URCHINS:

Age-structured model of Urchin population abundance:

Ct=not population size dependent

A=attack rate

conversion efficiency

P=kelp

N=urhcins

F=fishing mortality (incidental and otherwise)

M=mortality

S=survival

Beta- moves into the next size class at a rate

D=detrital supply rate

S=mortality

Catch conversion to mortality:

1. Recruitment (beverton holt)
2. loss due to fishing and natural mortality (Barnov catch equation- not sure if this is right, had to change it from discrete)
3. growth of population in reference to kelp consumed ???
4. transition into the next size class (determine gamma using method Holly described in her email).

Growth rate over time (I have the parameters)

Discrete version?:

Questions:

How do I determine gamma from a personal growth rate? / growth rate is age structured

I know how long it takes for one to get from one group to the other (units?)

How do I make the consumption size specific (would that make the conversion rate size specific?

X amount of individuals are eating kelp at Y rate and growing(personally) at Z rate

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| --- | --- | --- | --- | --- | --- |
| Size bin | Age | Consumption rate at size D | Growth rate at size D |  |  |
|  |  |  |  |  |  |
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|  |  |  |  |  |  |

r= Recruitment/population growth

a=age (in years)

k= growth rate constant

gamma= growth rate

c=size dependent consumption rate\*24 (per day)

1: recruitment

2: mortality (fishing and natural) and growth (here am I double accounting for death?)

3: growth from eating kelp

Where do I put in the conversion from kelp to urchin?

Din<- 63.38

K<- .327 #growth rate constant

a0<-0

diameter <- function(a) {

D <- Din\*(1-exp(-K\*(a-a0)))

*based on growth rate:*

a=age; d=growth constant (.327); Dinfinity=Maximum diameter (63.38 mm)

*exponential decay function based on fishing-based mortality (F) and natural mortality (D)*

*: Mt=*

Maybe cMt could = Mt/Mmax (the highest abundance of kelp possible or 90th percentile kelp abundance,

or kelp necessary for biomass growth 🡪 (Mt/number of urchins across all the size classes \* necessary amount of kelp needed for an urchin to grow)

fecundity goes on the top line and then diagonal of survivability

deterministic and discrete

probability of maturity will be