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Capture-Recapture.
Capture-recapture, also called *mark-recapture*, is a method for estimating the size of a population, as follows: Capture and mark some members of the population. Take a random sample from the population (recapture), and count the members of the sample with marks. The fraction marked in the sample estimates the fraction marked in the population. The estimated size of the population is the number marked in the population divided by the fraction marked in the sample. For example, suppose that 1,000 members of a population were marked, and that in a random sample of 500 members of the population, 200 had marks. Then the 1,000 marked members of the population comprise about 200/500 = 0.4 of the population, so the population size is about 1,000/0.4 = 2,500. Laplace was the first to use capture-recapture to estimate the size of a population—that of France in 1786 (Cormack, 2001). Capture-recapture has several crucial assumptions:

1. The sample (recapture) is a simple random sample from the population. So every population member must have the same chance of being in the sample, and the chance that a given member is in the sample cannot depend on whether the member was marked. This is called the *independence assumption*; violations cause *correlation bias*.
2. The population of marked and unmarked individuals is constant between capture and recapture (no births, deaths, immigration or emigration).
3. The marks are unambiguous.

Refinements of the method try to account for population changes, unequal probabilities of recapture, time-varying probabilities of recapture, "trap effects," and so on (Cormack, 2001; Otis et al., 1978; Pollock et al., 1990). Capture-recapture is sometimes used to estimate the size of animal populations, and has been adapted to estimate other population parameters, such as survival rates (Lebreton et al., 1992). Capture-recapture is the basis for a method that has been proposed to adjust the U.S. Census for undercount; see CENSUS ADJUSTMENT.

References:

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