

When the Use of Artificial Conspecific Attraction Methods Are Counter-Indicated

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Mentors

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Species Are Going Extinct

“Species are going extinct at a rate 100 to 1000 times higher than pre-human extinction levels”(Pimm, 1995)

Conservation Efforts

Extinction in History

Extinction has occurred across continents, for species that habitat in land or water. Much of the history focuses on endemic species, or those that specifically inhabit an area. There is also random extinction that has a lot to do with the fact that a large portion of the population inhabited one area.

Conservation Efforts

This is when the model being shown in this presentation can be used. In the case of random extinction, the population dies because they live in one specific area. However, if the population were able to disperse and/or individuals of another population were able to be drawn to another area, then the possibility of extinction would decrease.

Effect of Future

The effect on the future is that species will continue to be threatened if proper conservation methods are not used.

Conspecific Attraction

What

Who

Why

WHAT

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.

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.

WHY

With the understanding of conspecific attraction in bird populations, specifically territorial species, ecologists 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.

Concerns Affecting the Use of CSA

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.

Concerns	Implementation into Model
Allee Effects	Varying the size of the starting population.
Environmental Stochasticity and Habitat Quality	Altering the variance of the vital rates.
Philopatry	Removing a percentage of juveniles from a stable population into a failing population.

Allee Effects

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.

Environmental Stochasticity and Habitat Quality

The lower the environmental 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.

“Low environmental correlation ...will effectively spread the risk of extinction over more than one independent population” (Robinson).

Philopatry

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.

Recipient Population

$$\begin{array}{c}
 \text{Transition Matrix} \\
 \begin{array}{ccc}
 & 1 & 2 & 3 \\
 \begin{array}{c} 1 \\ 2 \\ 3 \end{array} & \begin{bmatrix} 0 & F_2 & F_3 \\ S_{12} & 0 & 0 \\ 0 & S_{23} & S_{33} \end{bmatrix}
 \end{array}
 \times
 \begin{array}{c}
 \text{Population Vector} \\
 \begin{bmatrix} N_{1t} \\ N_{2t} \\ N_{3t} \end{bmatrix}
 \end{array}
 =
 \begin{array}{c}
 \text{Projected Population Vector} \\
 \begin{bmatrix} M_{1t} \\ M_{2t} \\ M_{3t} \end{bmatrix}
 \end{array}
 \end{array}$$

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 collectively are called vital rates.

Recipient Population

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


 Allee Effect

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.

Recipient Population

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

Philopatry

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.

Recipient Population

	Transition Matrix				Population Vector		Projected Population Vector
	1P	2P	3P				
1P	0	F_2	F_3	$\times$ $\begin{bmatrix} N_{1t} \\ N_{2t} \\ N_{3t} \end{bmatrix}$	$=$ $\begin{bmatrix} M_{1t} \\ M_{2t} \\ M_{3t} \end{bmatrix}$		
2P	S_{1-2}	0	0				
3P	0	S_{2-3}	S_{3-3}				



 ES and HQ

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.

Recipient Population

$$\begin{array}{c}
 \text{Transition Matrix} \\
 \begin{array}{c} 1P \quad 2P \quad 3P \\
 \begin{bmatrix} 0 & F_2 & F_3 \\
 S_{1-2} & 0 & 0 \\
 0 & S_{2-3} & S_{3-3} \end{bmatrix} \end{array}
 \end{array}
 \times
 \begin{array}{c}
 \text{Population Vector} \\
 \begin{bmatrix} N_{1t} \\
 N_{2t} \\
 N_{3t} \end{bmatrix}
 \end{array}
 =
 \begin{array}{c}
 \text{Projected Population Vector} \\
 \begin{bmatrix} M_{1t} \\
 M_{2t} \\
 M_{3t} \end{bmatrix}
 \end{array}$$

ES and HQ (red arrow pointing to S_{1-2})
 Philopatry (blue arrow pointing to N_{2t})
 Allee Effect (green arrow pointing to N_{3t})

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.

Donor Population

$$\begin{array}{c}
 \text{Transition Matrix} \\
 \begin{array}{ccc}
 & 1 & 2 & 3 \\
 \begin{array}{c} 1 \\ 2 \\ 3 \end{array} & \begin{bmatrix} 0 & F_{2D} & F_{3D} \\ S_{12D} & 0 & 0 \\ 0 & S_{23D} & S_{33D} \end{bmatrix}
 \end{array}
 \times
 \begin{array}{c}
 \text{Population Vector} \\
 \begin{bmatrix} A_{1t} \\ pA_{2t} \\ A_{3t} \end{bmatrix}
 \end{array}
 =
 \begin{array}{c}
 \text{Projected Population Vector} \\
 \begin{bmatrix} B_{1t} \\ B_{2t} \\ B_{3t} \end{bmatrix}
 \end{array}
 \end{array}$$

Philopatry

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.

Donor Population

$$\begin{array}{c}
 \text{Transition Matrix} \\
 \begin{array}{c}
 1P \quad 2P \quad 3P \\
 1P \begin{bmatrix} 0 & F_2 & F_3 \\ 2P \begin{bmatrix} S_{1-2} & 0 & 0 \\ 3P \begin{bmatrix} 0 & S_{2-3} & S_{3-3} \end{bmatrix}
 \end{array}
 \end{array}
 \times
 \begin{array}{c}
 \text{Population Vector} \\
 \begin{array}{c}
 \text{Philopatry} \\
 \begin{bmatrix} N_{1t} \\ N_{2t} + (A_{2t} - pA_{2t}) \\ N_{3t} \end{bmatrix}
 \end{array}
 \end{array}
 =
 \begin{array}{c}
 \text{Projected Population Vector} \\
 \begin{bmatrix} O_{1t} \\ O_{2t} \\ O_{3t} \end{bmatrix}
 \end{array}
 \end{array}$$

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.

Growth Rate

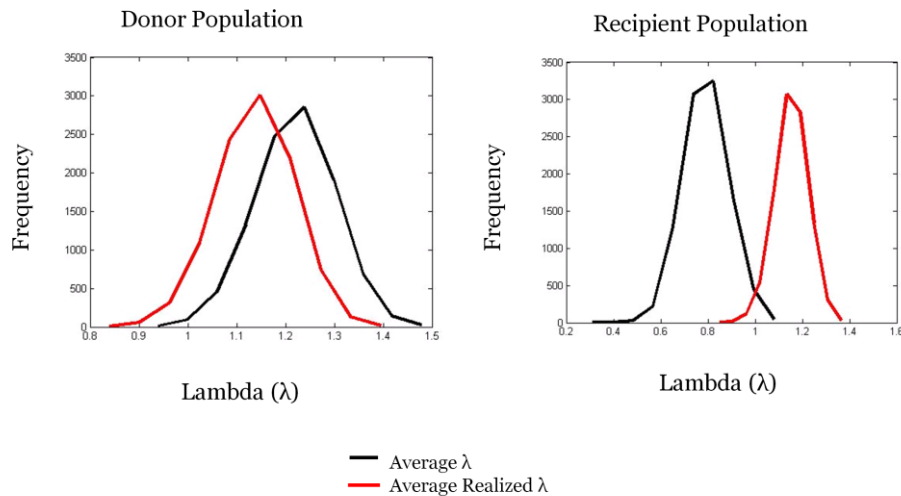
Dominant Right Eigenvalue (λ)

λ vs realized λ

Analyze Population over Time

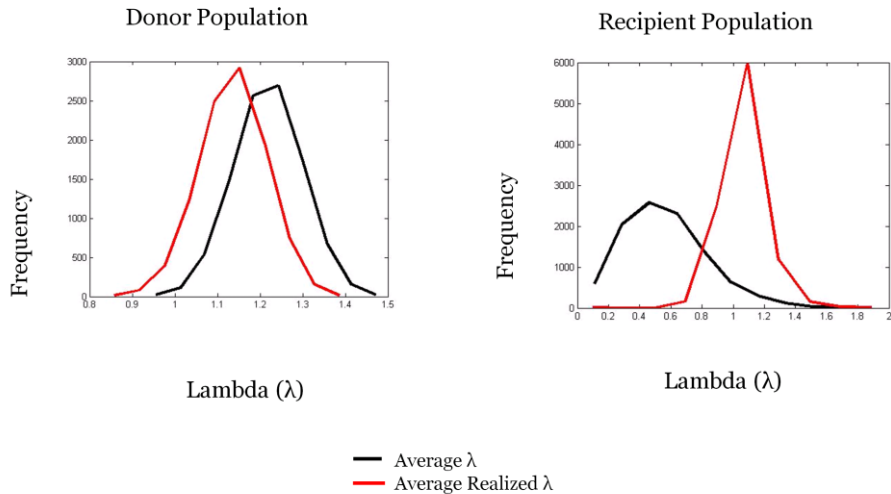
The growth rate is the dominant right eigenvalue. If over or around 1, this means that the population is growing. If under 1, this means that the population can be slowly or rapidly declining depending on the value. This value is represented by the lowercase greek letter lambda.

Failing Population-No Factors Affected

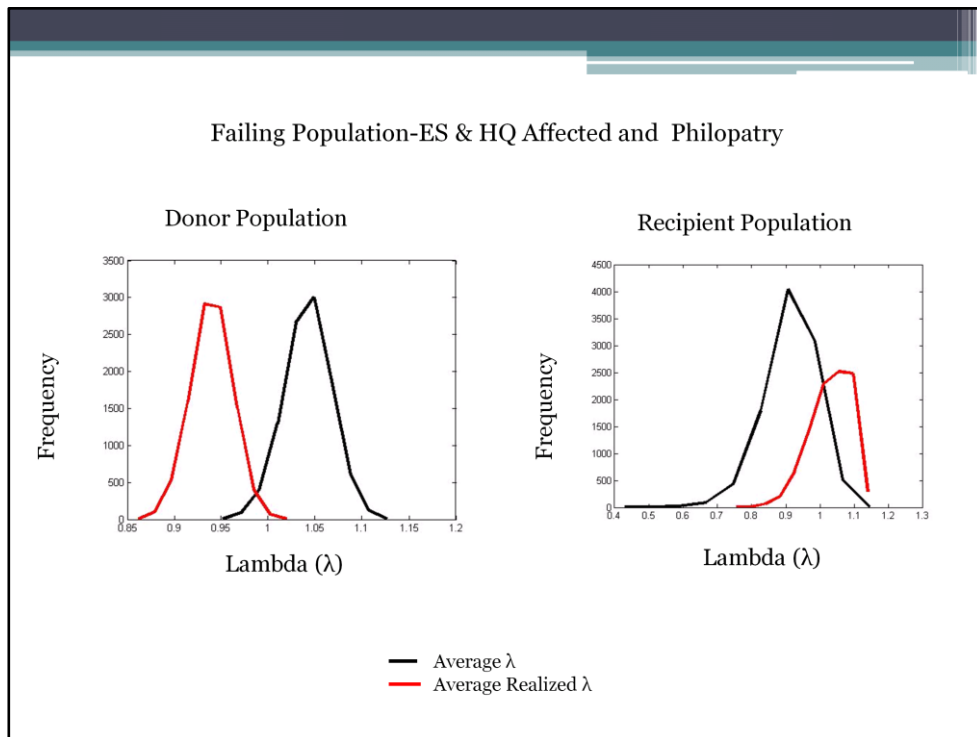


The donor population has an average lambda above 1. When a percentage of juvenile individuals of its population are removed, the average realized lambda is slightly lower than the average lambda, but it is still over one. The recipient population has an average lambda below 1, thus the population is failing. However, after receiving juveniles from the donor population, the population begins to grow because average realized lambda is above 1.

Failing Population-ES & HQ and Allee Effect Affected



The donor population has lambdas similar to those in Figure 8. In the case of the recipient population, it was failing and would quickly reach quasi extinction, but the addition of some juveniles created a new growth rate above 1.



This shows the growth rate of the recipient population increasing in a fashion similar to the other two implementations. This time, however, the donor population has actually failed. Its growth rate went from a value above 1 before individuals were removed to an average realized lambda of ~ 0.95 .

Discussion

Artificial Conspecific Attraction

shields population from affects of ES and HQ

importance of multiple populations

viable starting and receiving populations

Moreover, when ecologists and wildlife managers use artificial conspecific attraction, they are protecting the species from environmental factors that lead to the extinction of the species. The model used can also aid those in the field to use better discernment when considering conspecific attraction as a conservation method of a species.

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