Lecture 8

How many times should an organism reproduce?
Let's consider the extreme case - semelparity vs iteroparity
Semelparity - one reproductive event during life- span (=annual)
Iteroparity - more than one reproductive event during life-span. (=perennial)

Cole (1954) showed that all else being equal, a semelparous organism could achieve the same reproductive rate of population growth by simply increasing the number of offspring it produced by one greater than an iteroparous individual.
Example (see handout)

Not realistic because survival is never 1.0 for either juvenile survivorship in annual (semelparous), nor is adult survivorship in perennial (iteroparous) population ever equal to 1.0.

Let's change juvenile survivorship but make it equal for both semelparous and iteroparous species.
Where,
(Ba) = # of offspring produced by annual breeder.
(C) = juvenile survivorship
(Bp) = # offspring of produced by perennial breeder.
(P) = adult survivorship

so, with **same fecundity and juvenile survivorship** for both:
(Ba) (C) < (Bp) (C) + P
(10) (0.5) < (10) (0.5) +1 = 6 vs 5 for annual
but this time if we add one more offspring to annuals the result is different:
(11) (0.5) < (10) (0.5) +1
5.5 < 6, iteroparity wins

So, juvenile survivorship can affect the advantage in favor of iteroparity, even with adding one more offspring to annual fecundity, **all else being equal.**

What we need to consider is the survivorship of adults relative to that of offspring to understand the conditions under which semelparity and iteroparity may be favored:

We can rewrite our equation to read:
(Ba) C= (Bp) C + P, assuming C is constant in both then:
Ba= Bp +P/C,

Now, if **P is high** (adult survivorship of iteroparous species), for semelparous strategy to be equal or have an advantage over iteroparous form it will have to have higher number of offspring.

If **C** (juvenile survivorship) is low relative to **P**, then iteroparity is favored.
More realistic, Ba will be greater than Bp, so what are the conditions that will favor iteroparity?
e.g. where perennial fecundity is 1/2 that of an annual.

20=10 + 1/0.1
juvenile survivorship need only be equal or greater than 10 % before the perennial strategy is favored.

In general, if
Ba < Bp + P/C then, iteroparity is favored
Ba>Bp +P/C then, semelparity is favored

e.g. with some adult mortality (P= 0.5)
20=10 + 0.5/0.05,
juvenile survivorship need only be $\leq$ 5% before perennial strategy is adopted.

Conditions favoring iteroparity
adult survivorship is high
juvenile survivorship is low

Conditions favoring semelparity
adult survivorship low
Juvenile survivorship high

One last consideration not mentioned is the problem associated with variance – i.e. variation in fecundity and mortality associated with environmental factors – flood, fire, outbreak of disease, etc.

If variance in juvenile survivorship is high → iteroparity will be favored

If variance in adult survivorship is high → semelparity will be favored

May lead to "bet-hedging" strategy, iteroparous even when most of the time juvenile survivorship is high.
Also, semelparous organisms often have mechanisms to thwart variance in juvenile survivorship, e.g. seed banks where not all seeds germinate simultaneously.