GRTS workshop attendees,  
  
I wanted to follow up on our discussion about estimating total abundance in spsurvey. Several of us including myself were surprised to learn that it was necessary to first convert fish abundance data to density in order to accurately estimate the total abundance in spsurvey. As suggested by Don Stevens, I created a simple example in R to explore this question. The data and R code is attached as a .zip file and .wip file (for ODFW).  
  
The attached example data set is based on one of the examples provided by Olsen and Kincaid. I assigned an abundance of 100 fish to all possible samples in the population. I also calculated density for each sample by dividing the abundance by the length of stream represented by each sample. I then drew an equal probability sample of size n=10 from the population. The true total abundance was 42,900; true mean abundance = 100; true mean density = 0.052.  
  
The estimated total and mean for abundance reported by spsurvey was 82,248,810 and 100 respectively. Note that the estimated total for abundance was equal to the total stream length (822,488.1) times 100, which is an overestimate of the true abundance by over 3 orders of magnitude. However, the mean abundance was accurately estimated as 100.  
  
The estimated total and mean for density reported by spsurvey was 39,945 with 95% CI [24,869, 55,022] and 0.049 with 95% CI [0.030, 0.067]. Note that the estimated total using density as the response variable was close to the true total abundance of 42,900 and the true value was contained within the estimated 95% confidence interval. Also note that the estimated mean density was close to the true mean density of 0.052 and the true value was also contained within the estimated 95% confidence interval.  
  
The take home message is, Dr. Stevens was right. Never question Dr. Stevens! If you input raw abundance data without first dividing by the length of the river segment that each sample point represents, the resulting estimate of total abundance will be grossly overestimated. If you're interested in estimating a total abundance from density values reported in fish/area rather than fish/length, it would probably best to estimate mean density in spsurvey and then extrapolate outside of spsurvey to a total using the total area of stream in your frame.  
  
I would add that this subtle detail is not clearly explained in the documentation that I've read and could result in some major errors by naive GRTS users.  
  
If any more mathematically or statistically savvy individuals on this mailing list discover an error with what I've done here, please let me know.  
  
Casey Justice  
Fishery Scientist  
Columbia River Inter-Tribal Fish Commission  
729 NE Oregon St., Suite 200  
Portland, OR 97232