Estimation of Population Parameters and MSY-based Reference Points for Sidestripe Shrimp (*Pandalopsis dispar*) in Fraser Delta, British Columbia

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Objective

To Derive MSY-Related Reference Points through Modelling Approach

Approach

Use Survey Data (May-Aug 1998-2018) and Commercial Catch Data to Estimate:

Growth Model Parameters

Length-Weight Model Parameters

Natural Mortality (M)

Stock-Recruitment Model Parameters

Study Area: Fraser Delta

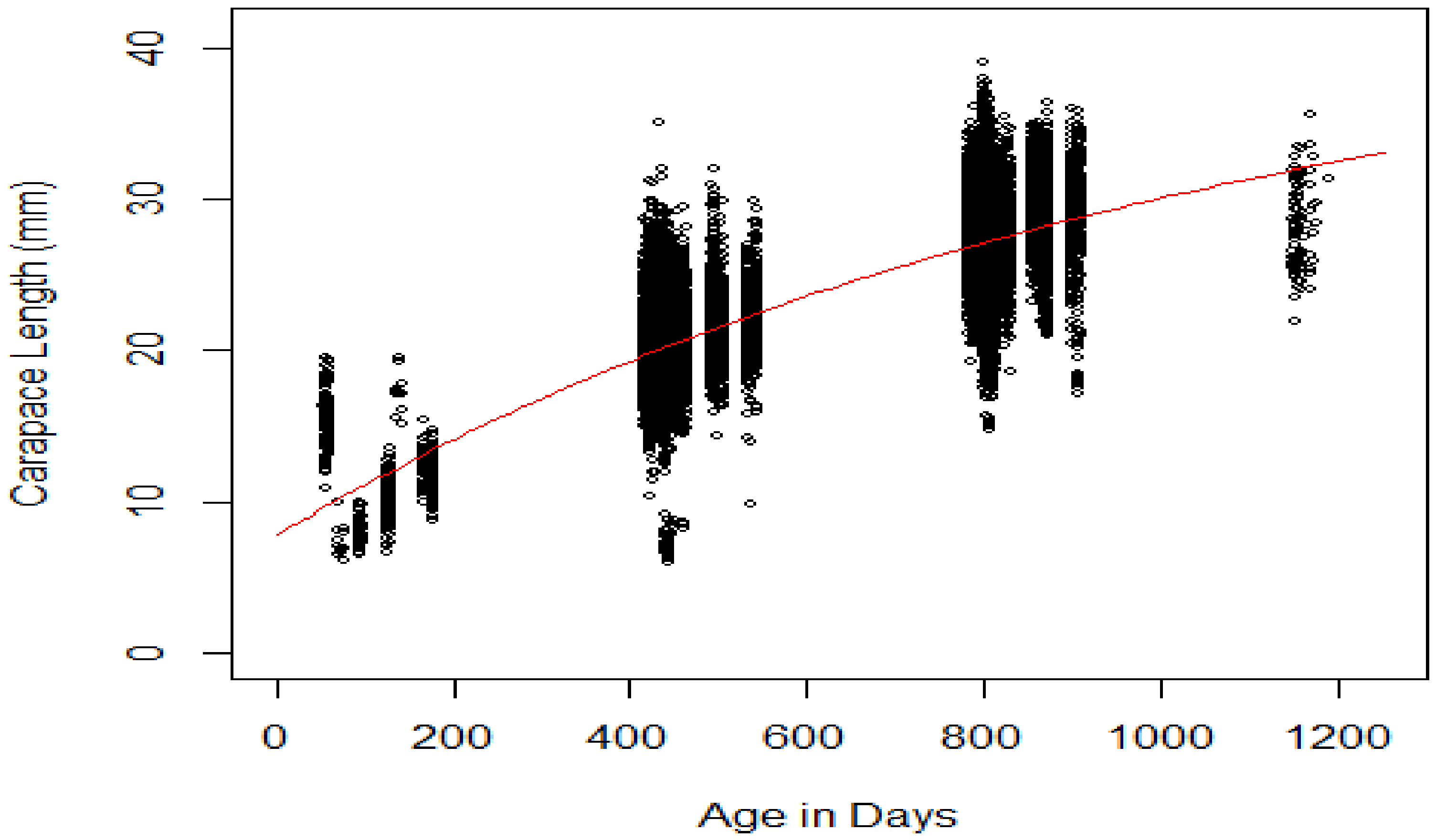
Biology of Sidestripe Shrimp

- Spawn in late fall of year y
- Eggs hatch between March and April in y+1
- Larvae -> immature males by July in y+1 (S0)
- Immature males -> mature males in y+2 (S1)
- Transition into female in Apr-July in y+3 (S2)
- Mature female in y+3 (S3)
- Egg-bearing female in y+3 (S4)
- Egg-released female in y+4 (S5)

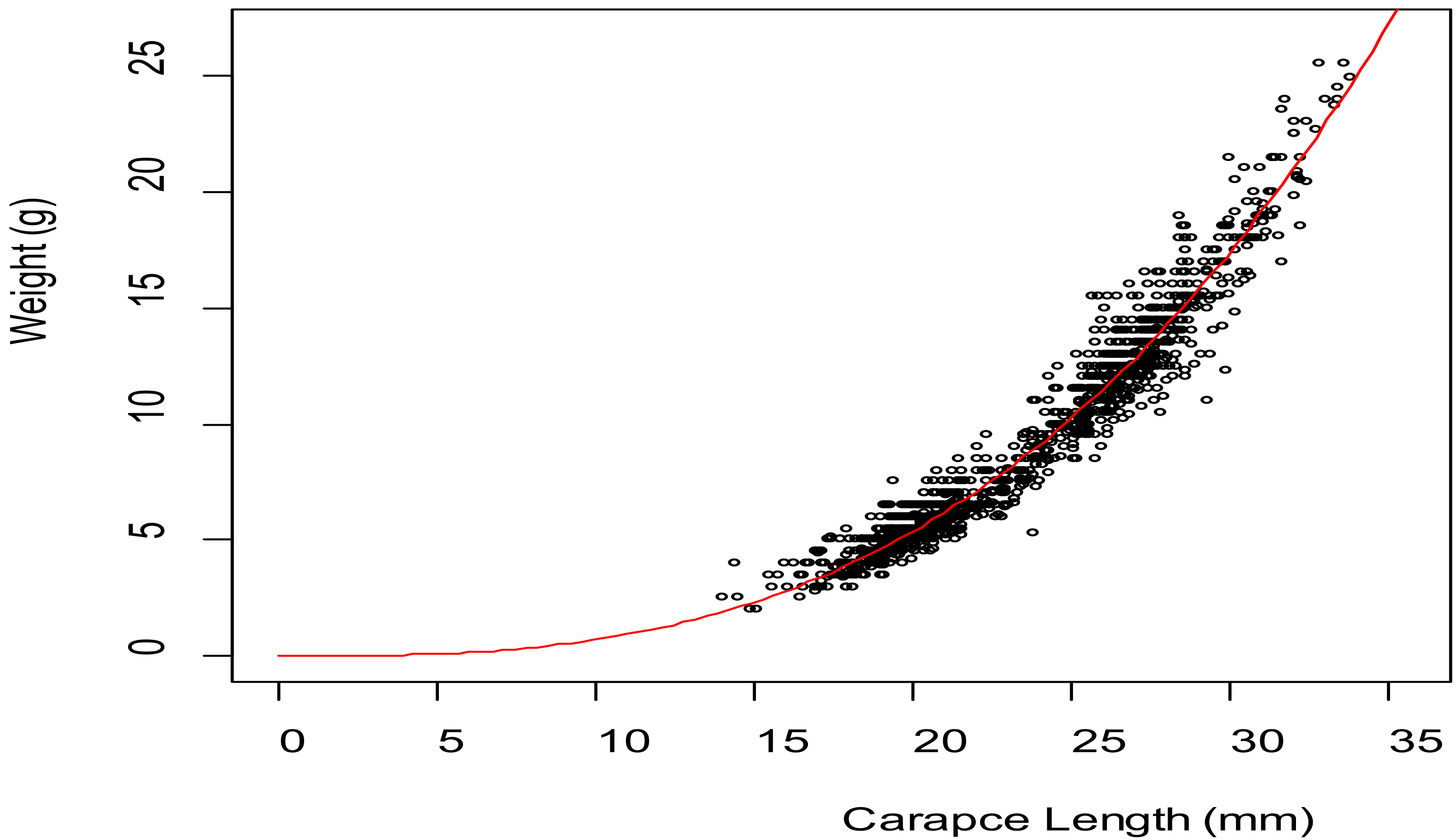
Age Determination

$$
\begin{cases}
A_0 = dif\left(d/m/y, \quad 1/4/y\right) \\
A_1 = dif\left(d/m/y, \quad 1/4/y-1\right) \\
A_{2,3,or\,4} = dif\left(d/m/y, \quad 1/4/y-2\right) \\
A_5 = dif\left(d/m/y, \quad 1/4/y-3\right)
\end{cases}
$$

Growth Model



Length-Weight Model



Estimation of M

- S1 in year y -> S2-3 in y+1
- Estimate Removal of S1 by Fishery
- Predict abundance of S-23 in y+1
- Comparing Survey-derived Abundance of S2-3 with the predicted Abundance of S2-3 -> M
- M = 0.24 (Reported Range: 0.2-1.0)

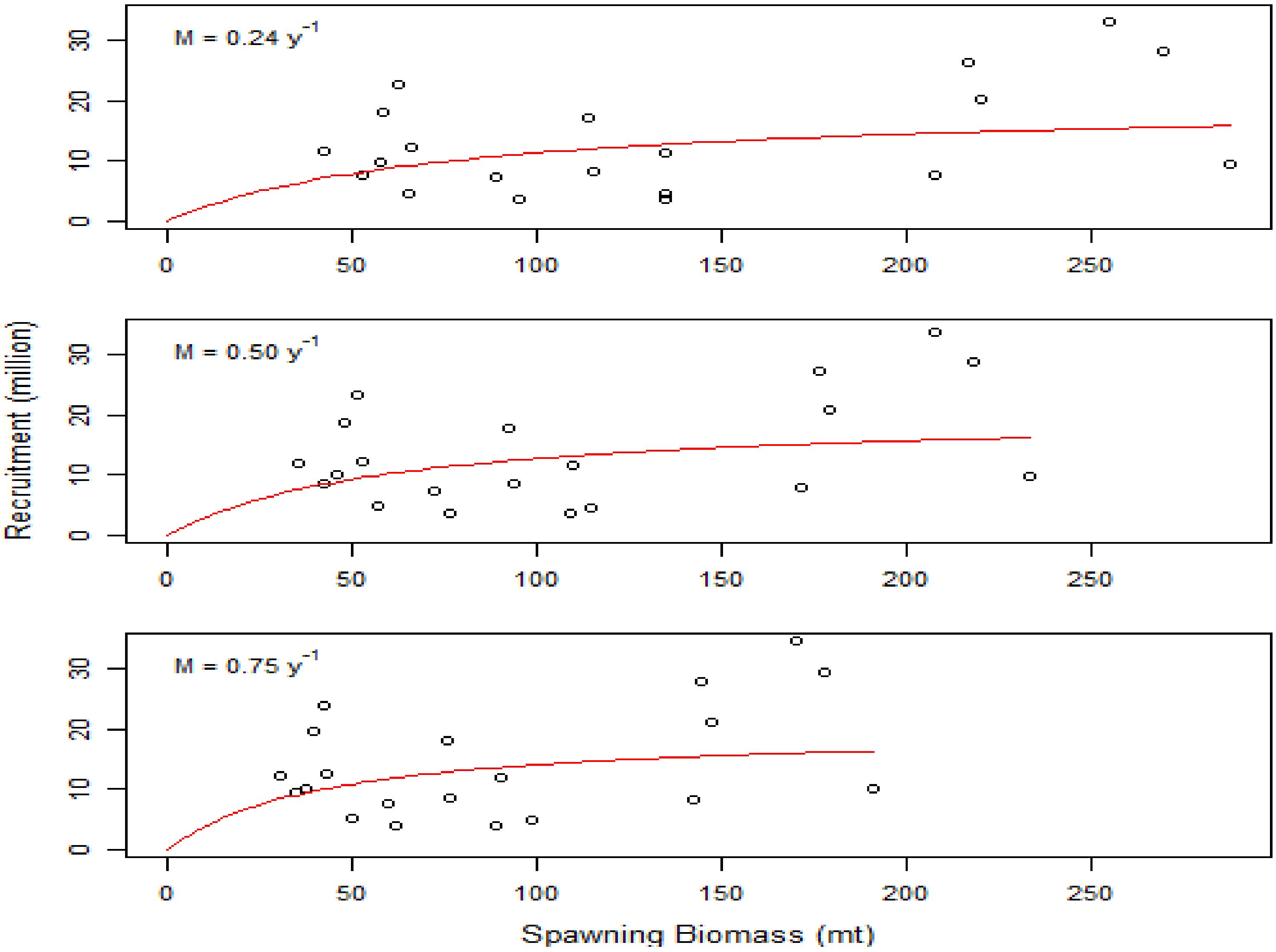
S-R Model

- Estimate biomass of S5 shrimp on Apr. 1
- Estimate abundance of S1 shrimp on May. 28
- Fit $R_{y+1} = \frac{\alpha \times SB_y}{\beta + SB_y}$

α maximum possible recruitment

β spawning biomass to produce 0.5 α

Stock-Recruitment Relationship



Problem

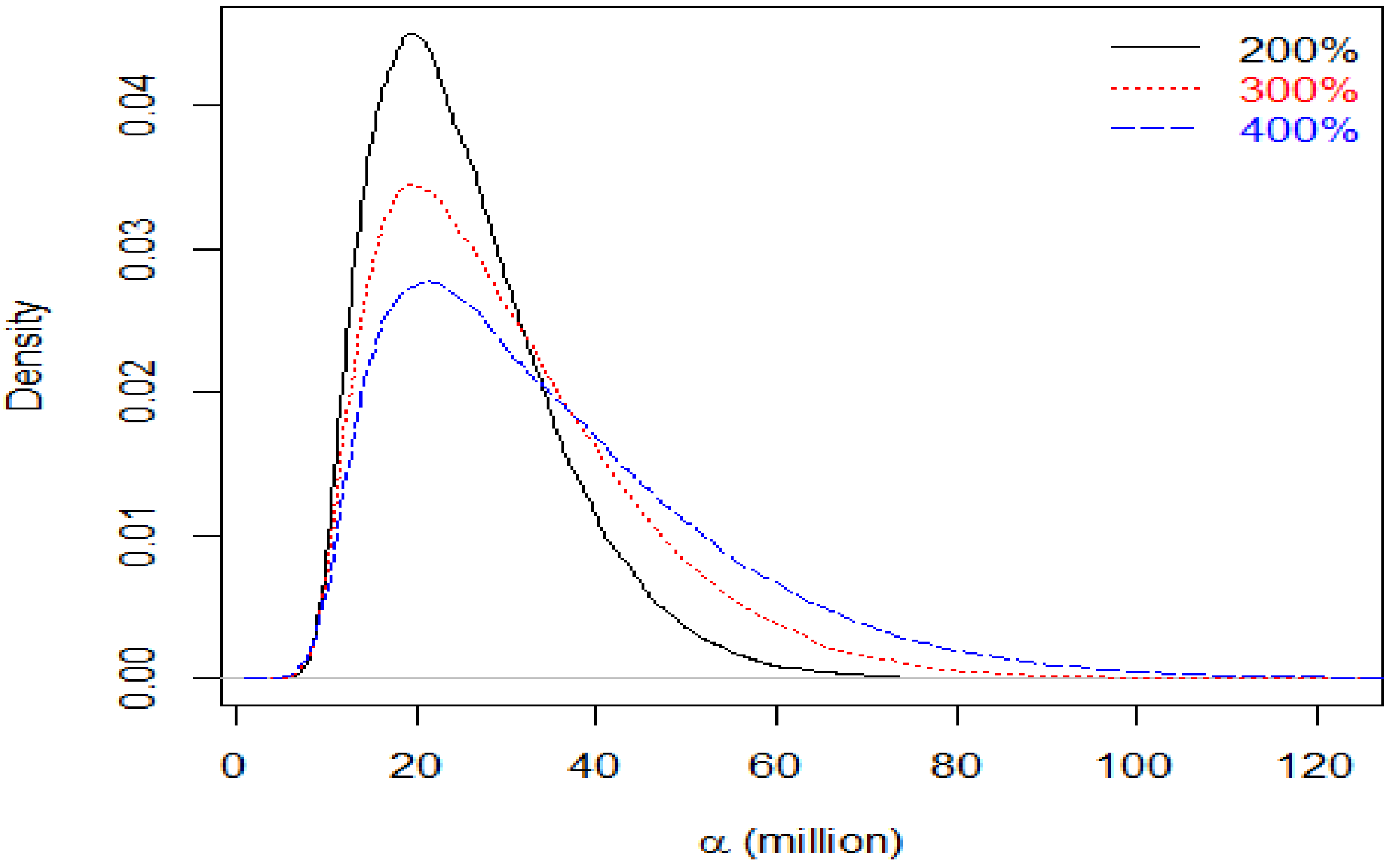
- Uninformative Priors on α and β
- Shape of S-R Curve cannot be well determined
- Data have information on α , not much on β

Approach

- Uniform prior on α
- Relatively informative normal priors on β

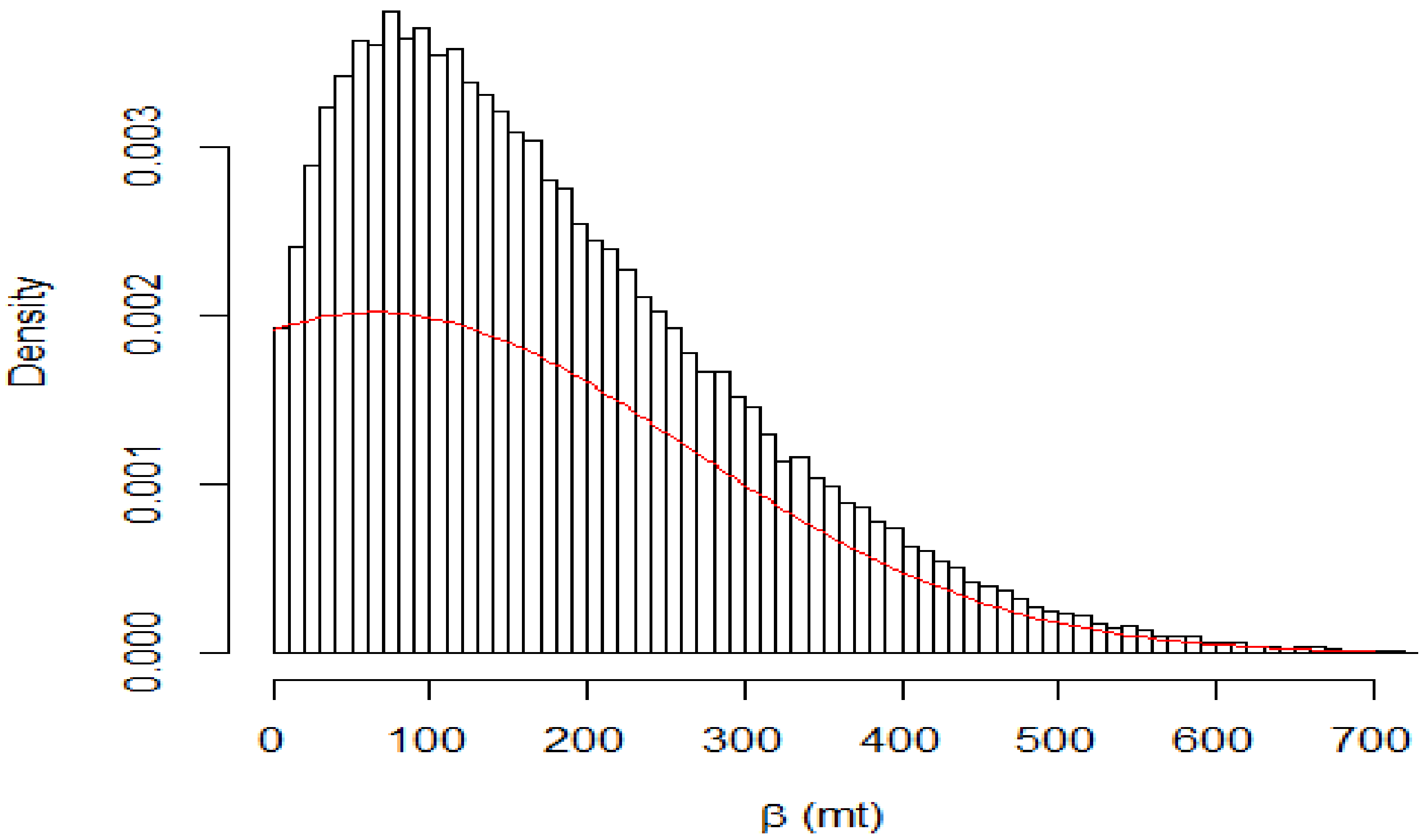
    CV: 200, 300, 400%

Alpha

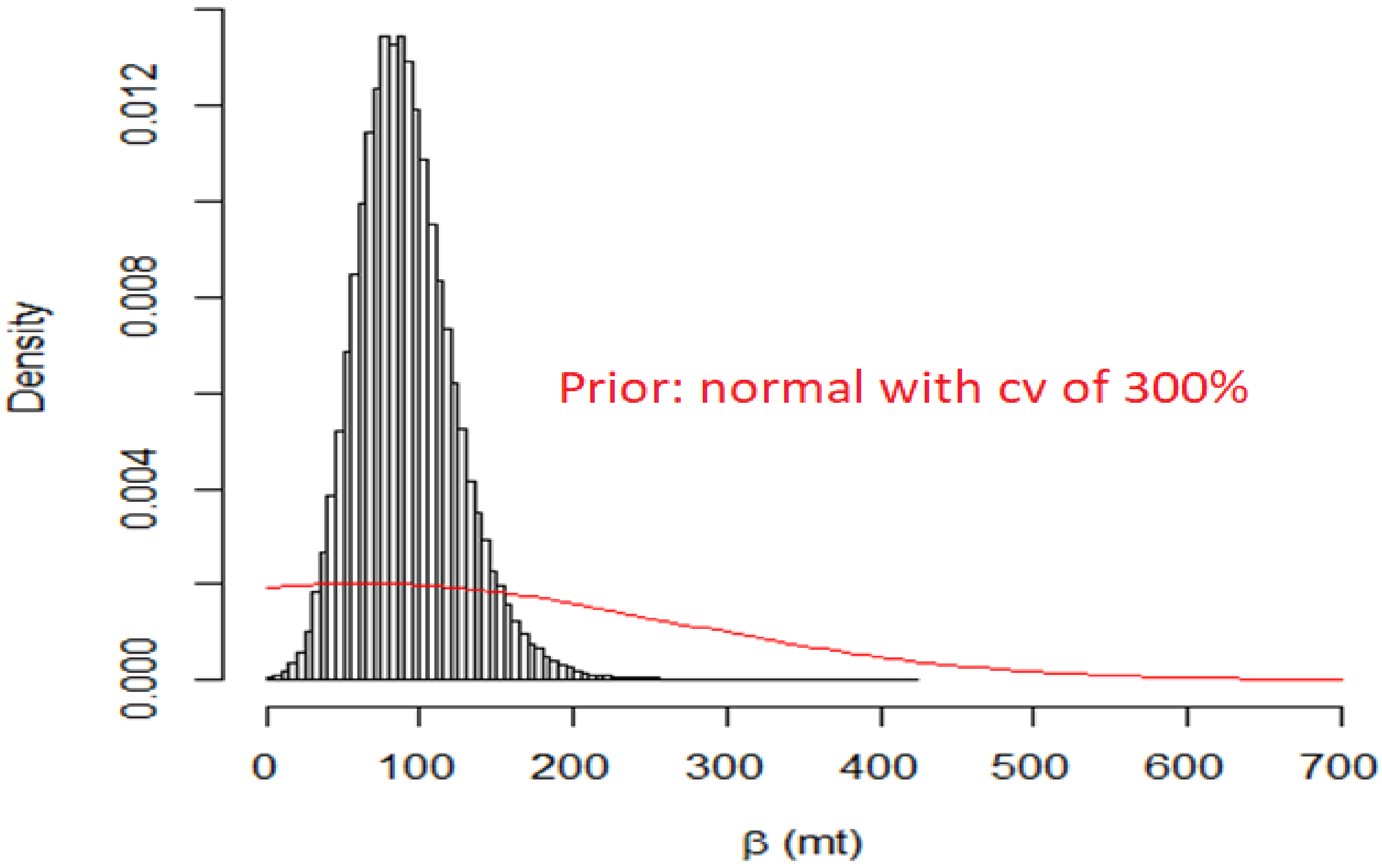


200%
300%
400%
Density
0.00
0.01
0.02
0.03
0.04
0
20
40
60
80
100
120
α (million)

Beta



Fix Alpha to the Mode



Derive RPs by Projection to Equilibrium

- Set a Fishing Rate
- Start with a spawning biomass (SB)
- Produce recruitment (R)
- Let “shrimp” grow, undergo M and Exploitation
- Repeat the process until equilibrium reached
- Record the amount of Equilibrium Catch
- Set another F, and repeat
- The maximum recorded catch -> MSY

MSY-Related RPs

RP	M=0.24	M=0.50	M=0.75
MSY (t)	37.12	23.50	13.54
Fmsy	0.31	0.26	0.22
SBmsy	63.19	39.58	21.73

Reported Catch: 8-67 t (mean 33 t)

THANKS!