Fall 2012 Course Syllabus - FW 828
Molecular Ecology and Conservation Genetics (3 credits)

Instructor	Kim Scribner
Meeting time	MW 9:10-10:00, F 8:00-9:50
Office Hours	MWF 10:00-11:00 or by appointment
Meeting location	Room 1 Natural Resources Building
Office	Room 2E Natural Resources Building
Phone	353-3288 **E-mail** scribne3@msu.edu

Required text -Allendorf, F. and G. Luikart. 2007. Conservation and the Genetics of Populations. Blackwell Publishing, Oxford, UK.
Supplemental Peer review literature

Grading	Homework assignments and computer problem sets	30%
	Mid-term exam	20%
	Oral presentations, discussion and class participation, and critiques of research papers	20%
	Project and report	10%
	Final Exam	20%

Course Objectives and Description: The primary course objective is to help students gain a fundamental understanding of population genetic principles and uses of molecular, biochemical, and quantitative genetic data and theory in areas of behavioral ecology, population ecology, forensics, resource management, and evolutionary ecology. The course will be divided into sections that encompass these general areas, with emphasis on human-driven changes that have either accentuated or disrupted natural evolutionary processes and linkages at the individual, population, community, and species levels. Each section will cover theory, statistical methods of inference, and empirical examples and applications including animal and plant taxa.

Course Format: Monday and Wednesday classes will primarily involve lectures and discussion of lecture material. Friday's classes will involve lecture, lab and student-facilitated discussion of assigned peer-review literature. Files of lecture materials and of the peer-review literature will be available on ANGEL.

Assigned Homework: Within each section there will be a computer laboratory or homework assignment.

Student-facilitated discussion of literature: Fridays and the last class of each section will be devoted to student-led discussions. Class periods will be used to synthesize the section's materials. The main portion of these 2 hr Friday sessions will be devoted to discussion of the assigned readings.

Projects:
Students will select a species, population/metapopulation, or community in Michigan, and using principles and methods discussed in class, develop a presentation and written report that applies principles and analytical methods from the class.

Tentative Lecture Schedule

Lecture/Discussion		Topic
Section I – Background, terminology, and concepts		
		Week 1
1	8/29	Introduction to concepts in conservation and genetics, Why is genetic diversity important? Neutral vs. adaptive variation, Biological diversity: how diversity is partitioned within and among populations in nature and how it is lost
2	8/31	Estimating allele frequencies, Hardy-Weinberg principles, linkage, sampling, power analysis, uncertainty in parameter estimation
Section II – Random processes		**Week 2**
3	9/5	Genetic drift, loss of genetic diversity, changes in allele frequency
4	9/7	Genetic markers used in Conservation Biology Molecular basis for genetic and phenotypic diversity (LAB #1)
		Week 3
5	9/10	Inbreeding and outbreeding, Effective population size in natural and manipulated populations, bottlenecks and founder events
6	9/12	Effects of management and other anthropogenic impacts on genetic diversity (e.g., supplementation, translocations, reintroductions)
7	9/14	CLASS DISCUSSION – Conservation of genetic diversity in natural and anthropogenically impacted populations (Assigned readings) (LAB #2)
Section III – Deterministic processes, adaptation, and analysis of quantitative traits		
		Week 4
8	9/17	Mutation and Epigenetics as sources of diversity and effects in finite populations
9	9/19	Selection models and selection component analysis
10	9/21	Bioinformatics and detection of molecular adaptation
		Week 5
11 & 12	9/24 & 9/26	Quantitative genetics
13	9/28	CLASS DISCUSSION – Methods of detection of selection at the genotype and phenotype levels (LAB #3)
		Week 6
14	10/1	Life history theory, reaction norms, phenotypic plasticity

15	10/3	Human influences on rates of phenotypic change, maximal rates of sustainable evolutionary change
16	10/5	Climate change and thermal adaptations
		Week 7
17	10/8	Evolutionary effects of selective harvest; domestication selection
18	10/10	Disease and selection; genetic theory/markers as epidemiological tools
19	10/12	CLASS DISCUSSION – Evolutionary change in human-altered environments (Assigned readings)
		Week 8
20	10/15	**Mid-Term Exam** covering lectures 1 thru 19

Section IV – Mating systems, behavioral ecology and effects on genetic diversity

21	10/17	Mating systems, behavioral ecology and gene conservation
22	10/19	Estimation of relatedness in natural populations, estimation of parentage, kinship, and variance in male and female reproductive success (LAB #4)
		Week 9
23	10/22	Inferring pedigrees in natural and captive populations, "individual importance" and selection criteria for breeding
24	10/24	Artificial propagation, captive breeding, and loss of genetic diversity
25	10/26	CLASS DISCUSSION – Effects of reproductive behavior on apportionment of genetic diversity and uses of molecular markers in behavioral ecology, conservation, and management (Assigned readings)

Section V – Spatial analyses **Week 10**

26	10/29	Estimating dispersal and gene flow
27	10/31	Delineation of population boundaries, spatial partitioning of genetic diversity, F-statistics, genetic distance
28	11/2	More spatial statistics and hypothesis testing, autocorrelation, cluster analysis at individual and population levels, (LAB #5)
		Week 11
29-30	11/5 & 11/7	Metapopulations and landscape genetics, effects of fragmentation, processes of extinction and recolonization, genetic criteria for reserves and conservation banking

31	11/9	CLASS DISCUSSION – Human-mediated changes to landscape permeability, constraints to gene flow and reapportionment of genetic diversity within and among populations (Assigned readings)

Section VI – Forensics and population demography

Week 12

32	11/12	Identification of individuals, forensics, species identification, genetic tagging Methods for estimation of current and historical population size
33	11/14	Estimation of population composition in mixtures, individual assignment to populations of origin
34	11/16	CLASS DISCUSSION Conservation genomics, emerging uses of various genomic technology in Conservation (Assigned readings) (LAB #6)

Section VII – Uses of systematic data and phylogenies

Week 13

35	11/19	Systematics and conservation biology, DNA bar-coding
36	11/21	Species concepts, speciation, and estimation of species diversity, finding biodiversity hotspots

Weeks 14

37	11/26	Phylogeography
38	11/28	Definition of 'species' under the **E**ndangered **S**pecies **A**ct Determining **E**volutionary **S**ignificant **U**nits and **M**anagement **U**nits
39	11/30	Class Discussion (Assigned Readings)

Week 15

40	12/3	Community genetics, metacommunities, and anthropogenic changes that decouple co-evolved species linkages
41	12/5	Hybridization as an evolutionary process and implications for conservation
42	12/7	Presentation of projects **CLASS ENDS**

Final Exam covers lectures 21-41 Monday December 1, 7:45-9:45AM, Room 1 Nat. Res. Bldg.