An Invitation to Examine the FHWAR Survey

Jerry Vaske and Jay Beaman

Introduction

One of the coeditors of HD, Vaske, has long been interested in accuracy and reliability of survey estimates. Much of his work on accuracy and reliability has been with Beaman, who has been independently involved in research on accuracy and reliability of tourism data (e.g. see Beaman et al. 2001; Beaman, Hill and O'Leary 2002). Both HD editors have been working with practitioners on making data more useful and their appropriate use. This has led to the consideration of the utility of various data. Such considerations lead to the belief that devoting an issue of HD to an examination of the Fishing Hunting and Wildlife Related Activity (FHWAR) Survey, here referred to as FHWAR. It has been a source of data on fishing, hunting and wildlife related activities since 1955.. The involvement of BOC (Bureau of Census) in survey design, data collection, processing and weighting suggests certain statistical criteria have been rigorously met. For example, the survey meets requirements for being part of UofMichigan ?? data archives. Also, BOC provides coefficients for determining the reliability of a variety of estimates made directly from the FHWAR data and estimates made using 2 or more of those estimates.

Purpose

This "article" is really a call for papers for the winter 2005 issue of HD. The reason for the article is to provide information on subject matter areas that require treatment, or at least, will benefit from relevant information being consolidated for use by HD readers. Vaske and his students are circulating this "call" to directors of state fish and wildlife services (just USA states because these people are clients for the data), asking about uses of the data, issues related to their use and unstructured comments on FHWAR. Results of this survey will be in the special issue. Several parties (e.g. Washington people responsible for FHWAR and a couple of state F&W directors) are being invited to contribute to the special issue. All other articles will be a result of this call and be subject to peer reviewed. Though we would like to see matters raised in this article covered, submissions addressing use of FHWAR will be accepted or rejected based on the review process.

Some information on the FHWAR

As of 1991 the methodology was changed somewhat to deal with recall error (Chu et al. 1992). This new methodology has been employed, with "minor" variations, in 1996 and 2001; and is slated for use in 2006. We refer to "minor" variations because reports are clear in pointing out that "--- use exact quote from 2001 national report that cautions re trends" (FHWAR 2001—

The sportsman file has over 25,000 cases with over 3700 variables for each (some calculated from other data).

Estimates

Some readers may not be sure what we mean when we refer to an estimate. Here estimate is just used in relation to surveys. It refers to numbers such as total Wyoming residents fishing, their total expenditure, total days fishing (e.g. in Wyoming), proportion of a population (e.g. of Wyoming residents) that fish (e.g. in their state of residence), etc. Some estimates are determined by using responses given in a survey. For FHWAR getting the total number of Wyoming residents who fished involves adding up "sportsman weights" for all who specified 1 or more days of fishing. Because FHWAR is for age 16+, the proportion of Wyoming residents fishing would be obtained by dividing the "total fished" estimate by e.g. a BOC estimate of the 2001 population of Wyoming 16+. Other estimates involve computations involving 2 or more estimates (e.g. the proportion of those that fished that fished on more than 10 days in 2001).

Accuracy of Estimates and Bias

When we refer to an estimate being accurate two ideas are actually involved and this can result in confusion. When told an estimate is accurate most users of such information probably have the disposition to think that the estimate is close to the correct value of what is being estimated. If the estimate is 101,112, the total number for fishing licenses bought by Wyoming residents for fishing in Wyoming, one might look at the estimate and assume it is at least within 1 or 2 thousand of the actually sales. In their official statistics Wyoming 128,166 resident licenses sold. This number is within 10,000 of the FHWAR estimate of 121,000 anglers in Wyoming in 2001 (FHWAR 2001 WY). However, processing data on the FHWAR 2001 CD gives 121,232 anglers in Wyoming but only 97,853 of those actually fishing in Wyoming. The point is that one aspect of accuracy is comparing apples to apples.

Now given that 128,166 is the accurate value for license sales, is what has been termed a standard (Beaman 2002; Beaman, Vaske and Miller forthcoming) and given that the value of it of 101,112 estimated using FHWAR data would not differ much if the survey were replicated, 128,166-101,112 gives one an idea of the bias in the FHWAR estimate. Stated differently, when one uses the FHWAR survey to estimate license sales for Wyoming, one expects to be in error by about 27,000. A statistician would refer to bias being 27,000 while someone else would simply, and correctly, refer to expecting the FHWAR estimate to be low by about 25%.

Reliability of Estimates

The last section has avoided introducing the idea of statistical reliability. It is important that readers who work with scales and scale reliability not be confused by the use of the term reliability here. Beaman, Huan and Beaman (2004) discuss statistical reliability issues for tourism data. There and here statistical reliability is use in the sense that it is used in the physical sciences. That is it refers to variability of an estimate when it is repeatedly determined. The repeated determination concept of reliability is presented in Appendix D of FHWAR reports (starting page D-6). In discussing variability that would occur with replications of surveys it is mentioned that non-sampling errors arise from refusal to participate, different interpretations of questions, intentional incorrect responses, etc. (p. D-4). Such factors are reasons for a bias of 28% low such as introduced in the last section. In the FHWAR report (p. 2 ?? both national and WY) it is stated that FHWAR for 1991, 1996 and 2001 can be compared because "these three

surveys used similar methodologies" but 2001 results should not be compared with those "from Surveys earlier than 1991 because of changes in methodology". In other words, bias in the earlier surveys may be different. The discussion makes it clear that statistical reliability, that BOC provides formulas for calculating, is variability of the estimate with any bias in it included and not contributing to variability (bias is the difference between the correct value of an estimate and the average of possible estimated values of it and is therefore a constant for a survey designed and administered in a given way).

Using a BOC's formula to get approximate values of the reliability, standard error, of estimates allows one to see the importance of being able to estimate reliability. There is a description of how to determine that the standard deviation in the estimate of 37,805,000 persons 16+ either fishing or hunting in the United States in 2001. By using "formula (1)" it is determined that the approximate standard error of the estimate is 365,500. Therefore, "the average estimate derived from all possible samples lies within" 365,500 of 37,805,000 for 68% of samples. In other words, it lies within about 1% of the estimate about 68% of the time and within 2% (≈1.96*1%) about 95% for 95% of possible samples. This may seem quite acceptable, however because state samples are about 1 50^{th} as large, comparable estimates have reliability inflated by about $(1/50)^{-.5}\approx 7$. This means that a state with and estimate of say 800,000 must accept that there is a 1/20 chance that repeated surveys would yield an average over 900,000 or below 700,000.

Now, you will recall that there was mention earlier of using 1991-2001 data for trends Trend information from 1991 to 2001 is presented in Appendix B. Let us consider what a trend shows if it is computed for persons 16+ either fishing or hunting in the United States in 2001 (e.g. for x_{2001} compared to x_{1996}). From BOC reliability estimates we know that the standard error in x_{2001} is about 1%. Assume that it is about the same for 1996. If this is the case, statistical theory allows you to infer standard error in the difference used

to calculate a rate by equation 1 is $(2)^{.5}\approx 1.41$ times 1% (see Beaman, Huan and Beaman 2004 or Beaman and Tompson 2004 for more on trend reliability). Ignoring variability associated with dividing by an estimate, one concludes that the standard error in the rate is 1.4%. However, this percent means that if 2% growth is estimated about 68 times per 100 the average rate for many surveys would be below .6% or above 3.4%? Are numbers with such variability good information for decision making? Now, if you are a state, consider that instead of 1.4% you face 10% (≈7*1.4%). You really know nothing unless you observe very large changes (e.g. over 10%).

Bias Change and "minor" Methodological changes in surveys

Technical problems in using FHWAR data and data structure

Consistent names for "similar" responses over time with value and variable labels/formats supported over time.

Files that support analysis.

Estimating standards as a step in getting unbiased estimates

The invitation

This presentation has focused on matters related to “how good” FHWAR statistics are. There is no intent to have a special issue of HD that only addresses such matter. We would hope that there would be articles that address bias and reliability. For example an article or articles that compared FHWAR estimates to standards. However we would also hope that there would be articles that address “usability” considering accuracy, reliability