# Fish 444: Conservation Genetics Spring 2017

## 1. Description

Conservation measures are aimed at protecting the long-term survivability of a species in a changing environment – one that includes human beings. We will examine the role that genetic approaches play in meeting this goal.

The class will start by examining the underlying principles relevant to conservation genetics. We will then move onto the practices: methods of measuring genetic diversity in populations; identification of the units of biodiversity to which conservation efforts are directed; genetics and consequences of population fragmentation; inbreeding and outbreeding; genetic management of wild and captive populations; reintroduction of organisms into the wild; the role of forensics in enforcement and development of recovery plans. We will examine current thought and practices in this constantly evolving field, and will draw from many well-known case studies in the region. Labs will include practical molecular laboratory work, analysis of genetic data in computer labs, and participation in a project within our research group.

## 2. Objectives

This class aims to develop your skills as a future scientist by providing a basis for progression in the field of conservation and genetics as a whole. The class builds on your previous education, and is aimed at developing "higher-level" skills and knowledge that will be important to the workplace and to graduate school.

*Specific goals are:*

- Develop advanced understanding relevant to the interpretation of genetic issues in conservation
- Promote the ability to critically evaluate papers from the primary literature
- Design and implement experiments in evolutionary and ecological genetics
- Analyze and interpret different types of data
- Write in a clear and concise manner research papers that are suitable for publication
- Contribute to discussions in a rapidly evolving field, both to lay people and to specialists.

## 3. Course Instructors

**Instructor:** Kerry Naish, Professor, School of Aquatic and Fishery Sciences
Office: Marine Studies Room 209 Email: knaish@uw.edu

**TA:** Sam May, Graduate Student, School of Aquatic and Fishery Sciences
Office: Marine Studies Room 201 Email: smay1@uw.edu

## 4. Meeting times:

Lectures: M, W, F 9:30 to 10:20, FSH 203
Labs: F 1:30 to 4:20, FTR 113 or FSH 136

## 5. Required Textbook

Allendorf FW, Luikart G (2013) Conservation and the Genetics of Populations. 2nd edn. Wiley-Blackwell, Malden, MA. Available at UW bookstore. An e-version is also available.

## 6. Online tools

We have set up a Canvas website that will be used to disseminate resources for the class. To access materials on the website, you will need your UW NetID and password. Lecture notes in Adobe acrobat format will be uploaded to the Lecture Notes page prior to each lecture. A Canvas email list will be used for notifications. *Please check your UW email regularly*, because assignment links will be sent to this email address. (There will be no excuses for emails not read!)

## 7. Teaching methodology

We are very interested in maximizing your learning and retention of knowledge, and developing your independent research skills. Through several years of research, we have found that you learn best by reviewing the topics prior to the lecture sessions, and applying your knowledge within those sessions. The class is therefore structured as follows:

***Lectures:*** Please complete the assigned readings before coming to lectures. The sessions will be used to practice the concepts you have read about using discussions, worksheets and hands-on simulations. Some lectures will be conducted in the computer labs.

***Assignments:*** The assignments are designed to allow you to apply your knowledge to new situations. They will often involve the use of freely available computer packages that you can download. These programs are also available in the SAFS computer labs (Fish 136 and 211). They will be in the form of problem sets that you will upload as documents or spreadsheets. The assignments comprise a significant portion of your grade. Points per assignment vary.

***Labs:*** The lab sessions comprise a mixture of instruction and independent research. We introduce analytical approaches relevant to interpreting data sets in Conservation genetics, and ask you to interpret these data. The knowledge gained in these labs will help you independently analyze the data generated in your research project. Other labs will be used to gather and analyze data for the research paper. We encourage independence in these latter sections.

***Research paper:*** Every year, we conduct research on a novel question in Conservation Genetics using techniques that are being used in our research group. This paper is central to our goal of developing your skills in independent research. Therefore, you will develop a paper that meets the standards of a scientific journal manuscript. We will work through two drafts of the paper: the first draft includes the introduction section, the methods section (minus data analysis), and a description of your ideas of data analysis and discussion. The second is the final draft. The research paper is the culmination of your learning, and so we place a large emphasis on this grade.

## 8. Coursework and Grades

Grades will be based on the following breakdown:

- Assignments: 40%
- First draft of paper: 15%
- Final Research paper: 25%
- Labs: 20%

We do not mark on a curve, but set the grade based on equal categories between the top grade and the passing grade. This means that your grade is only affected by the top grade. You do need 50% of the marks to pass this class. Submissions are electronic ONLY. If you don't have access to the internet, or find uploading files difficult, please let us know.

***Policy on late submissions:*** A full 10% will be deducted from a late submission for every day that the work is overdue, starting from the deadline given in class. In other words, if you are given a deadline of 5pm, and you hand in the paper at 6pm, you will lose 10%. This deduction will be waivered under exceptional circumstances. We strongly encourage you to contact us if you are experiencing difficulties prior to the deadline. We are reasonable people….!

**9. Academic Conduct**

At the University level, passing anyone else's scholarly work (which can include written material, exam answers, graphics or other images, and even ideas) as your own, without proper attribution, is considered academic misconduct. Plagiarism, cheating, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478-120). We expect that you will know and follow university policies on cheating and plagiarism. Any suspected cases of academic misconduct will be handled according to university regulations. For more information, see the College of the Environment's Academic Misconduct Policy and the Community Standards and Student Conduct website.

***Our specific policy*** in the class is to encourage reading of primary literature, and collaboration over data analysis and processing. However, we would like you to present your interpretation of the data independently, both in the lab sessions and in the course research project. This interpretation includes your own graphics and tables, except where we have asked you to present team-generated work. Assignments MUST be conducted independently. Instances of plagiarism will result in a zero grade on the assignment.

**10. Disability Accommodations:**

It is crucial that all students in this class have access to the full range of learning experiences. At the University of Washington, it is the policy and practice to create inclusive and accessible learning environments consistent with federal and state law.

Full participation in this course requires the following types of engagement:

| ***Course Component*** | ***Requirement(s)*** |
|---|---|
| Lecture | The ability to attend tri-weekly lectures of 50 minutes with 20 other students. The ability to collaborate in teams; includes worksheets, short discussions of data, the ability to conduct short computer exercises. |
| Lab work | The ability to manipulate lab equipment; includes repetitive motions (pipettes) in one lab section and standing for extended periods of time. The ability to spend 3 hours in computer labs to analyze data. The ability to collaborate in teams; includes 10-15 minute data presentations and discussions. |
| Assignments | The ability to independently analyze and interpret problem sets and data on a weekly basis; involves computer work, creating reports (up to five pages), uploading assignments. |

If you anticipate or experience barriers to your learning or full participation in this course based on a physical, learning, or mental health disability, please immediately contact the instructor to discuss possible accommodation(s). A more complete description of the disability policy of the College of the Environment can be found here. If you have, or think you have, a temporary or permanent disability that impacts your participation in any course, please also contact Disability

Resources for Students (DRS) at: 206-543-8924 V / 206-543-8925 TDD / uwdss@uw.edu e-mail / http://www.uw.edu/students/drs.

***Roles & Responsibilities***

*Student:* inform the instructor no later than the first week of the quarter of any accommodation(s) you will or may potentially require.
*Instructor and TA:* maintain strict confidentiality of any student's disability and accommodation(s); help all students meet the learning objectives of this course.

## 11. Schedule

| Day | Date | Lecture topic | Reading (Sections) | Lab Topic | Deadlines |
|---|---|---|---|---|---|
| W | 4-Jan | Basis of Genetic Diversity | 4.1 excluding subsections, 4.2.1, 4.2.4, 4.4.1, 4.4.4 | | |
| F | 6-Jan | Evolution: the Hardy-Weinberg principle | 5.1, 5.2, 5.3 excluding subsections, 5.6.1 | | |
| M | 9-Jan | Evolution: natural selection and adaptation | 8.1, 8.2, 8.4-8.4.1 | | |
| W | 11-Jan | Evolution: mutation and migration | 12.1-1.2, 12.2-2.1, 9.3 | | Assignment 1 |
| F | 13-Jan | *DNA Extraction, FTR 113* | | 1: DNA Extraction, FTR 113 | |
| M | 16-Jan | ***Holiday: Martin Luther King Day*** | | | |
| W | 18-Jan | Evolution: genetic drift | 6.1-6.4, 8.5 | | Assignment 2 |
| F | 20-Jan | Evolution: Effective Population Size | 7.1-7.5, 7.10 | 2: PCR and gel electrophoresis, FTR 113 | |
| M | 23-Jan | Evolution: Quantitative traits | 11- 11.1, 11.1.2-4, 11.2 excl subsections | | |
| W | 25-Jan | Conservation units: Molecular systematics | 16.2, 16.3, 16.4 - 16.4.1 | | Assignment 3 |
| F | 27-Jan | Conservation Units: Conservation Units | 16.5.1, 16.5.2 | 3: Phylogenetics, FSH 136 | |
| M | 30-Jan | Conservation Units: case studies | 16.6, 16.4.3, 16.7 | | |
| W | 1-Feb | *Research Paper Discussion* | | | Lab 3 |
| F | 3-Feb | Populations: Population subdivision | 9 intro, 9.1 | 4: Population structure, FSH 136 | |
| M | 6-Feb | Populations: metapopulations and fragmentation | 9.4, 9.5, 9.8.4, 15.1, 15.2, 15.4.1 | | |
| W | 8-Feb | Populations: integration with management | 9.10, 18.1, 18.2, 18.3, 18.5, 22.6 | | Lab 4 |
| F | 10-Feb | Hybridization: theory and consequences | 17 intro, 17.1, 17.2, 17.3 | 5: Data Analysis, FSH 136 | |
| M | 13-Feb | Hybridization: management of hybridization | 17.4 excl subsections, 17.5 | | *Research paper first draft* |
| W | 15-Feb | Individuals: Kinship and relatedness | 22.4, 9.2, 16.4.2 | | |
| F | 17-Feb | Individuals: Population assignment, forensics | 22.1.4, 22.5, box 22 | 6: Individual based analyses | |
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| Day | Date | Lecture topic | Reading (Sections) | Lab Topic | Deadlines |
|---|---|---|---|---|---|
| M | 20-Feb | ***Holiday: President's Day*** | | | |
| W | 22-Feb | Inbreeding | 13.1, 13.3 | | Lab 6 |
| F | 24-Feb | Inbreeding depression | 13.4, 13.5-13.5.2, 13.6 | 7: Data Analysis, FSH 136 | |
| M | 27-Feb | Breeding and restoration: captive populations | 19.1, 19.3, 19.4 | | |
| W | 1-Mar | Breeding and restoration: reintroductions | 19.5, 19.6, 19.7, 19.8-19.8.1 | | |
| F | 3-Mar | Breeding and restoration: case studies | Examples 19.6, 19.7 | 8: Data Analysis, FSH 136 | |
| M | 6-Mar | Genomics in conservation | 4.4.2, 4.4.3, 4.5, 4.6 | | |
| W | 8-Mar | Genomics in conservation | 9.7, 15.6.3 | | *Research Paper final draft* |
| F | 10-Mar | Viable populations and PVA | 14.8, 14.9, 15.7 | 9: Population Viability Analysis | |
| M | 13-Mar | Exam Week | | | Assignment 4 |