Permit Theory

Ben Buzzee, Biometrician, ADFG

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First, we observe that the total number of permits issued can be split into three groups:

where:

* is the number of compliant households that responded without a reminder or after the first reminder
* is the number of households that responded after the second reminder
* is the number of households that never responded.

We will assume that is a population of “noncompliant” households and is a random sample from said population. Further, note that , and the harvests from those households are fixed and known. We only need to estimate the harvest of households that never responded.

Since the permit holders making up are a random sample, both and share the same population mean harvest and proportion of permit holders that fished. So we will use observations from to estimate those parameters. From the households making up , we will estimate:

* as the proportion of that participated in fishing: = where is the number of households responding to the second reminder (mailing = 2) that reported fishing.
* and as the average harvest **among those that fished**: over households

And by the central limit theorem:

follows a distribution with

and is with where

So the estimated number of non-respondents that fished is: and the estimated total harvest by non-respondents is . Our estimated variance of the harvest estimate is then:

by Goodman (1960)

Finally, our estimated total harvest would be where both and are known. Since they are both known, the total variance would be the same as above.