Term Project: Conservation of Patrick's Marsh Wren

Introduction

Patrick's marsh wren (*Cistothorus palustris dawsonii*) is endemic to the southeastern Central Valley in California, where it is found in only a few small populations. *Cistothorus palustris dawsonii* is an isolated population of the common marsh wren (*Cistothorus palustris*). Although it is isolated, it is generally not considered to be a distinct species. Patrick's marsh wren occurs in a very limited geographic area and within a narrow habitat range. This bird usually nests in wetland reeds and grasses. It feeds on insects that accumulate around standing water, and depends on the water to protect against nest predation by coyotes and raccoons. Patrick's marsh wren migrates to Baja California during the winter, but returns to the Central Valley each spring to breed and raise young. Patrick's marsh wren has very high site fidelity: individuals tend to return to the same nesting sites year after year. When individuals mature they are not known to disperse more than 100 kilometers to new breeding grounds.

Green Valley Ranch, Inc., a major beef producer, owns much of the land surrounding the habitat of Patrick's marsh wren. The company has recently increased the size of its herds and now needs more pasture to allow them to graze. The ranch's property runs along the Rio Niebla, a major watershed of the Sierra Nevadas. There are several dams upstream from Yokestown, and flood-control dikes and levies contain much of the river in the Central Valley. One of the few lengths of the river that is still untouched is on the *Green Valley Ranch* and surrounding cattle ranches. Because intense seasonal flooding produces a semi-permanent wetland, the land along this stretch of river is not suitable for grazing. To begin using this land, *Green Valley Ranch* wants to erect a dike along the river to prevent seasonal flooding. The area they wish to reclaim is one of the few remaining habitats of the Patrick's marsh wren. If the dike is built, it will cut directly through one of the four remaining wetland habitats (Phillip Flat).

The map in **Figure 1** shows the four sub-population sites for Patrick's marsh wren: 1) Three-Mile Marsh; 2) Phillip Flat; 3) Castleton Creek; and 4) Delinger Meadow. If the new dike is built, Phillip Flat will be eliminated. The state asked the *California Fish and Game Department* to conduct an environmental impact study of the area. Wildlife biologists collected critical data on the current state of the four subpopulations of Patrick's Marsh Wren. This data includes estimated population sizes, carrying capacities, population growth rates, and dispersal rates/ability. The data collected by the *California Fish and Game Department* is summarized in **Table 1**.

Table 1: **Demographic information collected on the four subpopulations of Patrick's marsh wren**

<table>
<tr><td>Estimated Population Sizes</td><td>The four known populations of Patrick's marsh wren have been sampled, and the following abundances were estimated:

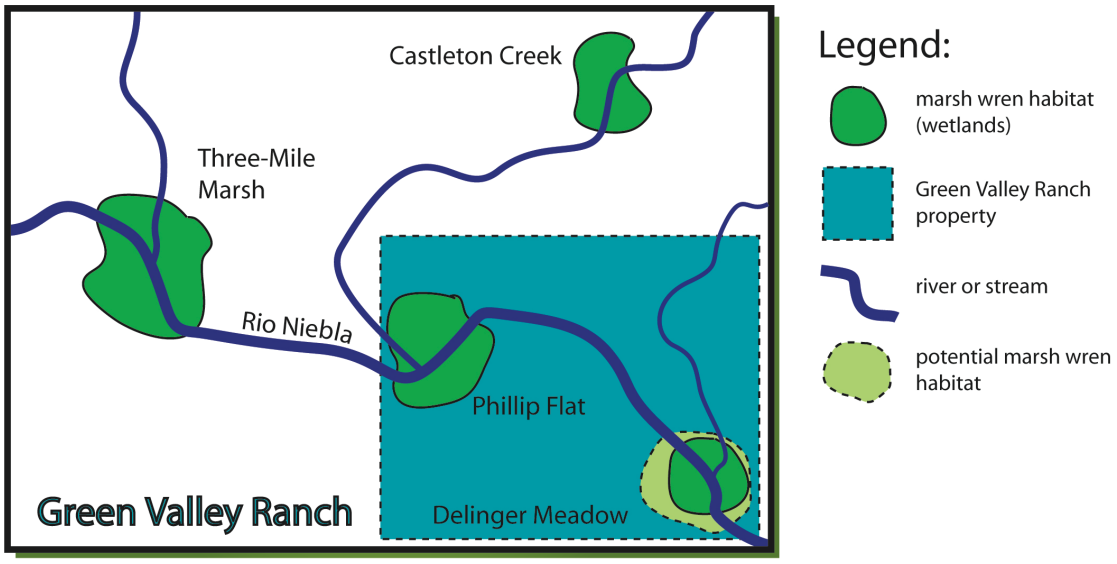
Location — Abundance
Three-Mile Marsh — 125
Phillip Flat — 95
Castleton Creek — 100
Delinger Meadow — 80

Note: these population sizes were estimated using a mark-recapture protocol that is known to measure population size with some margin of error.</td></tr>
<tr><td>Estimated Carrying Capacities</td><td>Based on the abundances estimated above and a crude understanding of marsh wren breeding territory sizes, wildlife biologists were able to estimate the carrying capacity at each location as follows:

Location — Carrying Capacity
Three-Mile Marsh — 150
Phillip Flat — 105
Castleton Creek — 120
Delinger Meadow — 100

Note: because we used the current abundances to determine the carrying capacities, these numbers may be over- or under-estimates of actual carrying capacity.</td></tr>
<tr><td>Estimated Growth Rates</td><td>Measured population growth rates for Patrick's marsh wren ranged from 1.02 to 1.08 with standard errors of 0.2 to 0.4. We assume that the intermediate growth rate of 1.05 is close to an average, but there is little support for this assumption. Survival rates have been estimated at approximately 0.7 for other populations of marsh wren, but the California Fish and Game biologists did not directly estimate survival.</td></tr>
<tr><td>Estimated Dispersal Distance/ Ability & Correlation of Environments</td><td>Although able fliers, juvenile Patrick's marsh wrens seems to disperse only to very nearby breeding grounds. Most adults breed in or near their birthplace, but a few disperse to nearby populations. The farthest any known individual has dispersed is 100 kilometers, but this is based on very few observations so in reality the maximum distance may be greater. The average dispersal distance (50 kilometers) and maximum dispersal rate (0.5 emigrants per individual per year) were estimated based on information from other similar species. Studies of temperature and rainfall trends suggest an environmental correlation of 0.1.</td></tr>
</table>

Figure 1: **Map of *Green Valley Ranch* and surrounding area**



When local environmental groups heard about the proposal, they joined forces to prevent *Green Valley Ranch* from redirecting any water. Environmentalists argue that the populations of Patrick's marsh wren are small and isolated and if any habitat that supports the species is destroyed all of the populations could potentially collapse. They argue that the land in question, Phillip Flat, is integral to the stability of the three other populations in the area. Although the environmental impact study conducted by the *California Fish and Game Department* was inconclusive, it did indicate that Phillip Flat might be a degrading habitat and thus a sink for the population.

In return for permission to build the proposed dike, *Green Valley Ranch* has offered to remove an old and disintegrating dike in the southern part of its property. Removing the dike would increase the wetland area available for the small population of Patrick's marsh wren in Delinger Meadow. The best possible result of this action would be an increase in the carrying capacity of Delinger Meadow. Assume that the worst possible result would be that the carrying capacity of Delinger Meadow does not increase at all. Furthermore, if Phillip Flat is destroyed, an attempt will be made to translocate individual birds from Phillip Flat to Delinger Meadow. However, it is difficult to predict whether this will be possible or successful.

Model Information

You will use the EcoLab *Multiple Populations* program to simulate the population growth of Patrick's marsh wren over the next fifty years. All of the average parameter values listed in **Table 1**, along with information on the

location of each habitat and competitive interactions of the wren, have been incorporated into the file *Wrenpop4.mp*, which can be downloaded from Blackboard. This represents the "original scenario" assuming that that Phillip Flat is *not* degrading. In order to represent the other possible scenarios, you will need to change the attributes of the *Wrenpop4.mp* file as shown in **Table 2**. For models B and C, make sure that you destroy (delete this habitat under the *Populations* option in EcoLab) Phillip Flat, not just set its initial abundance and/or carrying capacity to zero.

Table 2: **Models of potential scenarios for Patrick's marsh wren**

Name	Type	Attributes
A (0)	Unaltered habitat	Original model in which Phillip Flat is assumed to maintain a constant carrying capacity. Total initial population size (N_0) = 400 individuals.
A (-1)	Unaltered degrading habitat	Original model in which Phillip Flat is assumed to be mildly degrading. Carrying capacity is reduced by 1 individual per year. Total initial population size (N_0) = 400 individuals.
A (-2)	Unaltered degrading habitat	Original model in which Phillip Flat is assumed to be severely degrading. Carrying capacity is reduced by 2 individuals per year. Total initial population size (N_0) = 400 individuals.
B	Altered habitat, no remediation	Proposed model in which Phillip Flat is destroyed. Total initial population size (N_0) = 305 individuals.
C	Altered habitat, remediation performed	Proposed model in which Phillip Flat is destroyed after half of its population (47 individuals) is translocated to Delinger Meadow. The carrying capacity of Delinger Meadow increases from 100 to 157 due to removal of the aging dike. This model represents the best case scenario, which is by no means guaranteed. Total initial population size (N_0) = 352 individuals.

Assignment

Your assignment is to choose a position and defend it by applying analytical techniques from the previous chapters (particularly those from metapopulation dynamics) to the given scenario. The three possible positions are listed in **Table 3**. The best way to approach the project is to let the data lead you:

rather than choosing a position based on your intuition or convictions, perform as many simulations as you can and weigh the pro's and con's of each position.

Table 3: **Potential positions to advocate in regards to Patrick's marsh wren conservation.**

Position	Description
Environmentalist	You are an environmentalist, in which case you are against building the dike through Phillip Flat. Thus, under no circumstance do you want the habitat to be destroyed. Find data to support your case and refute the other two sides.
Green Valley Ranch	You represent *Green Valley Ranch*. Although you are an environmentally responsible company, you would like to build the dike through Phillip Flat. In exchange, you are willing to remove the aging dike surrounding Delinger Meadow and translocate wrens from Phillip Flat to Delinger Meadow. You argue that Phillip Flat is not crucial to the persistence of the metapopulation. Find data to support your case and refute the other two sides.
Arbitrator	You wish to reach a fair solution for both parties, but you feel that current data are inconclusive. You have identified areas where existing uncertainty makes it impossible to support either the Environmentalists or the Ranch. You suggest one or more areas where further study is required before a decision can be made. Find data to support your case and refute the other two sides.

Requirements for All Projects

1. The paper must be typed and submitted electronically.
2. The paper must be double-spaced and in 12 point font. Page limits will be strictly enforced.
3. The written portion of the paper should be 3-5 pages:
    - Keep the writing concise, directed, and to the point.
    - Figures, tables, graphs, and other data do not count towards the 3-5 page requirement, and should be included as an *Appendix* to the text.
    - The text should reference all sections of the *Appendix*. Do not assume that any evidence presented is "self-evident".

4. Simulations:
    - At minimum, you must perform simulations for each of the five scenarios (A(0), A(-1), A(-2), B, & C). Output relevant summary information for each of these simulations but avoid presenting extraneous details – be selective in what you present.
    - To augment your argument, you must run additional simulations, including sensitivity analysis on at least one parameter. Use EcoLab to explore and don't be afraid to go beyond the minimum requirements.
5. Results Summaries:
    - Extinction risks for each scenario of the project ***must*** be included and contrasted.
    - Additional output to support your arguments should be included.
    - Each figure and table should be given a number, title, and (if necessary) a legend. Use the number in referring to these in the text: "As Figure 1 shows…".
    - Avoid presenting data directly outputted from EcoLab. Tables and graphs which effectively summarize your data in a manner that supports your position are always preferred to endless lists of simulation data. Try to synthesize relevant data down to its most simple form.

Organization and Structure of the Paper

1. **Introduction:** This section should explain the purpose and scope of the project. Additionally, it should include a brief summary of the natural history of the species in question. State clearly the position you plan to advocate. In the concluding paragraph of this section, you ***must*** clearly state predictions or hypotheses in support of your position.
2. **Results of your simulations:** Discuss in detail your discoveries, inferences, and conclusions for all five models. Based on this data, advocate and defend your chosen position. Use your results to cast doubt upon competing positions.
3. **Conclusion:** Summarize the various simulations you performed and relate these results to your chosen position.
4. **Appendix:** This section should contain all your figures, graphs, and tables, each with a descriptive label and title. Pages in your *Appendix* do not count towards the 5 page limit.

Grading of the Project

Your term paper will be graded based on a scoring rubric. This scoring rubric is available to you on Blackboard. You are encouraged to look over the criteria on which you will be graded in order to assure that your paper is complete.

This project is worth 30% of your grade and is due on July 2nd!