

FISH 557
Estimation of Population Parameters

Instructor:	John R. Skalski (skalski@uw.edu)
Office Hours:	By appointment
Office Location:	FSH 264D; 1820 Puget Sound Plaza
Office Phone Number:	(206) 616-4851
Class Hours:	TTh 11:30 – 1:20 p.m.
Class Location:	FSH 213

Performance Evaluation:

Homework	9 Assignments	50 points each
Final (Due Tuesday, 18 March, 4:30 p.m.)		100 points

Grading:

<i>Score</i>	<i>Grade</i>
90%-Above	3.5-4.0
80%-90%	2.5-3.4
70%-79%	1.5-2.4

Prerequisites:

Calculus – MATH 124, 125 or QSCI 291, 292
Statistical Inference – QSCI 482, 483
Probability Theory – STAT 311 or STAT 341
Programming in Fortran, Basic, C, or C++, R

Policies:

Late homework – No credit unless prior permission

Computer Accounts:

Fisheries Computing Lab
Academic Computing Services

Textbooks:

Lecture Notes (The Ave Copy Center)
Edwards, A. W. F. 1992. Likelihood. Baltimore, MD: Johns Hopkins
University Press.

Topic Outline for FISH 557
Estimation of Population Parameters

Winter 2014

Skalski

1. Distribution of capture data
 - a. Review of probability distributions
 - b. Moments of random variables
 - c. Delta method, Taylor series

2. Estimation techniques
 - a. Method of moments
 - b. Maximum likelihood estimation
 - c. Least squares, weighted, and nonlinear least squares
 - d. Bootstrap and jackknife techniques
 - e. Difference equations and iterative solutions
 - f. Bayesian estimation

3. Statistical inference in abundance estimation
 - a. Interval estimation
 - b. Tag loss
 - c. Bias correction

4. Design of mark-recapture investigations
 - a. Sampling precision and sample size calculations for abundance estimation
 - b. Design and analysis of comparative surveys
 - c. Design and analysis of field experiments

5. Closed population, multiple mark-recapture studies
 - a. Lincoln Index
 - b. Schnabel census
 - c. Schumacher-Eschmeyer's method

6. Open population, multiple mark-recapture studies
 - a. Bailey's triple-catch method
 - b. Manly-Parr method
 - c. Jolly-Seber model
 - d. GLM analysis

7. Survival estimation
 - a. Radiotelemetry analysis
 - b. Release-recovery methods – Brownie models
 - c. Release-recapture methods – Cormack model
 - d. Multistate models
 - e. Cohort and individual covariates

8. Catch-effort analysis
 - a. Constant effort, closed population method – Zippin model
 - b. Variable effort, closed population method – Leslie, DeLury methods
 - c. Variable effort, open population methods

9. Tag-release studies
 - a. Continuous sampling models
 - b. CWT - analysis

10. Density estimation
 - a. Mark-recapture analysis
 - b. Line-transect methods
 - c. Program DISTANCE

Lecture Outline for FISH 557

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Week 1 6 – 10 Jan.	a. Why parameter estimation? (Lecture 1) b. Review of probability distributions (Lecture 2) c. Expected values, variances, and covariances (Lecture 3) d. Delta method (Lecture 4)
Week 2 13 – 17 Jan.	a. Method of moments, maximum likelihood (Lecture 5) b. Difference equations, iterative solutions (Lecture 6) c. Bootstrap, jackknife techniques (Lecture 7) d. Least squares, nonlinear least squares (Lecture 8)
Week 3 20 – 24 Jan. Jan. 20 - Holiday	a. Bayesian estimation methods (Lecture 9) b. Single mark-recapture model (Lectures 10) c. Interval estimation, transformations (Lecture 11) d. Example of CWT analysis (Lecture 12)
Week 4 27 – 31 Jan.	a. Tag loss and error corrections (Lecture 13) b. Sampling precision, sample size calculations (Lecture 14) c. Estimating survival, sex ratios from age composition (Lecture 15) d. Structural models for estimating λ (Lecture 16)
Week 5 3 – 7 Feb.	a. Regression analysis of abundance (Lecture 17) b. Multiple recapture – Schnabel census (Lecture 18) c. Otis et al. (1978) models (Lecture 19) d. Jolly-Seber method (Lecture 20)
Week 6 10 – 14 Feb.	a. GLM modeling of capture histories (Lecture 21) b. Minimum sufficient statistic (Lecture 22) c. GLM analysis of mark-recapture data (Lab)
Week 7 17 – 21 Feb. 17 Feb. - Holiday	a. Estimating productivity (Lecture 23) a. Band-recovery models – Browning models (Lecture 24) b. Program USER (Lab)
Week 8 24 – 28 Feb.	a. Cormack (1964) release-recapture models (Lecture 25) b. Estimation of movement (Lecture 26) c. Multistate models (Lecture 27) d. Constant effort removal model (Lecture 28)

- Week 9
3 – 7 Mar.
- a. Variables effort methods – Leslie, DeLury (Lecture 29)
 - b. Open population – Single-tag release (Lecture 30)
 - c. Change-in-ratio methods (Lecture 31)
 - d. Density estimation (Lecture 32)
- Week 10
10 – 14 Mar.
- a. Line-transect methods (Lecture 33)
 - b. Catch-curve analysis (Lecture 34)
 - c. Design of replicated release-recapture investigations (Lecture 35)
 - d. Age-structured population reconstruction/stock assessment (Lecture 36)
- 18 Mar. 2014 Final due by 4:30 p.m.