**The Evergreen State College**

**Graduate Program on the Environment**

### Thesis Prospectus

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**STUDENT AGREEMENT:**

**SIGNATURE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**FACULTY READER APPROVAL:**

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**MES DIRECTOR APPROVAL:**

**SIGNATURE:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. Provide the working title of your thesis[[1]](#endnote-1).

**Song discrimination between two subspecies of vesper sparrow: *Pooecetes gramineus affinis* and *Pooecetes gramineus confinis***

1. In 250 words or less, summarize the key background information needed to understand your research problem and question.

Vesper sparrows (*Pooecetes gramineus*) are grayish-brown songbirds of the family *Passerellidae*, found in open spaces such as prairies, meadows and sagebrush steppe (Jones & Cornely, 2002). Like other *Passerellidae*, male vesper sparrows sing throughout the breeding season to attract mates, as well as delineate and defend territories. There are four subspecies of vesper sparrow distributed across North America, two of which occur in Washington State (Jones & Cornely, 2002; Pyle, 1997). West of the Cascade mountains, the Oregon vesper sparrow (*Pooecetes gramineus affinis*) occurs on remnant prairie-oak habitat in the Puget Lowlands (Altman, 2017; King, 1968a). East of the Cascades, the Western vesper sparrow (*Pooecetes gramineus confinis*) occurs on sagebrush habitat in the Columbia Basin (King, 1968b).

The mountains along the Pacific Crest of North America act as a boundary between numerous endemic coastal bird species and those of the interior West (Behle, 1978). The degree to which this boundary affects speciation among vesper sparrows is unknown as wintering ranges for *P. g. affinis* and *P. g. confinis* overlap in Southern California (Altman, 2017; Erickson, 2008). For many birds, geographic isolation of breeding grounds can result in not only allopatric speciation, but also differences in culturally transmitted songs. Observing differences in male territorial response between songs of separate subspecies may indicate to what degree populations or subspecies may have diverged genetically. There has never been a genetic analysis of *P. g. affinis*, and Jones and Cornely (2002) describe the subspecies designations of the vesper sparrow as “weakly defined to moderately distinct.”

1. State your research question.

Do territorial males of two vesper sparrow (*Pooecetes gramineus*) subspecies discriminate between one another’s songs?

1. Situate your research problem within the relevant literature. What is the theoretical and/or practical framework of your research problem?

The theoretical framework for my research problem involves the evolution and function of birdsong. Nearly all birds possess syrinxes, noise producing organs believed to have developed in an extinct common ancestor. These organs serve no apparent purpose besides the production of noise signals and are therefore believed to facilitate biological necessities. The main functions of birdsong are for sexual selection, and for the defense and sorting of territorial boundaries (Collins, 2004). Differences in certain aspects of a bird’s song can be associated with differences in body mass, and likely other measures of sexual fitness (Mason et al., 2017). The time of the year when birds sing is concurrent with the breeding season, when birds are selecting mates, as well as partitioning resources within their habitat. This association has led to acceptance of birdsong as the means to which avifauna select mates and delineate breeding territories (Collins, 2004).

It is widely understood that most bird species within the oscines learn their songs from conspecifics (Slater, 1986), and may even have an innate preference for learning songs of their own subspecies (Nelson, 2000). These culturally transmitted songs can change over time due to indirect copying by juveniles (Podos & Warren, 2007; Slater, 1986), but also as a response to structural and temporal differences in the bird’s environment (Karin, Cicero, Koo, & Bowie, 2018; Slabbekoorn & Smith, 2002; Wilkins, Seddon, & Safran, 2013). Consequently, subspecies of a bird geographically isolated in different ecotypes over an extended period would develop distinct differences in song traits. While differences in culturally transmitted behavior cannot necessarily be equated to genetic differences, the former does seem to be a reliable indicator of the latter (Mason et al., 2017). The songs of vesper sparrows are highly variable and individualistic (Kroodsma, 1972; Ritchison, 1981), and therefore are difficult to discriminate by ear. It would be expected however, that the birds themselves, cuing into aspects of the signals not immediately apparent to humans (frequencies, song length), would be able to discriminate between the song of a closely related competitor and a more benign foreign individual (Mason et al., 2017).

A large body of research on the role of song in the evolutionary divergence of passerines includes numerous studies employing playback experiments as the primary methodology. Male territorial responses have been tested for differences in subspecies (Liu, Lohr, Olsen, & Greenburg, 2008; Matessi, Dabelsteen, & Pilastro, 2001; Petrinovich & Patterson, 1981), regional dialects (Nelson, 1998; Petrinovich & Patterson, 1981), and local versus non-local birds (Searcy, Nowicki, & Hughes, 1997). In most of these studies, results suggest that birds can discriminate between songs of their own and those of foreign individuals.

The practical framework being utilized for this study includes identification of problems common to playback experiments in the field of avian bioacoustics, as outlined in *Design of Playback Experiments: The Thornbridge Hall NATO ARW Consensus* (McGregor et al., 1992). This document overviews best practice study designs that avoid the issue of pseudoreplication. More importantly, the document provides a list of common features that authors should consider adopting in respect to stimuli, temporal factors, subjects, equipment, and protocol (McGregor et al., 1992). Several studies utilizing playback experiments are also informing the methodology of this experiment, with the overall methodological approach adjusted for the particular species and habitat (Akçay, Swift, Reed, & Dickinson, 2013; Liu et al., 2008; Matessi et al., 2001).

1. Explain the significance of this research problem. Why is this research important? What are the potential contributions of your work? How might your work advance scholarship?

In recent years, *P. g. affinis* have become increasingly rare in the Pacific Northwest, with current estimates at 150-200 individuals left in Washington State (Altman, 2017). This subspecies currently holds state protected status throughout its entire breeding and wintering ranges, and the U.S. Fish and Wildlife Service has been petitioned to list *P. g. affinis* under the Endangered Species Act (ABC, 2016). Limited published literature is available on this subspecies, so there is a need for additional research to inform conservation efforts. Altman (2017) and Roger (2000) both emphasized the need for research on the taxonomic statuses of *P. g. affinis* and *P. g. confinis*.This proposed research hopes to address the degree of subspeciation between *P. g. affinis* and *P. g. confinis* through measurement of territorial responses to song playbacks. If there is found to be significant discrimination between songs of different subspecies, it could be used as evidence supporting the current subspecies designation. This might add further encouragement for U.S. Fish and Wildlife Service to take decisive action regarding the listing of *P. g. affinis* under the Endangered Species Act.

Researching territorial responses to song playbacks would expand the current knowledge specific to vocalization, behavior, and systematics of vesper sparrows. There are few accounts on the life history of *P. g. affinis*, and that is why this playback study hopes to describe new information about this subspecies and highlight behavioral differences with *P. g. confinis*. Cataloguing multiple vocal recordings of *P. g. affinis* will serve as a record of the Puget Lowlands population if their numbers continue to decline. Few recordings of *P. g. affinis* are currently available from online databases. The song recordings made for this study will eventually be shared publicly on the internet via institutions such as the Macaulay Library, xeno-canto.org, and will also be shared with researchers from Klamath Bird Observatory working on a spectrographic analysis comparing the two subspecies.

While *P. g. affinis* has been petitioned for listing, there are many other species being reviewed by U.S. Fish and Wildlife Service, and the listing of new species has become increasingly scrutinized and controversial in recent decades (Wilde, 2014). Across North America scientists are alarmed by current losses in biodiversity, with avifauna experiencing population declines over the last several decades. North America has seen the loss of nearly 3 billion birds, with sparrows and grassland species experiencing some of the greatest loss in numbers (Rosenberg et al., 2019). This project will hopefully bring attention to a lesser known local bird species that has seen its historical range greatly diminished (Altman, 2011, 2017). Increased public awareness of *P. g. affinis* could result in greater state and federal protections as well as funding availability for conservation efforts.

1. Summarize your study design[[2]](#endnote-2). If applicable, identify the key variables in your study. What is their relationship to each other? For example, which variables are you considering as independent (explanatory) and dependent (response)?

For this study, subjects (individual vesper sparrows) will be exposed to two treatments: a playback of songs from *P. g. affinis*, and playback of songs from *P. g. confinis*. In other words, subjects will hear a song from their own subspecies, and a song from a foreign subspecies. Subjects will include individuals of both subspecies, their territorial responses to each playback stimuli will be quantified, and data from the two subspecies compared (Figure 1). Subspecific playback treatments are the “explanatory” variables, while the territorial responses being measured are “response” variables, and the “unit of analysis” is an individual vesper sparrow. Subjects from each subspecies will be sampled for treatment across several sites within their respective breeding ranges in Washington State. A minimum sample size of 20 playback trials for each subspecies is the goal for this experiment, and more trials will be attempted as time permits.

Prior to playbacks, each study site will be monitored to establish distribution and number of vesper sparrow territories. Observers will identify primary singing perches used by potential subjects, and these locations will be used for the playback experiments to maximize the likelihood of garnering a territorial response. Both playback treatments will be played from this same location (specified by UTM waypoint) on subsequent days. While Liu et al. (2008) suggested placing speakers at edges of swamp sparrow territories to maximize natural territorial behavior, preliminary monitoring of vesper sparrows suggest that males do most of their singing from a few preferred perches within their territory. Many *P. g. affinis* occur on sites with limited perch availability, so choosing a location near an individual’s preferred perch will increase the likelihood of garnering a response from that individual as well as limiting the chance of a neighboring bird interfering with the playback treatment.

This experiment will also need to determine whether the territorial responses during and after treatment are different than the territorial behavior of the subject prior to treatment. Monitoring of a subject’s behavior will begin while setting up the speaker for playback. Preliminary playback trials in 2019 showed that a pre-playback observation period is seldom successful, and that without a playback subjects would often vacate the area before the treatment could begin. Once playbacks began, subjects were usually drawn to the speaker. Observers will indicate whether the birds are singing, making flights, or interacting with conspecifics prior to playback. In the event a potential subject is engaged in a territorial dispute with a conspecific upon arrival of the observer, another territory will be selected for playback instead. The same variables measuring territorial response during playback treatments will be measured for a six-minute period post-playback. At least 24 hours will pass before exposing each subject the other subspecific playback stimuli.

An important part of this study is an appropriate sampling design of songs used for each of the playback treatments. To avoid pseudoreplication, a variety of vesper sparrow songs must be used in the playback treatments (Kroodsma, 1989; Kroodsma, Byers, Goodale, Johnson, & Liu, 2001; McGregor et al., 1992). Subjects from each subspecies will be paired with a unique set of stimuli, with each playback recording used no more than twice during the study, once for *P. g. affinis* and once for *P. g. confinis*. Treatments will be designed for each site that playbacks will occur, making sure to not include songs from individuals breeding at those sites, so that birds will not be played their own song or a song from an adjacent territory (Temeles, 1992). Treatments will also include songs of each subspecies sampled from a variety of locations throughout their range, allowing subspecies-level generalizations to be made about the responses.

Within each playback treatment, songs will be spaced at the mean between-song interval sung by individuals in the sampled recordings. Highly irregular songs within the sampled recordings should be removed from playbacks to avoid exposing subjects to atypical songs, which could affect the strength of a territorial response. *P. g. affinis* have been observed learning songs of other species (Kroodsma, 1972), which might not garner a typical response from other vesper sparrows and therefore should not be included in playbacks.

1. Describe the data that will be the foundation of your thesis. Will you use existing data, or gather new data (or both)? Describe the process of acquiring or collecting data[[3]](#endnote-3).

Liu et al. (2008) is the model study I am replicating with two subspecies of vesper sparrows; the following methodologies are based off their research*.* This project will involve both sampling of songs used in playback treatments, as well as sampling of individuals being exposed to playbacks (Kroodsma, 1989). Songs of 30 individual *P. g. affinis* will be recorded in the Puget Lowlands as well as songs of up to 30 individual *P. g. confinis* in the Columbia Basin. These recordings will be edited using bandpass filters at uniform frequencies to reduce background noises (traffic, other birds). Songs will also be edited for uniform amplitude and tested through a speaker with a sound pressure level meter, to mimic the natural amplitude produced by a vesper sparrow. These measures will help ensure uniformity among stimuli with minimal change to the originally recorded signal.

Two study sites for each subspecies have been selected within their respective ranges in Washington State. Proposed study sites include the Artillery Impact Area and Rainier Training Areas on Joint Base Lewis McChord (JBLM) within the Puget Lowlands, as well as Beezley Hills Preserve and Wenas Wildlife Area located within the Columbia Basin. *P. g. affinis* currently occurs only on several sites in Western Washington (Altman, 2017), all of which have limited access because they occur on a military installation. Access to these sites is being provided by JBLM Fish & Wildlife. The *P. g. confinis* study sites in the Columbia Basin are located approximately 100 miles east of the *P. g. affinis* study sites and were selected using data from Ebird.org (eBird, 2019). The *P. g. confinis* study sites were selected based on relatively high frequencies of vesper sparrow detections as well as their proximity to the *P. g. affinis* population. Research permits will be acquired from The Nature Conservancy and Washington Department of Fish & Wildlife.

Territory locations of singing individuals will be catalogued with each recording (UTMs). Songs will be recorded with an Olympus LS-100 Multi-track PCM recorder and a Sennheiser ME62 microphone with a parabolic reflector. A fellow researcher in Oregon will be providing songs of 30 individual *P. g. affinis* from several sites in Western Oregon as well as several individual *P. g. confinis* songs from Eastern Oregon. These songs have been recorded with a Marantz PMD-660 solid-state recorder and Sennheiser ME62 microphone with a parabolic reflector. Unlike *P. g. affinis*, recordings of *P. g. confinis* are publicly available on the internet through online resources such as Macaulay Library and xeno-canto.org. These resources will be utilized to adequately sample the song of *P. g. confinis* throughout their range, helping generalize results. Six-minute playback treatments will be made for multiple individuals from separate populations that will ideally capture variation of song types within the respective subspecies repertoires (Liu et al., 2008).

Six-minute playbacks of both subspecies will occur at two breeding sites of *P. g. affinis* in the Puget Lowlands as well as two breeding sites of *P. g. confinis* in the Columbia Basin. Playback trials will occur from late April through mid-July, with study sites on either side of the Cascades alternated to account for differences in response related to breeding phenology. Individual *P. g. affinis* territories will be selected for exposure to playbacks based on available access. Most *P. g. affinis* breeding in Washington State occur on JBLM’s artillery impact area, so limited access due to unexploded ordinances will determine where playback trials can occur. Individual *P. g. confinis* territories will be selected based on public accessibility within the Columbia Basin study sites. Monitoring efforts will emphasize finding *P. g. confinis* territories across the entire study site. Playback speakers will be placed near a perch adjacent to the subject’s preferred singing perch within its territory. Speakers will be placed on a stand at 2 meters based on the median and mode perch height of birds whose songs were recorded (n = 45). As illustrated in Figure 2, non-bright flagging will be placed at 5-meter intervals for a total of 10 meters in each cardinal direction from the speaker (Liu et al., 2008). Playback treatments will be broadcast from a single UBL JFLIP 4 Bluetooth speaker, with .WAV files being randomized and played via auxiliary cord sourced from an iPod (Apple, Inc.). Measured territorial responses include the subject’s minimum distance to speaker, number of songs sung by subject, number of flights by subject, and the amount of time spent within 10 meters of the speaker (Liu et al., 2008). Each treatment will start with brief, categorial observations during speaker set-up, followed by the six-minute playback, and then another 6 minutes of silent observation, during which the same response variables will be measured resulting in 12 minutes total observation for each treatment (Liu et al., 2008). Observers will watch birds using binoculars from a vantage point 50-meters from the speaker. Observers will dictate the subject’s actions onto an audio recording device. Dictations will indicate when the subject sings, when the speaker plays a song, when the subject and speaker songs overlap or “jam”, when the subject flies, when a subjects enters or leaves the 10 square meter flagged area, and “minimum distance to speaker” noted whenever the subject gets close. These variables will be measured the same way but categorized separately during the 6-minute post-playback period. Audio recordings will be reviewed, and experimental variables tallied and entered onto a Microsoft Excel spreadsheet as well as physical datasheets. Information to be recorded along with each playback trial includes date, time, temperature, wind speed, cloud cover, precipitation, study site, playback recording ID, observer, UTM of speaker location, and UTM of the subject’s initial location.

Which subspecific playback an individual is exposed to will be randomly selected using the iTunes randomizer function, and that same individual will be exposed to the opposite subspecies playback in a 1-2-day period (Liu et al., 2008). Ideally, observers will be blind to which subspecies song will be played randomly, as distinguishing between the subspecies song is difficult due to vesper sparrows’ individualistic singing (Balph & Balph, 1983; Kroodsma, 1986). Methods for randomized blind playbacks are currently being investigated. Multiple observers will be utilized to further limit observer-expectancy bias and maximize the amount of playback trials (Balph & Balph, 1983). While many individual *P. g. affinis* within the Puget Lowlands population are color-banded, the individuals within the *P. g. confinis* study-sites are not. Therefore, individual birds in this study will be differentiated based on territory location, which will be determined by singing perch locations.

1. Summarize your methods of data analysis. If applicable, discuss specific techniques that you will use to understand the relationships between variables (e.g., interview coding, cost-benefit analysis, specific statistical analyses, spatial analysis) and the steps and tools (e.g., lab equipment, software) that you will take to complete your analyses.

Spectrograms of songs sampled for playbacks will be viewed and analyzed through Raven Pro computer software to determine mean frequency range, mean song length, type of introductory notes, and average time between songs. Playback treatments will then be constructed in .WAV format using Raven Pro, as well as Audacity audio-editing software.

The analysis of territorial response data will involve determining if there is a significant difference in overall territorial responses to songs from a vesper sparrow’s own subspecies than to songs from a different subspecies. This can be achieved by conducting paired *t*-tests on each response variable (numbers of songs, minimum distance to speaker, number of flights, time spent within 10 meters of speaker) for all subjects exposed to playbacks. Paired *t*-tests can only be utilized if the response data is normally distributed, so if the data fails to meet the assumptions of a paired t-test, a Mann-Whitney *U* test will be conducted instead (Liu et al., 2008; Matessi et al., 2001). The open-source statistical software environment “R” will be used for statistical testing and producing graphs.

Differences in response will be analyzed across all subjects within the study but will be also be examined at the subspecies level. The same statistical testing will be applied to subjects in two subspecific groups, *P. g. affinis* and *P. g. confinis*. In total, differences in each of the four response variables will be analyzed at the species level as well as among *P. g. affinis* alone, and among *P. g. confinis* alone. Paired *t*-tests can also be conducted on the mean difference in responses to same versus foreign songs between *P. g. affinis* and *P. g. confinis* to analyze whether one subspecies discriminates between songs more than the other.

Another option for data analysis will be to conduct a principal component analysis (PCA). Many of the response variables will likely be correlated with one another, and large tables listing differences in individual response variables can make summative interpretation of data difficult (McGregor, 1992). Additional variables can be determined post hoc from recordings of dictations, such as total time of response, and measures of latency (latency to response, latency to singing, latency to approach within 10m), this will allow for a more holistic approach to the measurement of territorial response in a new species (McGregor, 1992). To determine whether a PCA is appropriate, first a correlation matrix will be created to determine to what degree response variables are correlated with one another. Principle components can then be selected by plotting variables on a orthogonal axis, and determining the amount of variance in the data they explain, eventually producing a smaller set of independent variables (McGregor, 1992). Some of the original response variables might need to be standardized through transformations to meet the assumptions of the PCA (McGregor, 1992). These principle components can then be compared with paired *t* tests to produce a more interpretable representation of overall differences in response (Demko & Mennill, 2018). Several playback studies that have utilized PCA have also used linear mixed models to analyze secondary influences such as individual sites, subject and stimuli. (Demko, Sosa-López, & Mennill, 2019; Greig, Baldassarre, & Webster, 2015).

1. Address the ethical issues raised by your thesis work. Include issues such as risks to anyone involved in the research, as well as specific people or groups that might benefit from or be harmed by your thesis work, perhaps depending on your results. List any specific reviews you must complete first (e.g., Human Subjects Review or Animal Use Protocol Form), and specific permits or permissions you need to obtain before you begin collecting data (e.g. landowner permissions, agency permits).

The main ethical issue raised by my thesis relates to the potential stress inflicted upon subjects from exposure to song playback stimuli. Broadcasting songs of male conspecifics within the breeding territory boundaries of *Pooecetes gramineus* will cause subjects to believe there is an intruder seeking to compete for mates or resources (Cuthill, 1991). The American Birding Association’s (2019) *Code of Ethics* discourages the use of playbacks to attract rare and sensitive species, especially near nesting sites. To limit negative impacts on subjects and for the accuracy of the experiment, playbacks will be stopped or refrained when neighboring conspecifics enter a subject’s territory. This will limit the stress brought on by subjects believing that there are dual intruding competitors within their territory. This situation would also compromise the parameters of the experiment, as it would be impossible to discern which stimuli the subject is responding to. Playbacks will also be stopped or refrained when potential predators are present such as raptors or carnivorous mammals.

Due to the increasing scarcity of *Pooecetes gramineus affinis* and lack of published literature on the subspecies, there is a strong need for new research. How evolutionary distinct is this coastal population of a continentally distributed *Passerellidae*? Investigating the amount of speciation among *P. g.* *affinis* through song playback, is far less intrusive than many other methods, including genetic analysis (Cuthill, 1991). Although a genetic analysis would provide a more compelling piece of evidence, it would be far more stressful to the animals, as it would likely involve physical capture as well as the extraction of genetic material from live birds (Drovetski, Pearson, & Rohwer, 2005). The strong need for new research, coupled with the relatively nonintrusive nature of playback experiments I believe justifies the stress subjects will experience from conspecific song playbacks.

The results of this study could have potential impacts to current land use taking place on sites hosting remnant populations of *P. g. affinis*. If *P. g. affinis* and *P. g. confinis* are found to significantly discriminate between each other’s songs, that evidence could support *P. g. affinis* as a distinct population segment of *Pooecetes gramineus*, strengthening the argument that protection of the subspecies under the Endangered Species Act is warranted. In Washington, nearly all remaining *P. g. affinis* occur on JBLM’s artillery impact area and Rainier training areas. Listing of *P. g. affinis* could have the consequence of restricting training exercises on JBLM. Several other listed species occur on JBLM, some of which share habitat with *P. g. affinis*, such as the Mazama pocket gopher (Thomomys Mazama), Taylor’s checkerspot butterfly (*Euphydryas editha taylori)* and streaked horned lark (*Eremophila alpestris strigata*). The fact that *P. g. affinis* breed in areas with training restrictions already in place means that listing of the subspecies might not have a profound impact on military exercises.

While I currently have permits and permission to access breeding sites of *P. g. affinis* through JBLM Fish & Wildlife, I will need to obtain similar permits for playback trials that will take place in the breeding habitat of *P. g. confinis*. Current sites I plan to conduct research on include Beezley Hills Preserve, owned by The Nature Conservancy; and Wenas Wildlife Area, owned by Washington’s Department of Fish and Wildlife. These entities will be contacted, and research permits obtained prior to beginning playback trials.

1. Reflect on how your positionality as a researcher could affect your results and how you will account for this in the research process[[4]](#endnote-4).

As an individual who values conservation and the preservation of rare plants and animals, I have a potential investment in the outcome of this study. As a graduate student and researcher, I have a desire to produce an interesting and noteworthy master’s thesis. As an employee of a local avian conservation program specializing in monitoring rare grassland songbirds, listing of *P. g. affinis* could result in additional funding opportunities. For this reason, I plan to employ multiple observers to assist with the playback experiment, reducing the potential of “observer bias” (Balph & Balph, 1983; Kroodsma, 1986; McGregor et al., 1992). Balph & Balph (1983) acknowledge “…it may be un- reasonable to expect a graduate student to conduct a ‘blind’ experiment by hiring and training observers to collect data for a project about which they have no knowledge; but it might be reasonable to expect that the test variables be clearly defined” (p. 756). The utilization of multiple observers, who will work independent from me will help reduce observer-expectancy bias. Furthermore, observers will be dictating observed behavior onto an audio recording device which will be analyzed separately, and certain well-defined behaviors will be tallied. Tallied behaviors will include actions on the part of the subject not easily interpreted subjectively and will be used as the variables that will be compared and tested. Well defined actions such as flights, songs, and distances to speaker are more difficult to interpret differently from observer to observer. In conclusion, the types of behaviors tallied as well as the use of multiple observers dictating their observations onto audio recorders, will ideally reduce the potential for observer-expectancy bias.

1. Provide at least a rough estimate of the costs associated with conducting your research.  Provide details about each budget item so that the breakdown of the final cost is clear.

|  |  |  |  |
| --- | --- | --- | --- |
| *Field Items* | *Cost ($ USD)* | *Amount* | ***Total*** |
| Speaker - JBL FLIP 4 | 79.95 | 1 | 79.95 |
| 50m auxiliary cord (100 ft) | 16.99 | 2 | 33.98 |
| iPod | 70 | 2 | 140 |
| Speaker Stand | 40 | 2 | 80 |
|  |  |  |  |
| *Mileage \** |  |  |  |
| Beezley Hills (410 mi roundtrip) | 235.75 | 2 | 471.50 |
| Wenas Wildlife Area (332 mi round trip) | 190.90 | 4 | 763.60 |
| ***Total*** |  |  | **1569.03** |

\* Privately Owned Vehicle mileage reimbursement rate is $0.575 per mile as of Jan 1st, 2020 (Office of Financial Management, 2019)

1. Provide a detailed working outline of your thesis.

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**Acknowledgements**

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*- P. g. affinis*

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* Historic vs current distributions
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* Description of the subspecies
* Range and distribution
* Habitat
* Conservation status
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    - *P. g. confinis* – Eastern Washington
    - Timeline of field work
  + Song Editing
    - Raven Pro Software
      * Band-Pass filters
      * Amplification Process
    - Audacity
      * Inter-song interval
      * Process for editing/exporting .WAV files
* Playback Protocol
  + Equipment/methods
  + Sampling Design
  + Summary of events/timeline
* Statistical Methods
  + Distribution of data
  + Paired *t*-test or Mann-Whitney *U*-test

**Results**

* *P. g. affinis*
  + Number of songs
  + Number of flights
  + Distance to speaker
  + Time spent within 10m
* *P. g. confinis*
  + Number of songs
  + Number of flights
  + Distance to speaker
  + Time spent within 10m
* Subspecies grouped together
  + Number of songs
  + Number of flights
  + Distance to speaker
  + Time spent within 10m
* Differences between subspecies

**Discussion**

* Interpretation of results
* Influence of temporal factors
* Influence of breeding phenology
* Evidence countering my interpretation

**Conclusion**

* Short summary of results/discussion
* Policy Implications

**References**

1. Provide a specific work plan and a timeline for each of the major tasks in the work plan. Be as realistic as you can, even though you will probably need to alter this schedule as you complete the tasks. Remember that faculty readers take time to return your drafts and that the final polishing and formatting of your thesis for binding will take longer than you ever imagined.

**Fall 2019**

* Continue with Case Studies.
* Write complete draft of literature review.

**Winter 2019 -2020**

* Apply for funding to help cover costs of equipment/travel.
* Acquire Raven Pro software for editing song recordings.
* Edit and organize all the songs that will be used in the playback experiment.
* Write up detailed protocol for playback experiment, this will serve as guide to myself and other observers during execution of experiment.
* Purchase/acquire equipment to be used for experiment.
* Test equipment prior to field use.

**Spring 2020**

* Starting in early to mid-April, take field trips to all the study sites and scout territory locations.
* Late April – once vesper sparrows have begun to establish territories begin playback trials, using the first few as training exercises (maybe do not use data from these)
* May – June – continue playback experiments, begin transcribing dictations

**Summer 2020**

* June – July - finish playback trials, with a goal of minimum 20 for each subspecies – 40 in total.
* July – August – finish transcribing dictations.
* August – September, begin “getting to know my data”. Start statistical analysis.

**Fall 2020**

* Summarize findings from analysis.
* Review results with reader and field advisor, to ensure my interpretation is sound.

**Winter 2020-2021**

* Begin writing thesis, starting with methodology (use protocol for this).
* Complete first draft of thesis (manuscript form)

**Spring 2021**

* Editing/formatting process for thesis.
* Work on presentation
* Present thesis.
* Submit thesis for bound copy
* Graduate

1. Who, beyond your MES faculty reader, will support your thesis? Indicate support both within and outside of Evergreen. Be specific about who they are and in what capacity they will support your thesis. If you are working with an outside agency or expert, be specific about their expectations for your data analysis or publication of results.

**Gary Slater** – Avian Ecologist for Center for Natural Lands Management. Gary proposed the idea of a playback experiment between subspecies of vesper sparrow and has acted as field advisor for this project. He has reviewed the thesis-related documents I have produced in MES and has given recommendations about study design as well as execution in the field. Gary is currently working with Bob Altman of the American Bird Conservancy on a region-wide demographic analysis of *P. g. affinis*. He has expressed interest in helping publish the results of this study.

**Jim Lynch** – Senior Biologist for Joint Base Lewis-McChord Fish & Wildlife. Jim is tasked with managing the prairie sites where *P. g. affinis* occur on base. He has gone out of his way to provide access to training areas and the artillery impact area, ensuring that I am able to complete field work for this study. Jim provided a location map of the distribution of *P. g. affinis* on the artillery impact area on JBLM. He has expressed great interest in this project and listing of *P. g. affinis* would have implications on how he manages JBLMs training areas.

**Emily Lind** – Emily is currently working with the Klamath Bird Observatory on a spectrographic analysis between songs of *P. g. affinis* and *P. g. confinis*. She has provided numerous recordings of *P. g. affinis* throughout Oregon. She has also provided several songs of *P. g. confinis* from Eastern Oregon. I have shared with her copies of the recordings that I have made for this project.

**Veronica Reed** – Veronica was employed as an avian field technician with CNLM’s Avian Conservation Program during Spring/Summer 2019. Veronica has worked on numerous avian playback experiments, including with song sparrows at the University of Washington, Western bluebirds with Cornell Lab of Ornithology and for her Master of Science in Biological Sciences thesis at Cal Poly. During the 2019 field season, Veronica provided detailed information on study design and proper execution of avian playback experiments. Veronica participated in preliminary playback trials and critiqued the protocol for this study as well as gave suggestions for improvement. Veronica was an invaluable source of information for the planning and design of this study.

**Karla Kelly** – Karla is employed as an Americorps Avian Technician with the Center for Natural Lands Management. She is tasked with monitoring *P. g. affinis* in the Rainier Training Areas on JBLM. During the 2019 season she provided detailed location data that facilitated the recording of vesper sparrows at that site. Karla will be providing the same information in 2020, as well as assisting with playback trials as an observer.

**Allison Styring** – Allison met with me at the beginning of MES when I initially began designing this thesis project. Allison listened to the plan for my study and gave me advice and suggestions that were very helpful during that initial stage of the project.

**Media Loan** – Evergreen’s media loan provided all the equipment for recording vesper songs. I plan to use media loan again during the playback phase of the project for voice recorders that observers will use to dictate the response to playback.

**Science Support Center** – The Science Support Center has sound level meters and range finders (for more accurate distance estimation) available for loan upon completion of a Project Information and Space Request Form.

1. List the 3-5 most important references you have used to a) identify the specific questions and context of your topic, b) help with issues of research design and analysis, and c) provide a basis for interpretation. For each reference, explain how your project specifically connects to the source by extending, challenging, or responding to the conclusions, methods, or implications.

Altman, B. (2017). *Conservation Assessment for Oregon Vesper Sparrow ( Pooecetes gramineus affinis )*. Retrieved from <https://cascadiaprairieoak.org/documents/conservation-assessment-for-oregon-vesper-sparrow-pooecetes-gramineus-affinis>

This document is the most comprehensive conservation assessment for the Oregon vesper sparrow, written by Bob Altman of the American Bird Conservancy for the United States Forest Service and Bureau of Land Management under the Interagency Special Status and Sensitive Species Program. The current knowledge on the range, population size, and life history of this subspecies is compiled. I will need to be informed of the current distribution of each subspecies to inform the geographic area songs will be sampled from. The Oregon vesper sparrow has a very limited range compared with other subspecies of vesper sparrow. Due to this limited range, detailed information on current distribution of Oregon vesper sparrows is essential to my sampling design. The section of the conservation assessment on research needs has informed the significance section of the prospectus. This document also provides an overview of subspecies designation and status, citing evidence for *P. g. affinis* as a distinct population segment.

Liu, I. A., Lohr, B., Olsen, B., & Greenburg, R. (2008). Macrogeographic Vocal Variation in Subspecies of Swamp Sparrow. *The Condor*, *110*(1), 102–109. <https://doi.org/10.1525/cond.2008.110.1.102>

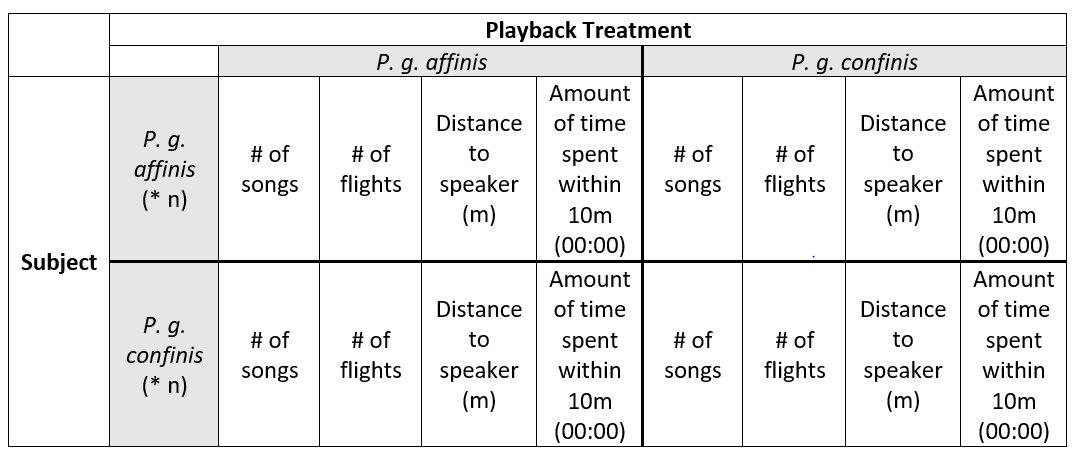
In this study, the authors aimed to determine the degree of song divergence between two subspecies of swamp sparrow through subspecific song playbacks and spectrographic analysis. This is the paper I am using to model my basic study design and methodology. While I am not conducting a spectrographic analysis, I am adopting the overall experimental design and details of the playback portion, although several details (position of speaker, distance of flagging) have been changed based on behavioural differences of vesper sparrows. The authors note the limitations of generalizing their results to a subspecies level due to sampling song recordings from only two different populations. For my study, I am sampling song recordings and subjects from as wide a geographical area as practically possible in an attempt to generalize my results to a subspecies level. This has been an important resource to use as an example of a study asking a very similar research question to mine.

McGregor, P. K., Catchpole, C. K., Dabelsteen, T., Falls, J. B., Fusani, L., Gerhardt, H. C., … Weary, D. M. (1992). Design of Playback Experiments: The Thornbridge Hall NATO ARW Consensus. *Playback and Studies of Animal Communication*, 1–9. <https://doi.org/10.1007/978-1-4757-6203-7_1>

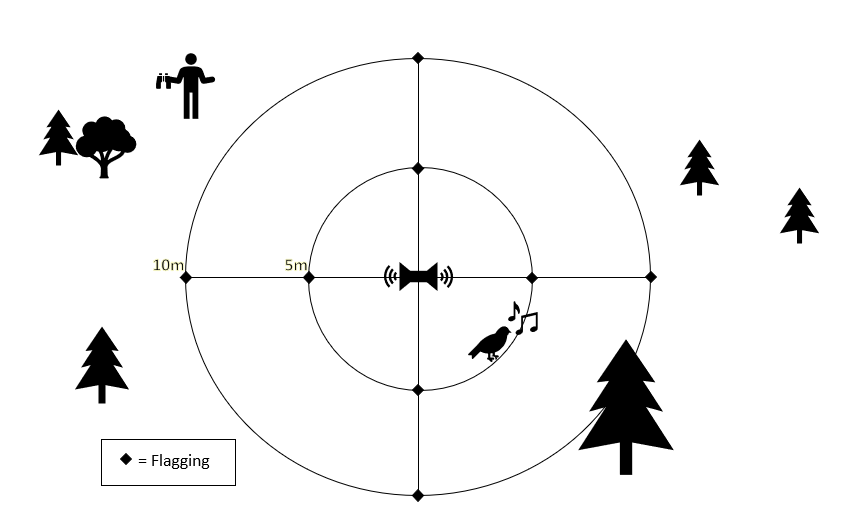
This first section of this document overviews the consensus among researchers regarding the issue of pseudoreplication in playback experiments. The second section of this document outlines a variety of potential issues that can occur during the execution phase of a playback experiment, as suggested by practitioners within the discipline. The purpose of this document is to provide researchers with a practical framework to avoiding potential pitfalls within the study design and execution of playback experiments. Using this document will ideally prevent my thesis from being compromised due to common mistakes that can invalidate an experiment. This “consensus” was published after a several other papers were published on the issue of pseudoreplication in playback studies (Hulbert, 1984; Kroodsma, 1986, 1989). I will be utilizing the suggested study designs from these works to inform this project. The second section detailing issues common to the execution phase of a playback experiment has also been used as a guide to ensure that I am not overlooking potential pitfalls in the field that could jeapordize the valitidity of my results.

List of Figures

**Figure 1**

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**Figure 2**



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1. You are not locked into this title; its purpose is to help you identify the main point or topic of your thesis at an early stage. [↑](#endnote-ref-1)
2. You might discuss selection of case studies, sampling methods, experimental design, and/or specific hypotheses you will test. You should also address any specialized knowledge or skills that are necessary to complete the research. [↑](#endnote-ref-2)
3. If you are planning to use existing data, explain the specific source, contact information, arrangement with collaborating agencies, and expectations about use of data and final products of your research. If you are planning to gather new data, describe specific methods, time, place, and equipment that will be required. [↑](#endnote-ref-3)
4. Your *positionality as a researcher* refers to the fact that one’s “…beliefs, values systems, and moral stances are as fundamentally present and inseparable from the research process as [one]’s physical, virtual, or metaphorical presence when facilitating, participating and/or leading the research project…” (The Weingarten Blog 2017). [↑](#endnote-ref-4)