

April 4, 2007

FW663 Final Exam

This exam is a take-home, open-book exercise. There are 3 sets of questions; you must answer all of them. You may use any reference material (class notes, assigned reading, library material, WWW site, etc.). Under NO circumstances are you to discuss this exam with classmates or any other individual. You are to work independently and you should not confer with others. If you need clarification on a question, please email gwhite@cnr.colostate.edu or doherty@cnr.colostate.edu and ask for clarification by 5:00pm Thursday, 5 April. This exam is to be turned in by 4:00 pm Friday, 6 April, to Dr. Doherty or Dr. White. Turn in this sheet and your answers and computer files on CDs, or USB drives. **Question 1 should be stapled in a separate bundle with its own CD from Questions 2 and 3 because each bundle will be graded by a different individual. Identify each page of your answer sheets and your computer files with your student number only.** Only put your name (via your signature) on this sheet.

By my signature below, I certify that I have not collaborated with anyone concerning any material related to this examination.

Student Number

Signature

Date

Question 1 (25 points): Mountain Goats. Real species, simulated data.

The U.S. National Park Service (NPS) desired a population estimate of the number of mountain goats in White Goat National Park. You contract with NPS, and conduct a mark-resight study. Fifty goats were radio-collared, and you obtained the following results.

ID	Detections	ID	Detections	ID	Detections
Animal 1	0	Animal 18	8	Animal 35	2
Animal 2	0	Animal 19	3	Animal 36	2
Animal 3	2	Animal 20	2	Animal 37	0
Animal 4	1	Animal 21	0	Animal 38	0
Animal 5	2	Animal 22	0	Animal 39	1
Animal 6	0	Animal 23	0	Animal 40	0
Animal 7	0	Animal 24	6	Animal 41	0
Animal 8	6	Animal 25	1	Animal 42	0
Animal 9	0	Animal 26	2	Animal 43	2
Animal 10	0	Animal 27	0	Animal 44	0
Animal 11	0	Animal 28	4	Animal 45	0
Animal 12	1	Animal 29	2	Animal 46	0
Animal 13	0	Animal 30	1	Animal 47	0
Animal 14	0	Animal 31	2	Animal 48	1
Animal 15	6	Animal 32	3	Animal 49	0
Animal 16	0	Animal 33	4	Animal 50	1
Animal 17	1	Animal 34	0	Unmarked	551

- Compute the population estimate of goats in the park, and its associated 95% confidence interval (15 pts).
- NPS claims that the monetary value of goats to the park can be computed as

$$V = \frac{a\hat{N}}{b + \hat{N}}, \text{ where } a = 200,000 \text{ and } b = 10. \text{ Given your results above, compute}$$

the standard error of V assuming that a and b are fixed constants (10 pts). Hint: Compute $SE(\hat{N})$ using the formula in the NOREMARK User's Manual.

Question 2 (45 points): Man-O-War Jellies. Real species, simulated data.

A survey for Man-o-War jellies (also known as jellyfish) in Mexican waters is conducted. Two strata are defined, the outer Pacific coast waters (Stratum 1) and the inner Sea of Cortez (Stratum 2). In stratum 1, 250,000 km² are surveyed using 30 lines each 100 km long. In stratum 2, 150,000 km² are surveyed using 30 lines, each 50 km long. Jellies occur in small clusters and the clusters are the unit of detection. The water in the Sea of Cortez is less clear and might cause jellies to be harder to detect than in outer Pacific coast waters. All surveys were conducted from a boat using observers on both sides of the boat with extremely precise rangefinders borrowed from the United States Navy SEALs. In DISTANCE, use the CDS analysis engine only.

- A) Describe the thought process, steps and models that you went through in analyzing these data. (10 pts)
- B) Supply appropriate tables of model selection results. (10 pts)
- C) Supply a graph(s) of the detection function(s) from your best model (identify which model and data filter these graphs result from). (10 pts)
- D) What are your best estimates of $f(0)$, average probability of detection including the strip width to which this estimate applies, density and abundance of the jellies in the two areas? (15 pts)

Question 3 (30 points). California gnatcatchers. Real species and real data.

California gnatcatchers (CAGN) are a species of concern in southern California that is often the target of litigation due to the rarity of the bird and conflict with urbanization. The US Fish and Wildlife Service (USFWS) conducts a first-time abundance survey across San Diego (SD) and Orange Counties (32344.56 ha) to count how many CAGN exist. The USFWS focuses on distance sampling theory and methods. Fifteen observers are trained for 2 weeks on how to identify gnatcatchers and in use of survey equipment. Playback recordings are used to increase detection probabilities. 435 points are randomly selected across the area and surveyed up to 4 times each (every 2 weeks) during the breeding season.

- A) Construct, describe, and run appropriate models and supply a table of model selection results. (10 pts)
- B) What are your best estimates of $h(0)$, average probability of detection including the radial distance to which this probability of detection applies, density and abundance of CAGN in Southern California? (5 pts)
- C) Given these results what is your estimate of the number of points that must be visited to achieve a density CV = 10%? What value of b did you use? (10 pts)
- D) Are there any suggestions that you would make to improve data collection in the field? (5 pts)