- Effective population size rarely greater than twice the
- In general – skewed sex ratios do not have large effects on the Ne/N ration unless there is a large excess
- Small departures from 50:50 have little effect on Ne
- Lots of equations
- Effective population size (7.1) defined as reciprocal of the probability that two gametes come from the same parent (N_f = female)
- To adjust for nonrandom progeny contribution: $N_e = (4N-2)/(2+V_k)$
    - N individuals
    - K = number of gametes
    - N = next generation of the same size
    - V_k = reproductive variance
        - To maximize effective population size, minimize reproductive variance
- Combine middle two equations to get bottom equation
- Natural populations can fluctuate greatly in size
- Heterozygosity can be calculated using $h = (1-1/N_1)(1-1/N_2)(1-1/N_3)$
- Assume discrete populations (one parent one generation)
- Overlapping generations don't have huge impact
- Biological impacts of overlapping populations is significant
- 2 measures of effective population size: inbreeding effective population size (NeI) & Variance effective populations size (NeV)
    - NeI more related to the # of parents
    - NeV more related to the # of progeny
- Ne can be used to predict loss of heterozygosity or change in allele frequency due to gen drift
- Generation interval: estimated based on avg age of parents
- Loss of gen variation through time depends on effective pop size and gen interval
    - Important to incorporate generation interval in management strategies
- Chapter assumes population is isolated
- Measures of effective population size is similar for stable and isolated populations
- Greater variance of Ne in populations that migrate
- NeI and NeV poor indicators of the rate of gen drift in subpops affected by migration due to overestimate of gene drift rate and underestimate of local effective population size
- In large populations, census population size (N_c) is often easier to estimate than Ne (see figure 7.10)
    - N_b is the number of effective breeders
    - N_e is across time
    - Census size is much larger than however you want to measure effective population size
- Effective pop size can decline without decline in Nc
- # of effective breeders to N_c is usually within 0.1 - 0.5

Discussion Questions:

- Basically N_e can be substituted for all equations in Ch. 6; directly correlated to genetic diversity and heterozygosity
- What are some of the challenges that you may face when estimating effective population size?

        - Unknown info about species; info needed to estimate Ne
        - Very few organisms with discrete, non-overlapping populations
        - Prezygotic barriers (sperm protein detection by egg)
            - Generation time of coral = long
                - Based on chemical detection
        - Reproductive variance of individuals; non heterosexual organisms and some organisms lacking discrete gender or a means of discerning sex
        - Lots of info needed
            - # of males and females in population
            - Reproductive variance
                - Only really works with annual plants
- Means of identifying populations at higher risk of inbreeding depression = fragmentation; can cause many downstream effects
- Population size in big cats – one dominant male breeding with multiple females; can sex ratio affect deleterious traits and population size? No effect on deleterious traits but maybe pop size – "tiers of the cheetah"
- Using effective population size in the context of captive populations – increase effective population size in captive organisms by limiting the # of progeny produced by one individual to control genetic diversity
    - Inbreeding and outbreeding depression
    - Refer to $N_e = (4N-2)/(2+V_k)$
    - By each individual contributing the same # of progeny to the generation, they are attempting to minimize reproductive variance (V_k), thus maximizing effective population size
    - Sexual selection and mating behaviors may cause genetic drift
- Is effective population size and functional extinction related? – yes