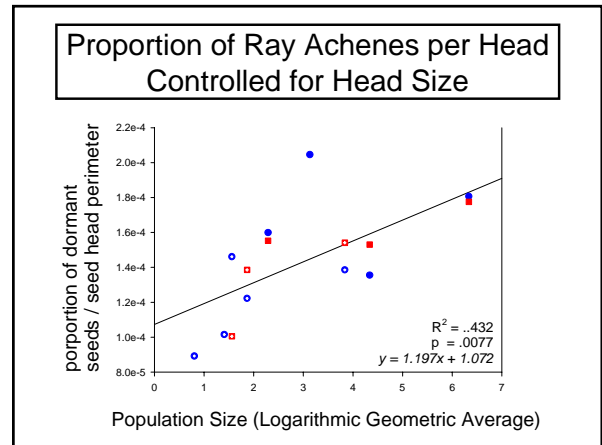
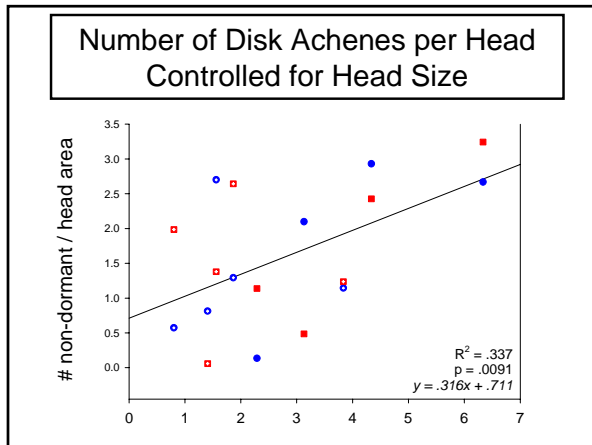
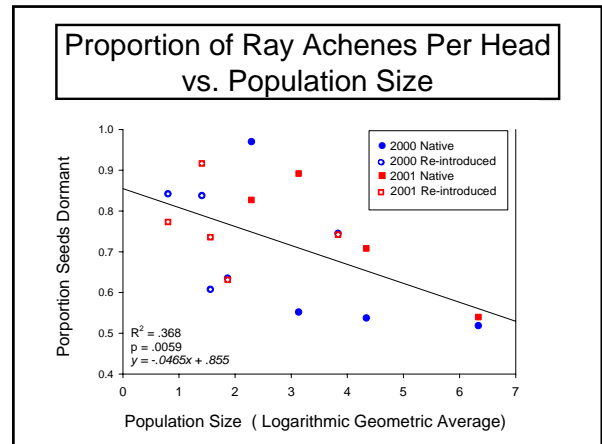
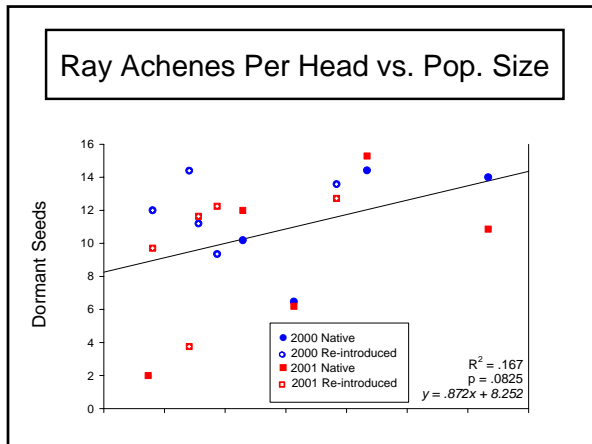
- Same data set taken with the exception of not removing seeds from certain populations (Graham Hill, some of the experimental populations)

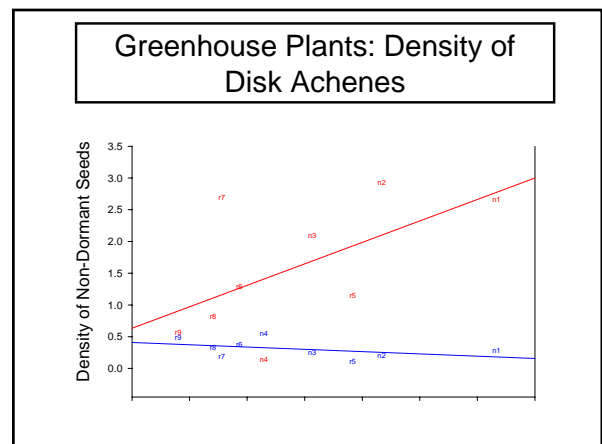
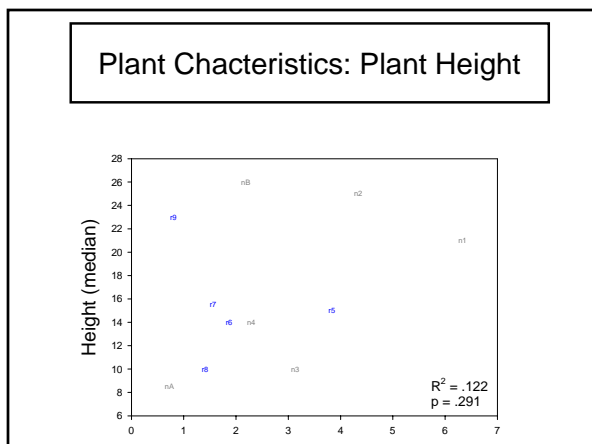
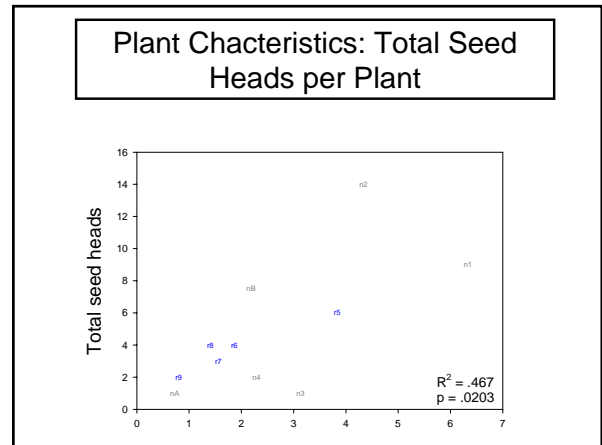
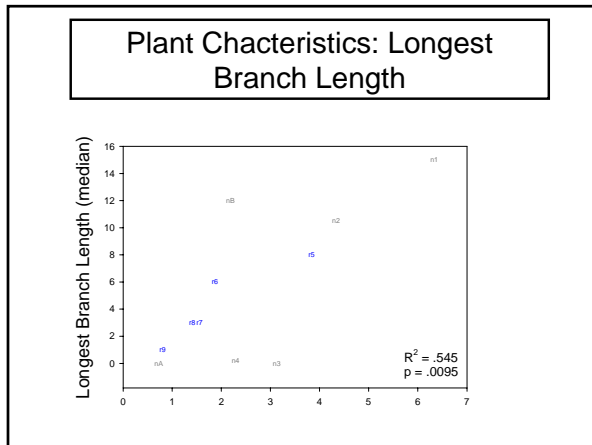
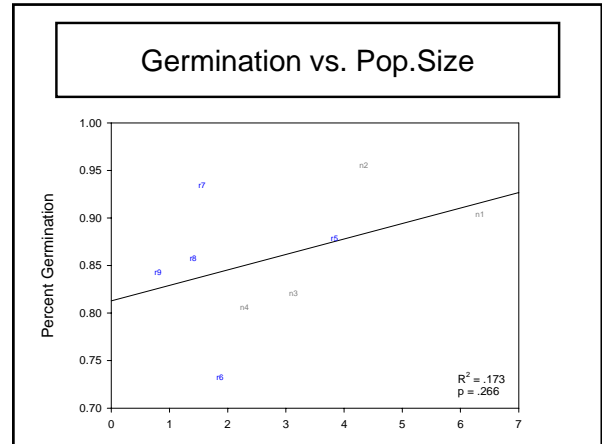
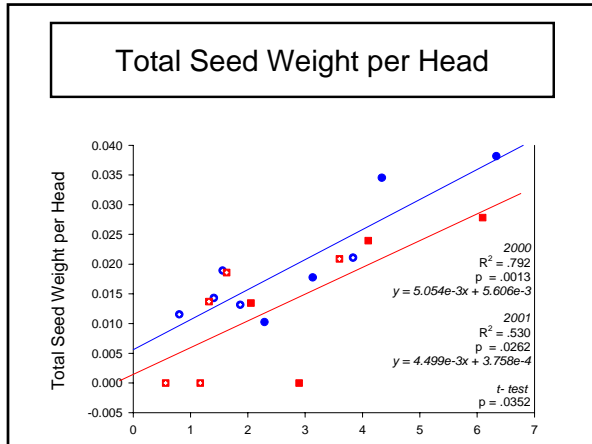
### Population Size Data

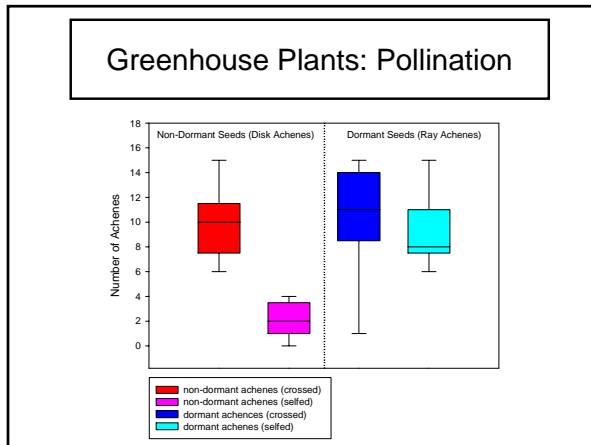
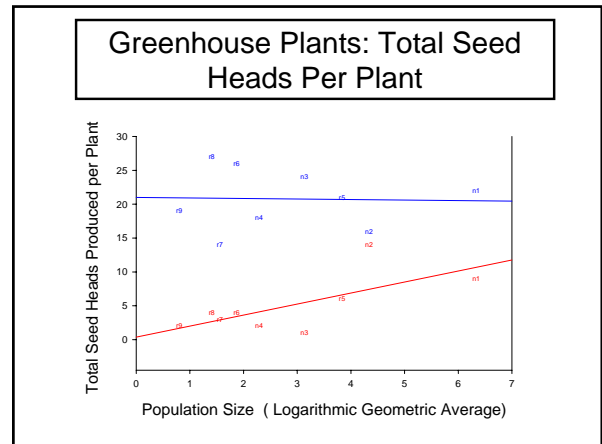
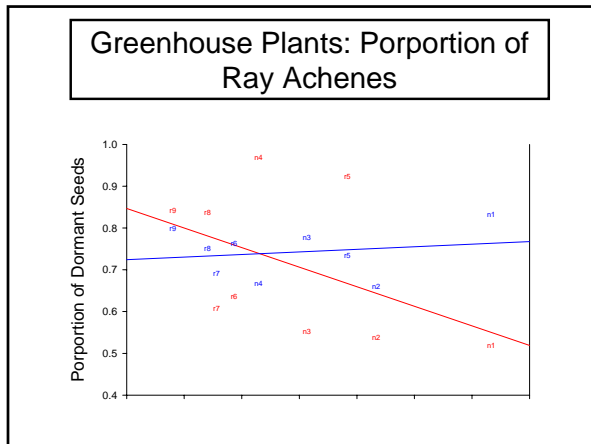
- Population data taken from the CNDDDB, population managers, other researchers, and counting plants myself.
- Plant data plotted against the geometric average of population size over the last ten years on a logarithmic scale
- Better population data would be very welcome!!!

### Disk Achenes Per Head vs. Pop. Size









- ### Data Summary
- Smaller Populations Tend to Contain:
    - fewer disk achenes (regardless of seed head size)
    - a higher **proportion** of dormant seeds (also regardless of seed head size)
    - lighter dormant seeds
    - less seed weight per head
    - plants with fewer seed heads
    - plants with shorter branches
  - Smaller Populations Do Not Tend to Contain:
    - **Fewer** Dormant Seeds
    - Lighter disk achenes
    - Less germinable disk achenes
    - Smaller plants by all measures

- ### More Data Summary
- When grown in a Common Garden Situation:
- Plants in smaller populations **DO NOT** exhibit any traits that distinguish them from larger populations
  - Cross-pollinated plants produce more disk achenes than selfed plants but not more ray achenes

- ### Possible Mechanisms for Relationships with Population Size
- Less pollination leads to less non-dormant seed production.
  - Stressed plants allocate more energy to dormant seeds.
  - Stressed plants in unfavorable environments are producing lighter seeds, fewer seed heads, and fewer branches

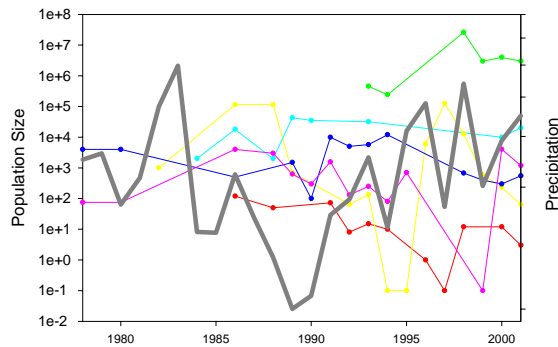
### What does it mean?

- Apparently no loss of genetic viability in smaller populations
- Tarplant Strategy:
  - In hard times, go dormant and wait for a stimulus to bring the population back.
- Bad News: Small tarplant populations decrease exponentially because they are producing mostly dormant seeds
- Good News: There should be plenty of dormant seeds (albeit small ones) should we decide to restore 'extirpated' populations

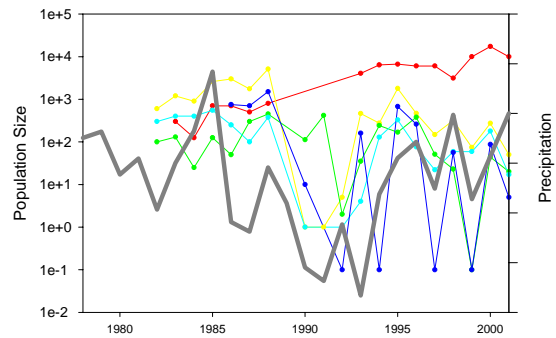
### Recommendations for Management

- Increase Quantity and Quality of Seed Output in Small Populations
- Maintain non-dormant seed production
  - Increase plant size
  - Increase pollination
- Stimulating germination of non-dormant seeds is important in rehabilitation but many seeds might be very small and more sensitive than larger seeds

Native Populations: Santa Cruz



Re-Introduced Populations: Berkeley



### Thank You's

- Grey Hayes
- Sue Bainbridge
- Val Haley
- Melanie at CDFG
- EBMUD Survey Team 2000
- Advisors back in R.I.