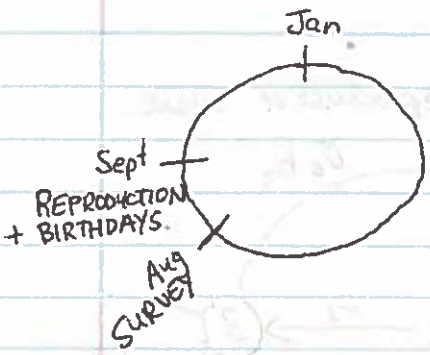
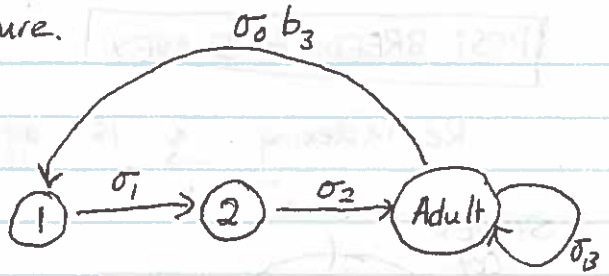
PRE-BREEDING SURVEY



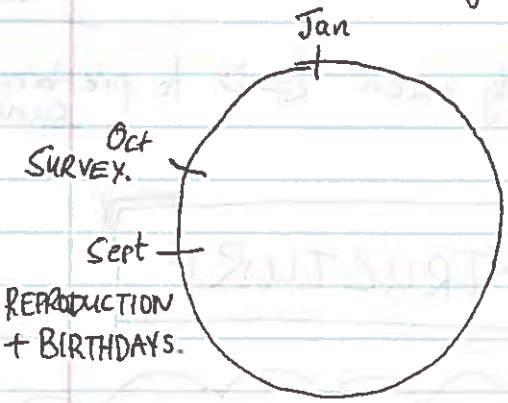
Age-structure.

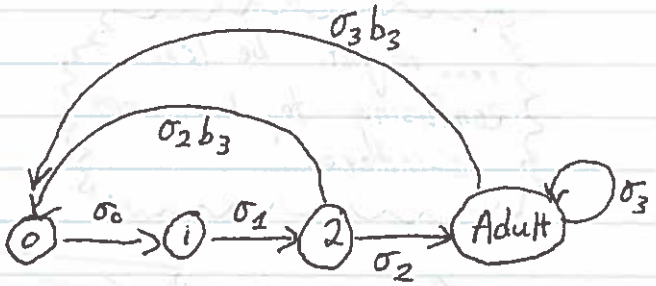


where b_i is the fecundity of ~~class~~ age i.
and σ_i is the survivorship of age i.

POST-BREEDING SURVEY

Age-structure.





- σ_3 appears on fecundity arrow since adults must survive to reproduce due to the timing of the census.
- Note, individuals that are age 2 at the survey, will be age 3 when the next reproductive event occurs.

IF THIS SEEMS TOO WEIRD AN OPTION IS TO redefine THE INDEX.

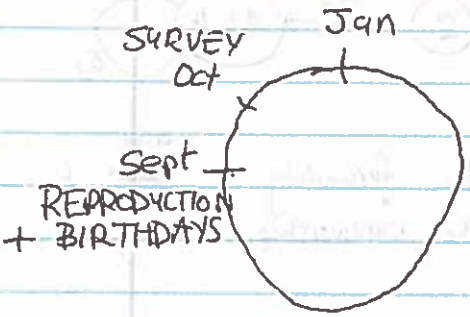
.... Let i be the age of individuals when the next reproductive event occurs.

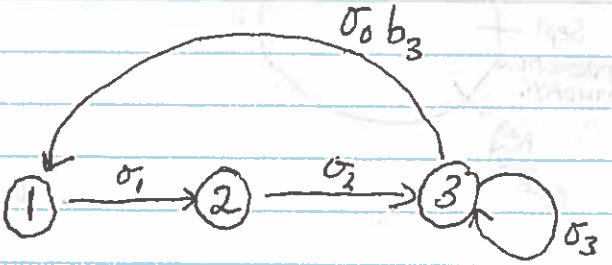
$\Rightarrow$ b_3 fecundity of ind. that will be 3 when the next reproductive event occurs .... but some of these individuals are 2 at the census.

POST-BREEDING SURVEY

Age-structure.

Re-indexing : i is age at next reproductive event.





σ_1 is prob. of surviving from age 0 to age 1 at census

$\Leftrightarrow$ age 1 to age 2 at next reproductive event.

.... might be less confusing to have not re-indexed.'

(pretty much $\Leftrightarrow$ to pre-breeding survey)

STAGE STRUCTURE

Let,

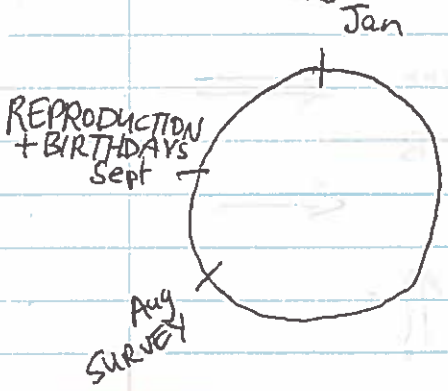
$P_J = \sigma_J(1-\gamma_J)$ prob of remaining a juvenile.

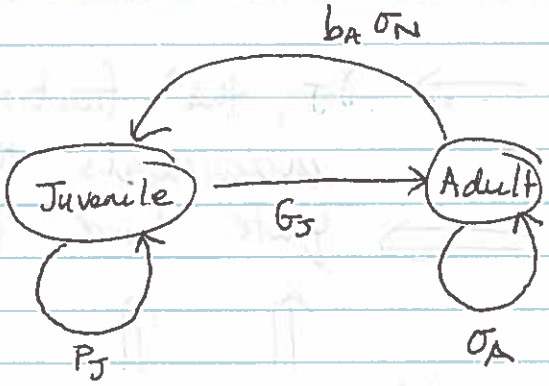
$G_J = \sigma_J \gamma_J$ prob a juvenile matures to an adult.

where γ_J fraction of surviving juveniles that mature.

see next page ↓

Pre-breeding survey

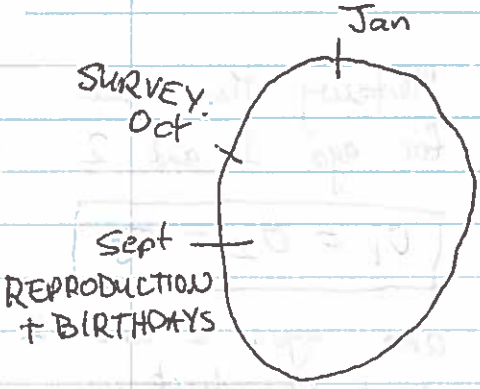


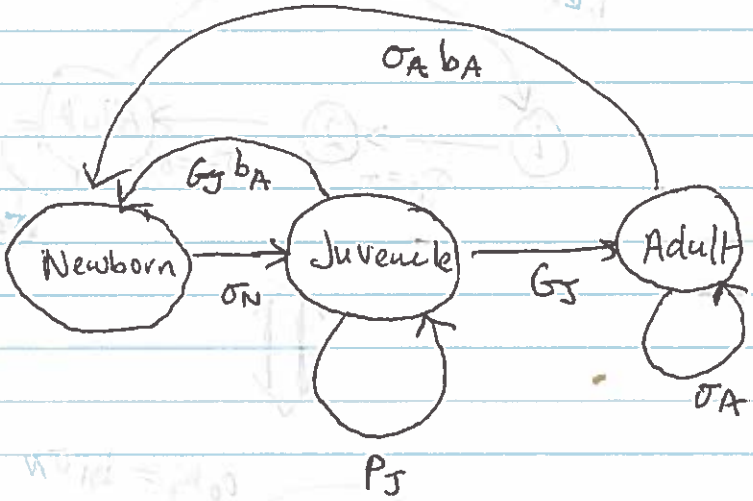


where σ_N is survival of newborn to ~~census~~ survey.

P_J and G_J were defined on page (2) at the bottom.

Post-breeding survey





.... SO STAGE-STRUCTURE is similiar to AGE-STRUCTURE, but we should note the definitions of P_J and G_J at the bottom of page 2

WAIT!!! ★ ★ ★ ★ there is one more important thing! ★ ★ ★

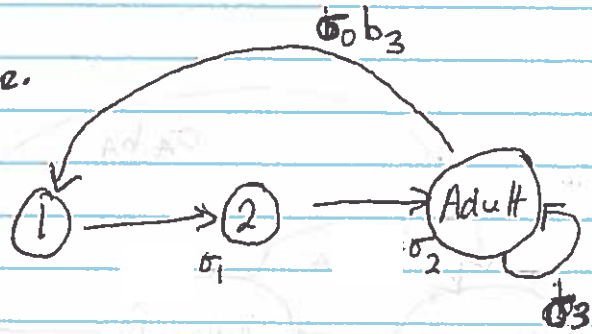
$\Rightarrow$ γ_J, the fraction of surviving individuals that mature is quite hard to estimate $\Leftarrow$

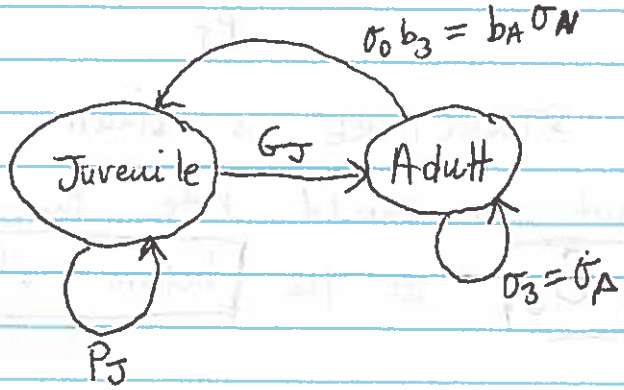
GOAL

Same intrinsic growth rate, λ, for an age-structure MPM and an equivalent stage-structured MPM.

??? What should γ_J be to achieve this ???

i.e.





with $P_J = \sigma_J (1 - \gamma_J)$

$G_J = \sigma_J \gamma_J$

What should γ_J the probability of Juv. $\Rightarrow$ Adult transition be?

(5).

- GOAL is to have λ be the same for age or $\Leftrightarrow$ stage formulation.

but γ_J depends on

~~stable~~ age structure within the juvenile stage

could calculate the stable age structure, but we'd need to know

the intrinsic growth rate, λ, and that depends on....

It's a  and  kind of problem

that is best solved with an iterative procedure on a computer. (e.g. in R)

"Assymptotic age-within-stage structure"

AAS iterative method.

- Guess λ
- Calculate stable age-structure
- Calculate γ_J
- Calculate new λ
- Calculate new stable age-structure

..... and eventually this procedure will start to give the same thing over and over .... then you can stop.

For complete details, references,
and a more precise explanation.

SEE

Kendall, B. E. et al. PERSISTENT PROBLEMS IN THE CONSTRUCTION OF MATRIX POPULATION MODELS. 2019
Ecological Modelling 406 : 33 - 43