Analyzing the Concerns of Conspecific Attraction Using Population Projection Matrix (PPM) Models of Territorial Birds

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Conspecific Attraction: *What?*

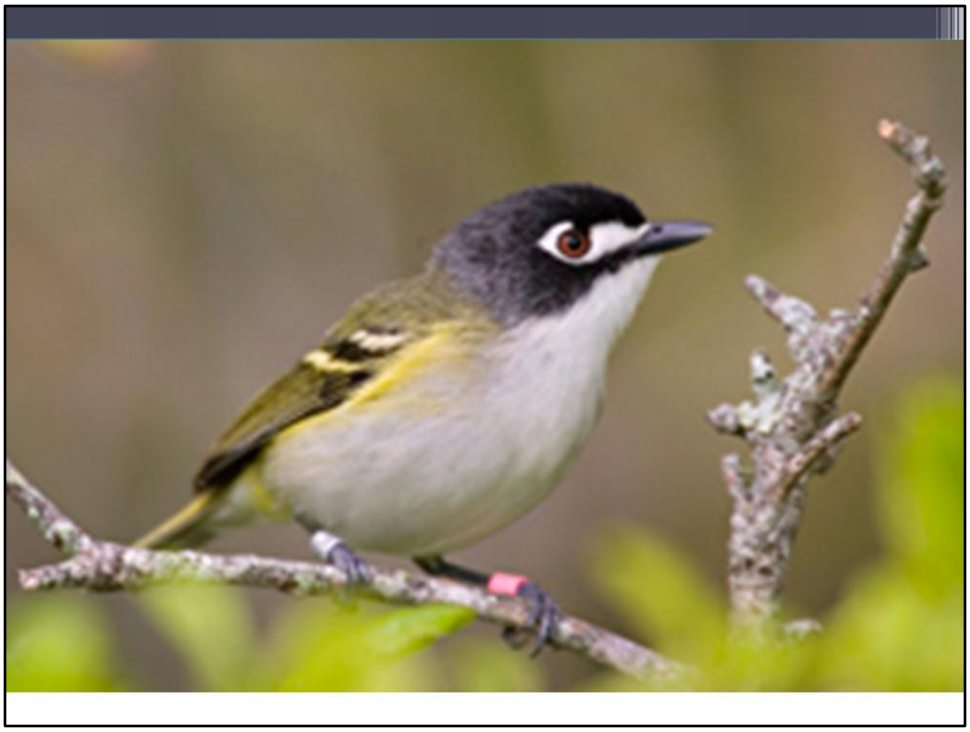
Definition: “tendency for individuals of a species to settle near one another” (Ward & Schlossberg, 2004)

For animals, conspecific attraction is used when selecting a habitat. Numerous species practice conspecific attraction, which is considered a social cue. It allows the individual to make an assumption about the quality of life of a certain area.

Conspecific Attraction: *Who?*

Fruit Fly-*Drosophila melanogaster*

In an experiment conducted by Stamps et al used statistical models to demonstrate how virgin female fruit flies use conspecific attraction to inoculate fruit with nourishments and other small organisms. By doing this, they provide the larva with food for survival.

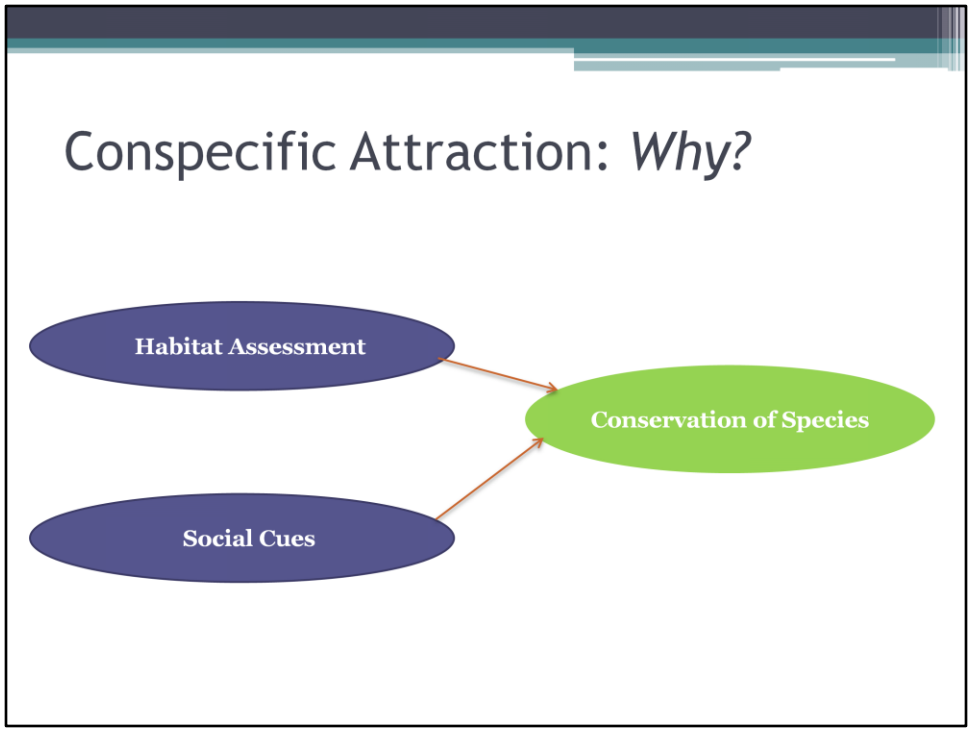


Black-Capped Vireo – *Vireo Atricapilla*

Ward and Schlossberg used artificial conspecific attraction to draw Black-Capped Vireos to new habitats. This territorial bird species is found through small regions of Texas, Oklahoma, and Mexico but have been threatened by habitat loss due to fire and parasites.

Ghost Crab-*Ocypode rotundata*

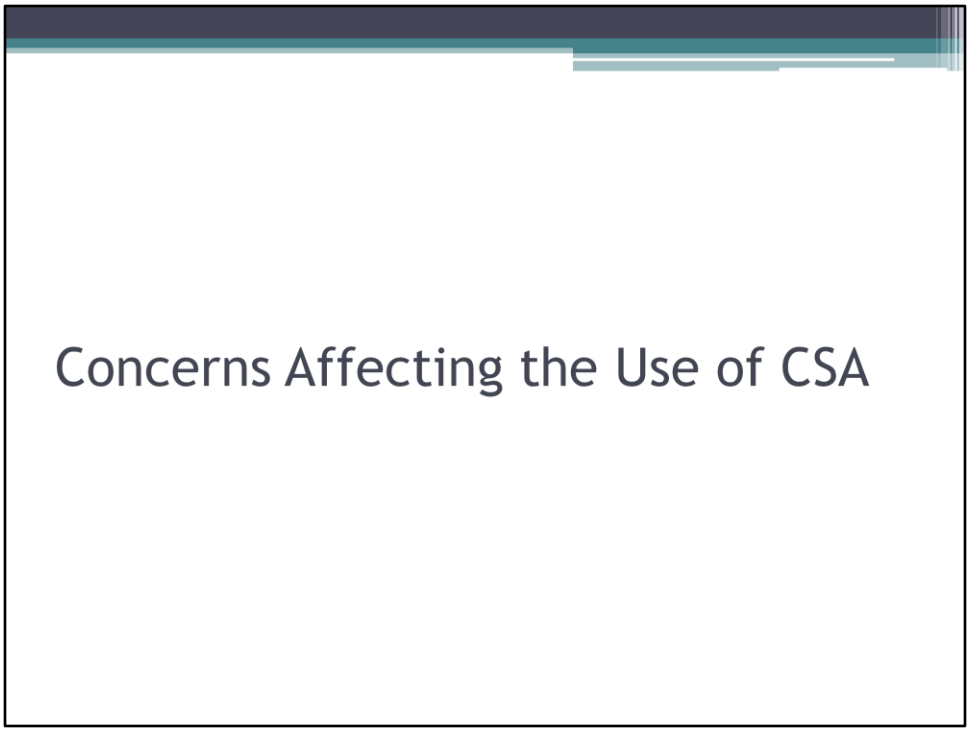
In the same study done by Stamps et al found that ghost crabs may use conspecific when working in foraging patches. They modeled this with statistics and probability.



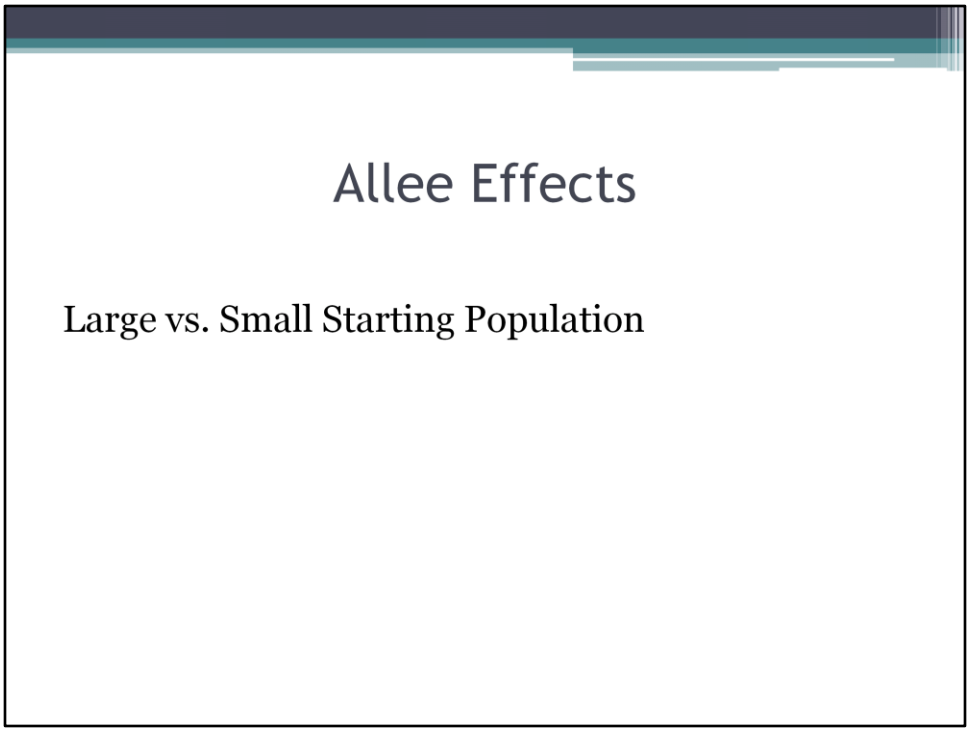
With the understanding of conspecific attraction in bird populations, specifically territorial species, ecologist can protect an endangered population. With the use of projected population matrices models, there is also the possibility of not only protecting them but also increasing populations.

CSA places emphasis on habitat management. If there is an understanding of the suitable habitat of the bird populations, then the birds can be called to beneficial areas using song playback. Density dependence effects cause the population to reach a maximum
Restored Habitats…or habitats that are not being used

Assessing the cues that cause birds to co-habitat are also important in the conservation of the species. This main clue is song playback as well as habitat quality. (In addition, the proliferation of offspring will also draw males to a specific site?) "If successful males are more likely to be site-faithful, dispersing males could use these site faithful males as an additional indication of habitat quality beyond structural habitat cues" (Ahlering & Faaborg). Social cue is the communication.

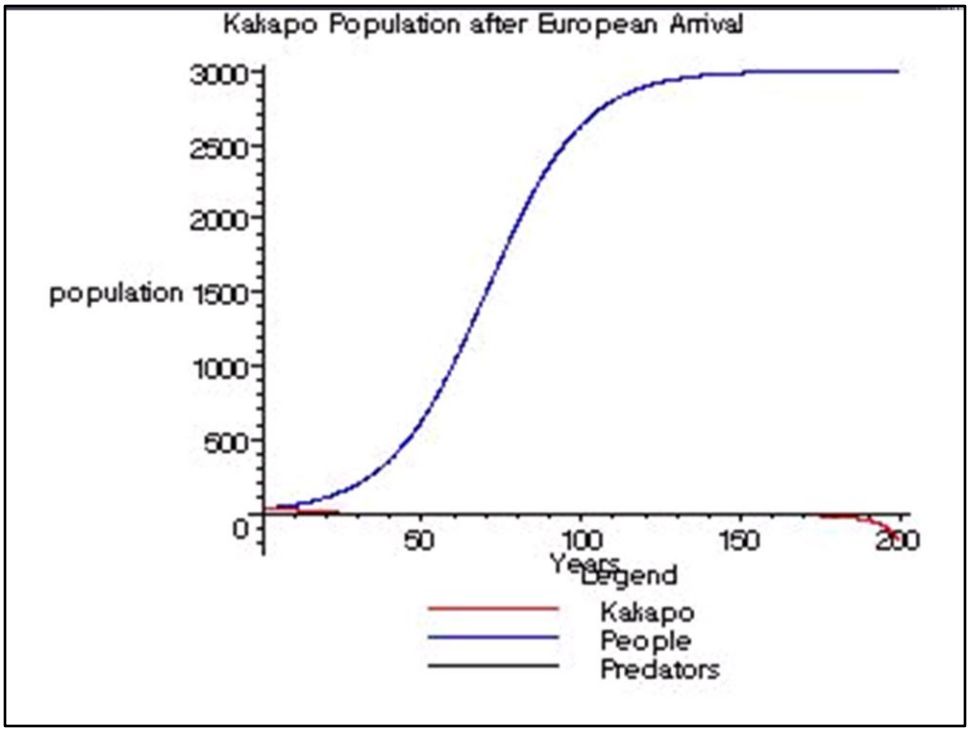


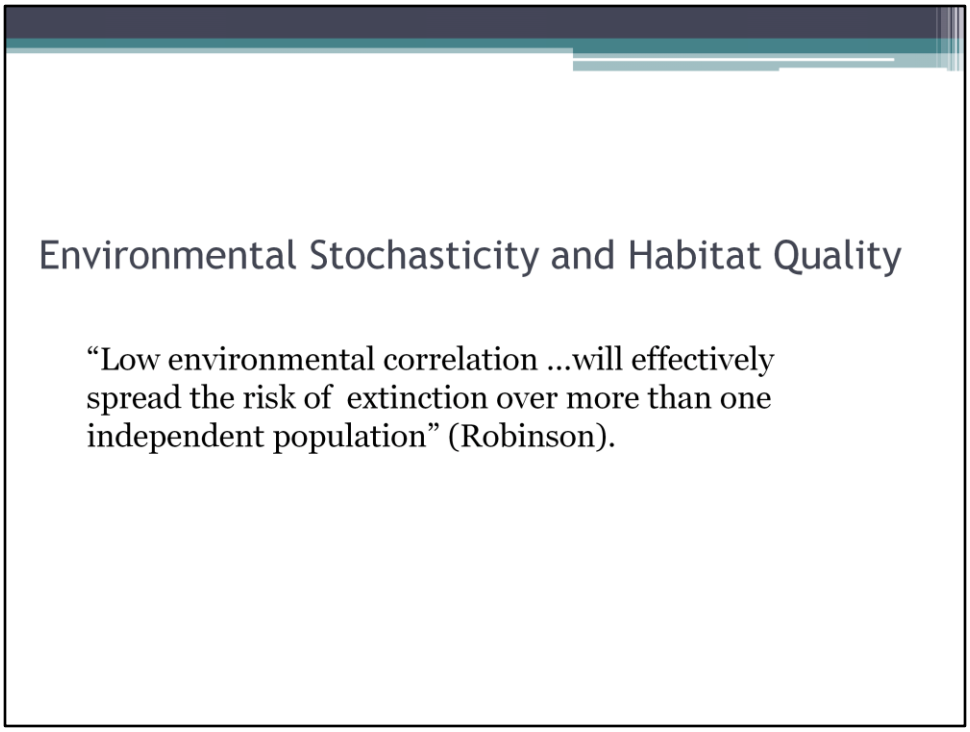
The population projection matrices will focus on the concerns that affect the success of artificial conspecific attraction and in turn the population of the birds. These variables are the Allee Effects, Environmental Stochasticity and Habitat Quality, and Philopatry.



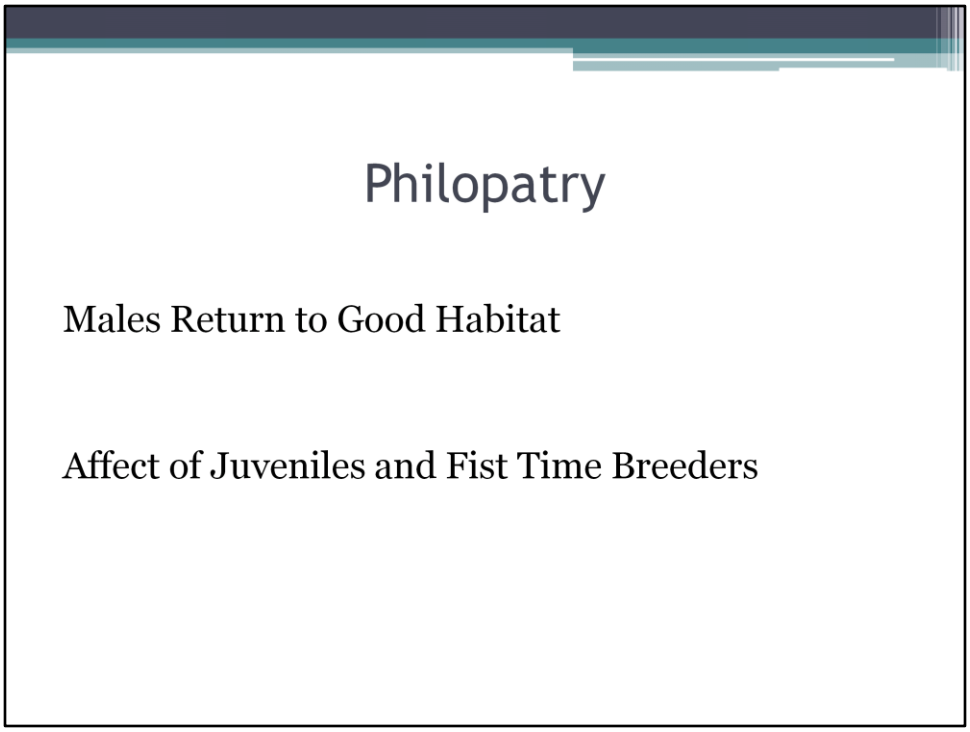
Density Dependence is a positive effect.

In order for CSA to be most effective, the starting population has to have minimum viable population (Quasi Extinction Threshold) so that areas of different populations can thrive.


Kakapo Population after European Arrival
population
3000
2500
2000
1500
1000
500
0
50
100
150
200
Years
Legend
Kakapo
People
Predators



The lower the enviromental stochasticity and higher the Habitat Quality, the more chances the population has to survive and the more stable the population. When there is less ES, then the population probability has less variation and is more predictable.



The successful males drawn to an area will return if mating was successful. In addition, juveniles and first time breeders will be drawn to new location. How this will affect the artificial removal of the juvenile and 1st breeders to the population.

What would happen if juveniles and first time breeders are taken from the source population?

PPM Model Breakdown

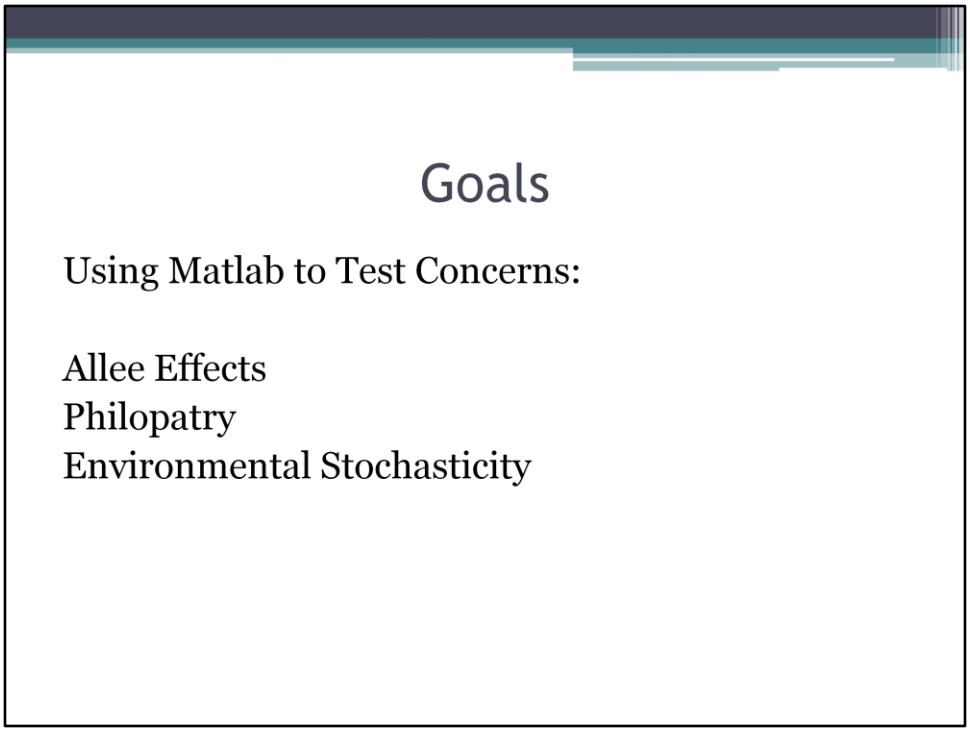
Transition Matrix | **Population Vector** | **Projected Population Vector**

$$\begin{array}{c} \\ 1\text{P} \\ 2\text{P} \\ 3\text{P} \end{array} \begin{array}{c} \begin{array}{ccc} 1\text{P} & 2\text{P} & 3\text{P} \end{array} \\ \begin{bmatrix} 0 & F_2 & F_3 \\ S_{1-2} & 0 & 0 \\ 0 & S_{2-3} & S_{3-3} \end{bmatrix} \end{array} \times \begin{bmatrix} N_{1t} \\ N_{2t} \\ N_{3t} \end{bmatrix} = \begin{bmatrix} M_{1t} \\ M_{2t} \\ M_{3t} \end{bmatrix}$$

P – phase (3 phase breakdown)
F – Fecundity (offspring)
S – Surviving Offspring

This is the breakdown of the elements used in the matrices to determine the PPM model. The probability matrix uses. beta probability distribution. The 2nd vector is the population vector, and the 3rd the projected population vector. The elements of the column are P1, P2, and P3. In the case of birds, P1, P2, and P3 are egg, juvenile, adult respectively.

Fecundity and Survival collectivity are called vital rates.



Allee –vary initial population

Philopatry – percentage of juveniles and first time breeders taken from population and then the projected population from each year

ES –changing the variance (deviation) of the vital rates (fecundity and surival elements of transition matrix)

Works Cited

Literature

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Photos

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Thank You