

### Jolly-Seber Mark and Recapture

Jolly-Seber method extend the mark and recapture method to open populations. The biggest change in the sampling procedures over the Schnabel method is the inclusion of the information of when a marked individual was last captured.

#### Advantages:

- Both Peterson and Schnabel assume closed populations, Jolly-Seber uses an open population (permits for birth, death, immigration, and emigration).
- The time interval between samples need not be constant, any number of samples (at least three!) can be accommodated so that series of data extending over many years can be used in the method.

#### Assumptions:

- Every individual has the same probability ( $\alpha_t$ ) of being caught in the  $t^{\text{th}}$  sample, whether it is marked or unmarked.
- Every marked individual has the same probability ( $f_t$ ) of surviving from the  $t^{\text{th}}$  to the  $(t+1)^{\text{st}}$  sample.
- Individuals do not lose their marks, and marks are not overlooked at capture.
- Sampling time is negligible in relation to the intervals between samples.

$$\hat{\alpha}_t = \frac{m_t + 1}{n_t + 1}$$

$$\hat{M}_t = \frac{(s_t + 1)Z_t}{R_t + 1} + m_t$$

# Natural Resource Biometrics

$$\hat{N}_t = \frac{\hat{M}_t}{\hat{\alpha}_t}$$

$\hat{\alpha}_t$  is a estimate of the proportion of the population that is marked.  $M_t$ s an estimate of the marked population just before sample time  $t$ .  $N_t$  is an estimate of the populations size at time  $t$ .

Table 1. After Krebs, 1989, page 38, Table 2.2 Mark-recapture Data for a series of 11 samples of a field vole (*Microtus pennsylvanicus*) population in Southwestern Yukon

Time of last capture	Time of Capture										
	1	2	3	4	5	6	7	8	9	10	11
1		15	1	0	0	0	0	0	0	0	0
2			15	0	1	0	0	0	0	0	0
3				37	2	0	0	0	0	0	0
4					61	4	1	1	0	0	0
5						75	3	2	0	0	0
6							17	4	0	0	0
7								69	0	0	0
8									8	1	0
9										14	0
10											19
<b>Total marked (<math>m_t</math>)</b>	0	15	16	37	64	79	81	76	8	15	19
<b>Total unmarked (<math>u_t</math>)</b>	22	26	32	45	25	22	26	15	11	12	3
<b>Total caught (<math>n_t</math>)</b>	22	41	48	82	89	101	107	91	19	27	22
<b>Total released (<math>s_t</math>)</b>	21	41	46	82	88	99	106	90	19	26	22

The dotted section represents the Z6 area and the gray section represents the R6 area.

## Also See:

Chapter 2 - Estimating Abundance: Mark-and-Recapture pages 30-37 in:

**Krebs, C. J.** 1989. Ecological Methodology. Harper and Row, Publishers. New York. 654 pp.

**Zar, J. H.** 1996. Biostatistical Analysis. Prentice-Hall, Inc. Englewood Cliffs, New Jersey. 718 pp.

