Lesson Question Answers

Basic Questions

1. How did the resulting population estimate from the Groups differ? Why would Groups 2 and 3 answers differ from Group 1?
	1. Answers will vary slightly (Group 1 should get N ~ 100), but in general Group 2 should have an estimate significantly higher than group 1. There are two reasons for this. First, the population size increases by 50 individuals. Second, the increase in individuals also decreases the likelihood of recapturing individuals during the census period. As “r” decreases, N increases. Group 3 should have a much lower estimate than group 1. Again, because you are decreasing the number of individuals, but also because the likelihood of recapturing an individual from the census period increases. As “r” increases, N decreases.
2. How did the resulting population estimates differ between the low effort and high effort groups?
	1. Again, answers will vary, but in general, the high sampling group should get much closer to the actual population size of 100. Additionally, this group should be more precise, with much less variability if you have multiple groups for each high and low effort.
3. What can we conclude about the amount of effort we put in to sampling a population?
	1. More effort is more accurate!
4. Fisheries managers use Mark-Recapture population estimates to calculate the number of fish that can be harvested on a system. The Black Lake system allows a seasonal annual harvest of 1.2% as described in the Black Lake Management Plan. Based on your calculation of the male population size in Black Lake, what would a hypothetical harvest number be?
	1. See excel sheet for calculation. N = 629 individuals; 629 \* 0.012 = 7.5 males
5. A major assumption of a mark recapture model is that you have an equal likelihood of catching fish during the marking and recapture periods. Lake sturgeon females do not return to the river to spawn annually, but rather spawn every 3-4 years. How might this affect you calculated population size if female data were included?
	1. You would not have equal likelihood of an individual being captured in the marking period and the census period. As such, your likelihood of recapturing an individual would be much lower. As “r” decreases, N increases. You would overestimate the number of individuals.
6. The actual calculated population size of Black Lake Male Lake sturgeon in 2018 was 637. How does your calculated population size compare?
	1. It’s close: 629 individuals compared to the actual number of individuals calculated (637).
	2. If you’re interested, this number comes from a much more complex mark recapture model from: Pledger S., E. Baker and K.T. Scribner. 2013. Breeding return times and abundance in capture-recapture models. Biometrics. 69:991-1001. It’s a neat read!
7. Bonus question: A 95% confidence interval is an estimate of where the calculated sample mean (or in this case, estimated population size, N) would fall if we took repeated samples. The 95% confidence level loosely quantifies the level of confidence with which one can expect to find the true population size in the calculated interval. In short, the 95% confidence interval quantifies uncertainty in our calculation of the population, as we cannot be 100% confident in the population size unless we sample every single individual fish in a system. The wider the interval, the greater the uncertainty in our sample collection. We can decrease uncertainty by increasing sample effort.

Utilizing a “normal approximation,” one can calculate the 95% confidence interval of Lincoln-Peterson mark-recapture estimate as follows. For this population, calculate the 95% confidence interval. Does the true population size (calculated in question 6) fall in this interval?

* 1. See excel sheet for full calculation, broken down step by step.
	2. Lower Limit: 558
	3. Upper Limit; 720