

**ESTIMATES,  
TOTAL COUNTS,  
SAMPLE  
COUNTS,  
MODELS AND  
ARITHMETIC**

**Basic Census  
Methods**

Overton and Davis recognize five categories of basic census methods. Direct Count: The term direct refers to counting the animal itself rather than some related object such as tracks. This is the most obvious way to determine the number of individuals in a population. An attempt is made to count all individuals and this type of complete count is called a census. Two types of census are generally recognized: (1) spatial and (2) temporal censuses. By definition "A spatial census is one in which a count is made of all the animals in a specified area at a

specified "point" in time."

Included in the spatial census are drive counts and territory mapping methods.

Territory mapping has been used for wild turkey, quail, song birds and ruffed grouse. In some cases this is the mapping of a true territory, which in the definition of behaviorists means a defended area. In other situations it involves mapping some-thing intermediate between a home range and a territory. For example, among wild turkeys the individual flocks are distinguished by flock size, sex and age composition special track or body-color characteristics. These separate flocks are plotted on maps in an attempt to avoid duplicate counting of some groups. The investigator makes

use of his own observations as well as those of cooperators (persons working or living in the area of interest). Modern radio telemetry equipment has permitted considerable refinement in territorial mapping methods.

Drive counts have been used for deer, pheasants, and for prairie chicken on booming grounds. They are used to survey deer within enclosures and to sample habitat with well-defined boundaries. In states where road systems are laid out on the square mile this unit is used as the boundary of the area to be surveyed. This technique requires considerable manpower but inexperienced groups such as scouts, prison labor, and school classes are normally

used. Observers are stationed on three sides of the square mile and count all deer passing to their right between them and the next observer. Other observers line up on the fourth side of the square mile and walk through it driving the deer past the counters. The "drivers" count all deer which run back through the drive line.

"A temporal census is one in which the spatial dimension is a "point" and the count is made of all animals passing the point during some interval of time.

Examples of this type of census would be counts of migrating deer passing a given point, sandhill cranes leaving a roost or salmon moving up a fish ladder.

Another type of direct count is the **Extermination or**

## **Total Capture Method.**

For big game it has rather restricted use and is expensive. It is a useful technique for censusing rodents in small areas. This method refers to censusing the trappable portion of the population. Some direct counts are called “**pseudo-sample**” censuses. A pseudo-sample refers to census over portions of a study area for which the boundaries have not been delineated. The King Method for censusing grouse and the Hahn Method for deer are examples of this type of pseudo-sample. The acreage sampled has been determined in several ways. Using the Hahn census method the observer walks or rides a horse along a transect line and records all the deer he sees.<sup>7</sup> The acreage surveyed is the area in

which the observer feels deer would have been visible from the transect line.

In the **King Method** the sample width is twice the distance from either the observer or a point on the transect line to the point where the grouse was flushed.

If the population being studied dwells in an area too large for a complete inventory then sampling becomes necessary. There are several types of sample census. Basically they are censuses conducted on only a part of the space or time dimension of the population. The portion sampled is assumed to be representative of the total population and a statistical estimate of the entire population can be made from the sample. Five basic sampling schemes are

possible. Simple Random Sampling requires that the space or time component of the population be subdivided into equal units. Each subunit should have an equal probability of being selected for sampling. A table of random numbers, sampling dice or other means may be used to select the sample units.

**Stratified Random Sampling** requires some prior knowledge of the population so it will be possible to subdivide the study area into separate homogenous sub-populations. For example, one might know from previous experience that rats were extremely abundant in slum areas, moderately abundant in industrial areas, and low populations were present in the suburbs. With this meager information it is

possible to define three strata or levels of rat populations within a city. Now we can take random subsamples of each strata, selecting our sampling units just as we did in the Simple Random Sampling Method.

**Stratified Random Sampling** has the advantage of providing data on subdivisions of the population. It generally means greater precision for the entire population estimate. For a given degree of accuracy it requires less sampling than the Simple Random Sample Method.

**Systematic sampling** is simply a situation where sampling units are spaced at regular intervals. As an example, the study area might be marked off in grids and every fourth or fifth grid sampled. This method

is appropriate where distribution of the population is homogenous.

### **Two-stage sampling**

is commonly used where very large populations are to be censused such as the statewide raccoon population. **The Simple Random Sample Method** could be used to determine which counties would be sampled. Within the chosen counties a random sample would then be taken of a certain number of smaller land units. Two-stage sampling is basically a means of working down to a sampling unit of manageable size.

**Double sampling** is a modification of the Two-stage Method whereby on the county level one might count the number of raccoons seen along the road as roadkills.

This extensive sample would then be strengthened by intensive sampling on smaller land units to determine what type of population density contributed to the associated count of roadkilled raccoon.

**Roadside counts** are commonly used census methods for rabbits, pheasants, turkey, deer and other species. They can be applied to a statewide population and normally are used only to detect population trends. These figures could be expanded to provide estimates of the entire population if the observer knew how the roadside populations related to the populations of the remainder of the habitat.

This survey is repeated annually and provides information on trends that is useful for setting

hunting seasons. A study by Shaw indicates the amount of effort necessary for a given accuracy.

He used roadside counts to measure trends in the turkey population on a 500-square-mile study area. ' driving 3,400 miles of survey each year he was able to detect changes of 25 percent in trend figures which were significant at the 90 percent confidence level.

Roadside counts are influenced by factors such as season, food supply, weather and condition of roadside cover. To minimize the influence of these variables the inventory is standardized so it will be comparable from year to year. The same routes are used each year, during the same time interval and at the same driving speed.

Adjustments may be made for weather and other factors that would influence the count. Overton and Davis<sup>18</sup> refer to these corrections as **"calibration."** For example, if doves are likely to be seen three times as frequently during a wind velocity of 5 miles per hour than they are at a velocity of 15 miles per hour, then an appropriate correction could be made so census figures would be comparable from year to year.

Frye's Strip Census for quail and Time-Area Counts for squirrel are other **pseudo-sample censuses.**