Technical detail from Chapter 15 by Hiby, E., Eckman, H. & MacFarlaine, I. in *The Domestic Cat* (3rd edition)

Cat population management

To estimate population growth rate the following formula is derived from the balanced equation that relates the number of kittens born in a population growing at a constant rate to the number of recruited females. The growth of the population over the interval between successive breeding times is calculated first. In populations with an annual breeding season that interval equals one year; however, in populations that are not limited to one annual breeding opportunity the interval is the reciprocal of the number of litters per year, $1/L$. The factor, λ, by which the population grows over such an interval can be calculated by iteratively solving the following equation:

$$\lambda = (S_b\lambda^{rL-1} + KS_j)^{1/rL}$$

where S_b is adult survival over one interval. Annual growth is then calculated as λ^L. Using this equation example 1 has an estimated annual growth rate of 1.01 and example 2 has a rate of 2.11; the growth rate of example 2 is thus more than double that of example 1. Similarly, the percentages of females that would need to be sterilised per interval to stabilise such populations are very different. This percentage equals $100(1 - m)$ where m can be calculated by iteratively solving the following equation:

$$m = \left(\frac{1}{KS_j\left(1/(1 - S_b m)\right)}\right)^{1/rL}$$

The formulae above are for a closed population; however, the value for adult survival can be reduced to allow for dispersal to surrounding areas in addition to mortality and for the number of females permanently adopted from the feral population and confined. Similarly, to allow for immigration from surrounding untrapped areas or from previously confined owned animals the average litter size can be increased by a factor reflecting the resulting increase in recruitment, for example by 1.2 if 20% of the recruits are immigrants.