Box 3.4 Example of Stratified Random Sampling

A grid was superimposed on the map of a shallow lake, and all grid cells were classified as being in one of three depth strata (0–2 m, 2–4 m, >4 m). Ten grid cells were sampled in each depth stratum, and at each site the catch of age-0 yellow perch in a throw trap (assumed to be equally efficient at all sites in the lake) was recorded. The goal of the sampling program was to estimate the mean density of age-0 yellow perch.

Table Catch of age-0 yellow perch at three depth strata within a shallow lake. Variance in parentheses below mean.

0–2-m stratum		2–4-m stratum		>4-m stratum	
Catch and mean	(Catch – mean)²	Catch and mean	(Catch – mean)²	Catch and mean	(Catch – mean)²
0	2.89	4	1.21	7	1.69
2	0.09	2	0.81	5	0.49
2	0.09	3	0.01	7	1.69
2	0.09	5	4.41	7	1.69
3	1.69	2	0.81	5	0.49
1	0.49	4	1.21	5	0.49
3	1.69	1	3.61	7	1.69
2	0.09	3	0.01	6	0.09
2	0.09	2	0.81	3	7.29
0	2.89	3	0.01	5	0.49
1.7 (1.122)		2.9 (1.433)		5.7 (1.789)	

Within each stratum, the mean catch and variance were computed using formulae for a simple random sample (Table 1; Box 3.1 example). The lake contained 320 grid cells, which included 172 in the 0–2-m stratum, 80 in the 2–4-m stratum, and 68 in the > 4-m stratum, so the weight for each stratum (W_h) was

$$W_h = \frac{N_h}{N}.$$

$$W_{0\text{-}2} = \frac{N_{0\text{-}2}}{N} = \frac{172}{320} = 0.5375.$$

$$W_{2\text{-}4} = \frac{N_{2\text{-}4}}{N} = \frac{80}{320} = 0.250.$$

$$W_{>4} = \frac{N_{>4}}{N} = \frac{68}{320} = 0.2125.$$

The stratified mean catch was

$$\bar{y} = \sum_{h=1}^{L} W_h \bar{y}_h = (0.5375 \cdot 1.7) + (0.2500 \cdot 2.9) + (0.2125 \cdot 5.7) = 2.85.$$

The SE of the stratified mean catch per effort was

$$SE(\bar{y}) = \sqrt{\sum_{h=1}^{L} \frac{W_h^2 s_h^2}{n_h}} = \sqrt{\left(\frac{0.5375^2 \cdot 1.122}{10}\right) + \left(\frac{0.2500^2 \cdot 1.433}{10}\right) + \left(\frac{0.2125^2 \cdot 1.789}{10}\right)} = 0.222.$$

Approximate 95% confidence intervals can be computed (assuming normality) using the same approach as for simple random sampling (Box 3.1).

Guy and Brown 2007, Chapter 3