

# Wildlife Conservation Genetics

## Spring Semester, 2010

### *Course Listing*

Undergraduate students: Forest and Wildlife Ecology 375, lecture 003

Graduate students: Forest and Wildlife Ecology 875, seminar 003

*Credits: 2*

### *Meeting Time and Location*

Tuesdays: 1:00-1:50 pm, A228 Russell Labs

Thursdays: 1:00-1:50 pm, A228 or A120 (if computer exercise) Russell Labs

### *Instructors*

Instructor: Dr. Zach Peery, [mpeery@wisc.edu](mailto:mpeery@wisc.edu), 890-2766, A233 Russell Labs

Instructor: Dr. Don Waller, [dmwaller@wisc.edu](mailto:dmwaller@wisc.edu), 263-2042, 232b Birge Hall

Teaching Assistant: Stacie Robinson, [sjrobinson@wisc.edu](mailto:sjrobinson@wisc.edu), 630-0541, 208 Russell Labs

### *Prerequisites*

Conservation Biology

Genetics or Population Genetics

### *Course Overview*

This course is intended to provide graduate and advanced undergraduate students with an understanding of how genetic methods are applied to problems in conservation biology. The emphasis will be on vertebrate species in terrestrial and marine ecosystems. The first portion of the course will cover general topics in conservation genetics such as the nature of genetic diversity and inbreeding depression. The second portion of the class will be method based and cover individual- and population-level methods in molecular ecology where students will be gain practical experience analyzing genetic data. The course will include a mix of lectures, discussions of relevant articles, and computer-based exercises. As such, students should be prepared to read current conservation genetics literature, lead and participate in discussions, analyze genetic data using sample datasets (provided) with genetics software packages, and answer written questions regarding the results of computer exercises. In general, lectures and discussions of methods/concepts will occur on Tuesdays, while computer exercises based on Tuesday's materials will occur on Thursdays.

### *Course Materials*

Readings and datasets can be accessed from your Learn@UW page.

### *Grading*

Grading will be based on your performance leading one discussion reading, participation in discussions, and answers to questions relating to computer exercises.

## Lecture Outline

<u>Week</u>	<u>Date</u>	<u>Topic</u>	<u>Presenter</u>
Week1	19-Jan	Class Organization and Overview of Cons. Genetics	Peery
	21-Jan	Primer in Population Genetics	Peery
Week2	26-Jan	Molecular Markers for Conservation	Peery
	28-Jan	ARLEQUIN - Estimating Diversity Exercise	Peery
Week3	2-Feb	Marbled Murrelet Case Study	Peery
	4-Feb	Visit to Biotech Center	Adams
Week4	9-Feb	Species Identification and Barcoding Lecture	Reid
	11-Feb	BLAST and PRIMER DESIGN Exercise	Robinson
Week5	16-Feb	Inbreeding and Loss of Genetic Variation in Small Populations	Waller
	18-Feb	Genetic Rescue Discussion	Waller
Week6	23-Feb	Measuring Population Structure Discussion	Student
	25-Feb	ARLEQUIN - Estimating Structure Exercise	Peery
Week7	2-Mar	Conservation Units Discussion	Student
	4-Mar	STRUCTURE - Estimating Structure Exercise	Peery
Week8	9-Mar	Estimating Gene Flow with Assignment Tests Discussion	Student
	11-Mar	GENECLASS - Assignment Test Exercise	Peery
Week9	16-Mar	Parentage Analyses Discussion	Student
	18-Mar	CERVUS - Parentage Assignment Exercise	Robinson
Week10	23-Mar	Relatedness Estimation Discussion	Student
	25-Mar	ML-RELATE - Relatedness Estimation Exercise	Robinson
Week11	30-Mar	Spring Break	
	1-Apr	Spring Break	
Week12	6-Apr	Genetic Effects of Habitat Fragmentation Discussion	Student
	8-Apr	Telomeres and Ageing Guest Lecture	Pauli
Week13	13-Apr	Estimating Effective Population Size Discussion	Student
	15-Apr	NEESTIMATOR - Effective Population Size Exercise	Peery
Week14	20-Apr	Detecting Bottlenecks Discussion	Student
	22-Apr	BOTTLENECK - Bottleneck Exercise	Peery
Week15	27-Apr	Historic Genetics Discussion	Student
	29-Apr	SIMCOAL - Simulating Genetic Data Exercise	Peery
Week16	4-May	Landscape Genetics Discussion	Student
	6-May	BAPS - Landscape Genetics Exercise	Robinson

## Reading List

<u>Week</u>	<u>Date</u>	<u>Reading</u>
Week2	26-Jan	(1) Morin (2004). SNPs in ecology, evolution and conservation. <i>Trends in Ecology &amp; Evolution</i> 19:208-216. (2) Mueller and Wolfenbarger (1999). AFLP genotyping and fingerprinting. <i>Trends in Ecology &amp; Evolution</i> . 14:389-394. (3) Selkoe and Toonen (2006). Microsatellites for ecologists: a practical guide to using and evaluating microsatellite markers. <i>Ecology Letters</i> 9:615–629.
Week3	2-Feb	(1) Peery, M.Z. (2008). Characterizing source-sink dynamics with genetic parentage assignments. <i>Ecology</i> 89:2746–2759. (2) Hall et al. (2009). Characterizing dispersal patterns in a threatened seabird with limited genetic structure. <i>Molecular Ecology</i> . 18:5074–5085. (3) Peery et al. (2010). Genetic analyses of historic and modern marbled murrelets suggest decoupling of migration and gene flow after habitat fragmentation. <i>Proceedings of the Royal Society</i> . Available Online.
Week4	9-Feb	(1) Rubinoff (2006). Utility of mitochondrial DNA barcodes in species conservation. <i>Conservation Biology</i> . 10:1026-1033. (2) Valentini et al. (2009). DNA barcoding for ecologists. <i>Trends in Ecology and Evolution</i> . 24:110-117.
Week5	16-Feb	(1) Keller and Waller (2002). Inbreeding effects in wild populations. <i>Trends in Ecology &amp; Evolution</i> 17:230-241. (2) Tallmon et al. (2004). The alluring simplicity and complex reality of genetic rescue. <i>Trends in Ecology and Evolution</i> . 9:489-496.
Week6	23-Feb	(1) Hedrick (1999). Perspective: highly variable loci and their interpretation in evolution and conservation. <i>Evolution</i> 53:313-318. (2) Pearse and Crandall (2004). Beyond FST: Analysis of population genetic data for conservation. <i>Conservation Genetics</i> 5:585-602.
Week7	2-Mar	(1) Palsboll et al. (2007). Identification of management units using population genetic data. <i>Trends in Ecology and Evolution</i> . 22:11-16 (2) Crandall et al. (2000). Considering evolutionary processes in conservation biology. <i>Trends in Ecology &amp; Evolution</i> 15:290-295.
Week8	9-Mar	(1) Manel (2005). Assignment methods: matching biological questions techniques with appropriate. <i>Trends in Ecology &amp; Evolution</i> 20:136-142. (2) Saenz-agudelo et al. (2009). Estimating connectivity in marine populations: an empirical evaluation of assignment tests and parentage analysis under different gene flow scenarios. <i>Molecular Ecology</i> 18, 1765-1776.

Week9	16-Mar	<p>(1) Marshall, T.C. (1998). Statistical confidence for likelihood-based paternity inference in natural populations. <i>Molecular Ecology</i> 7:639-655.</p> <p>(2) Li et al. (2009). Extrapair paternity and maternity in the three-toed woodpecker, <i>Picoides tridactylus</i> : insights from microsatellite-based parentage analysis. <i>PLoS One</i>. 4(11). Article e7895</p>
Week10	23-Mar	<p>(1) Weir (2006). Genetic relatedness analysis: modern data and new challenges. <i>Nature Reviews Genetics</i> 7:771-780.</p> <p>(2) Liker (2009). Genetic relatedness in wintering groups of house sparrows (<i>Passer domesticus</i> ). <i>Molecular Ecology</i> 18:4696-4706.</p>
Week11	30-Mar	Spring Break
Week12	6-Apr	<p>(1) Keyghobadi (2007). The genetic implications of habitat fragmentation. <i>Canadian Journal of Zoology</i> 85:1049-1063.</p> <p>(2) Epps et al. (2005). Highways block gene flow and cause a rapid decline in genetic diversity of desert bighorn sheep. <i>Ecology Letters</i> 8:1029-1038.</p>
Week13	13-Apr	<p>(1) LeBerg (2005). Genetic approaches for estimating the effective size of populations. <i>Journal of Wildlife Management</i>. 69:1385–1399</p> <p>(2) Roman and Palumbi (2003). Whales before whaling in the North Atlantic. <i>Science</i>. 301:508-510</p>
Week14	20-Apr	<p>(1) Garza and Williamson (2001). Detection of reduction in population size using data from microsatellite loci. <i>Molecular Ecology</i> 10:305-318.</p> <p>(2) Luikart and Cornuet (1998). Empirical evaluation of a test for identifying recently bottlenecked populations from allele frequency data. <i>Conservation Biology</i> 12:228-237.</p>
Week15	27-Apr	<p>(1) Leonard (2008). Ancient DNA applications for wildlife conservation. <i>Molecular Ecology</i> 17:4186-4196.</p> <p>(2) Miller and Waits (2003). The history of effective population size and genetic diversity in the Yellowstone grizzly (<i>Ursus arctos</i> ): implications for conservation. <i>Proceedings of the National Academy of Sciences</i>. 100:4334-4339.</p>
Week16	4-May	<p>(1) Manel (2003). Landscape genetics: combining landscape ecology and population genetics. <i>Trends in Ecology &amp; Evolution</i> 18:189-197.</p> <p>(2) Manel (2007). A new individual-based spatial approach for identifying genetic discontinuities in natural populations. <i>Molecular Ecology</i> 16:2031-2043.</p>