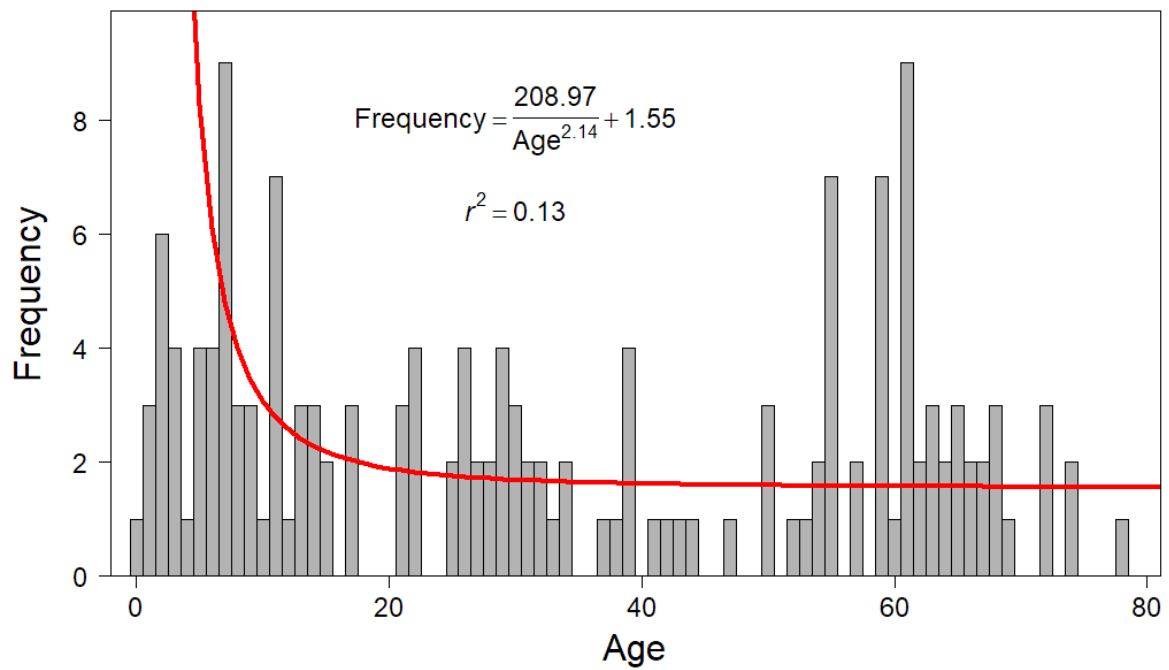


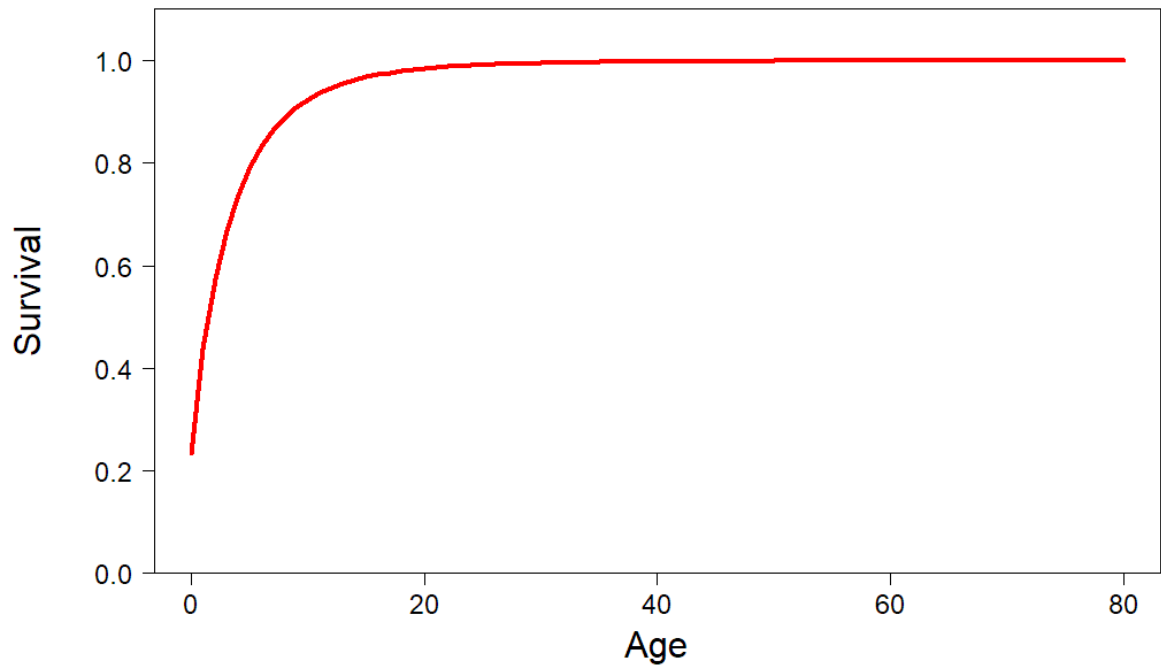
# Supplementary material

$$\begin{bmatrix} 0 & 0 & 0 & \cdots & 0 & R_{10} & R_{11} & \cdots & R_{78} & R_{79} & R_{80} \\ S_1 & 0 & 0 & \cdots & 0 & 0 & 0 & \cdots & 0 & 0 & 0 \\ 0 & S_2 & 0 & \cdots & 0 & 0 & 0 & \cdots & 0 & 0 & 0 \\ 0 & 0 & S_3 & \ddots & 0 & 0 & 0 & \cdots & 0 & 0 & 0 \\ \vdots & \vdots & \ddots & \ddots & \ddots & \vdots & \vdots & \cdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & \ddots & S_9 & 0 & 0 & \cdots & 0 & 0 & 0 \\ 0 & 0 & 0 & \cdots & 0 & S_{10} & 0 & \cdots & 0 & 0 & 0 \\ 0 & 0 & 0 & \cdots & 0 & 0 & S_{11} & \ddots & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \cdots & \vdots & \vdots & \ddots & \ddots & \ddots & \vdots & \vdots \\ 0 & 0 & 0 & \cdots & 0 & 0 & 0 & \ddots & S_{78} & 0 & 0 \\ 0 & 0 & 0 & \cdots & 0 & 0 & 0 & \cdots & 0 & S_{79} & 0 \end{bmatrix}$$

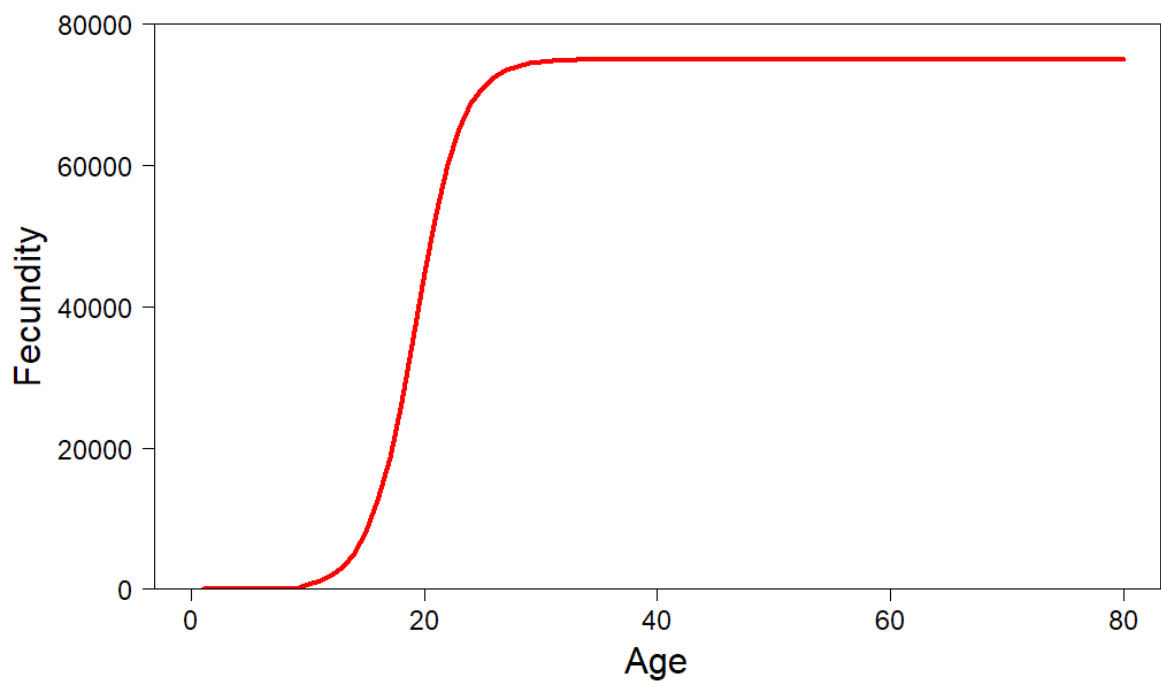
**Figure S1:** Projection matrix construct for the lungfish population model.



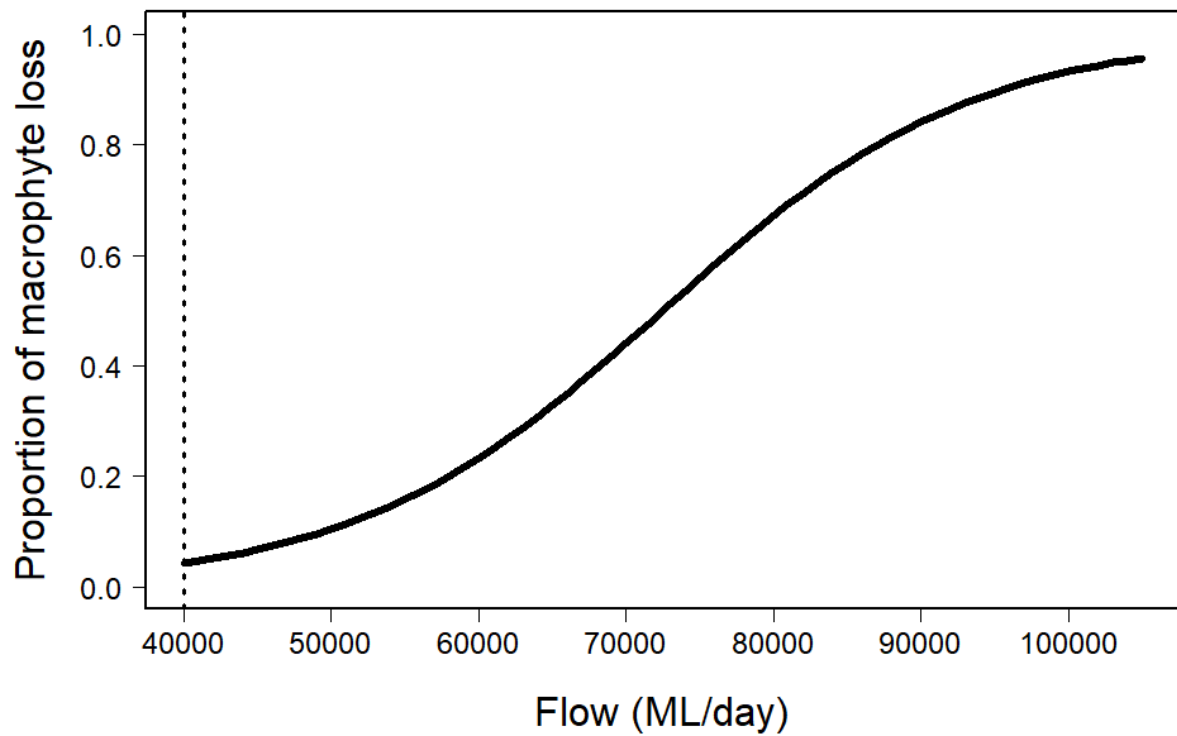
**Figure S2:** Age-frequency data and regression line to estimate age specific survival.



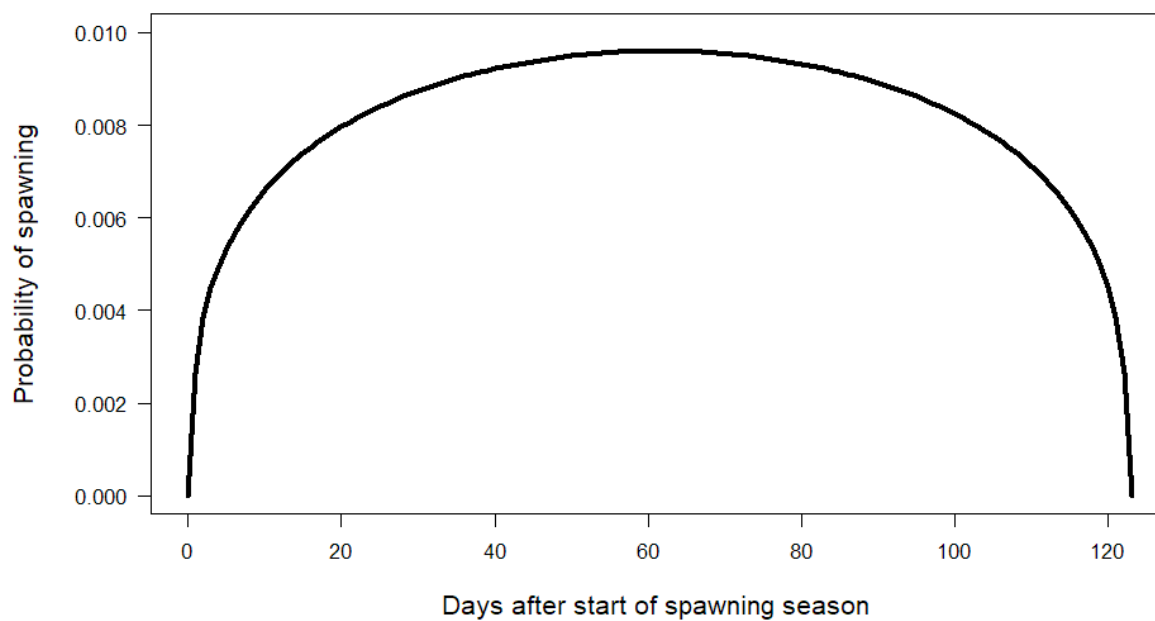
**Figure S3:** Survival rates by age, survival at age 1,  $S_1 = 0.2331$ .



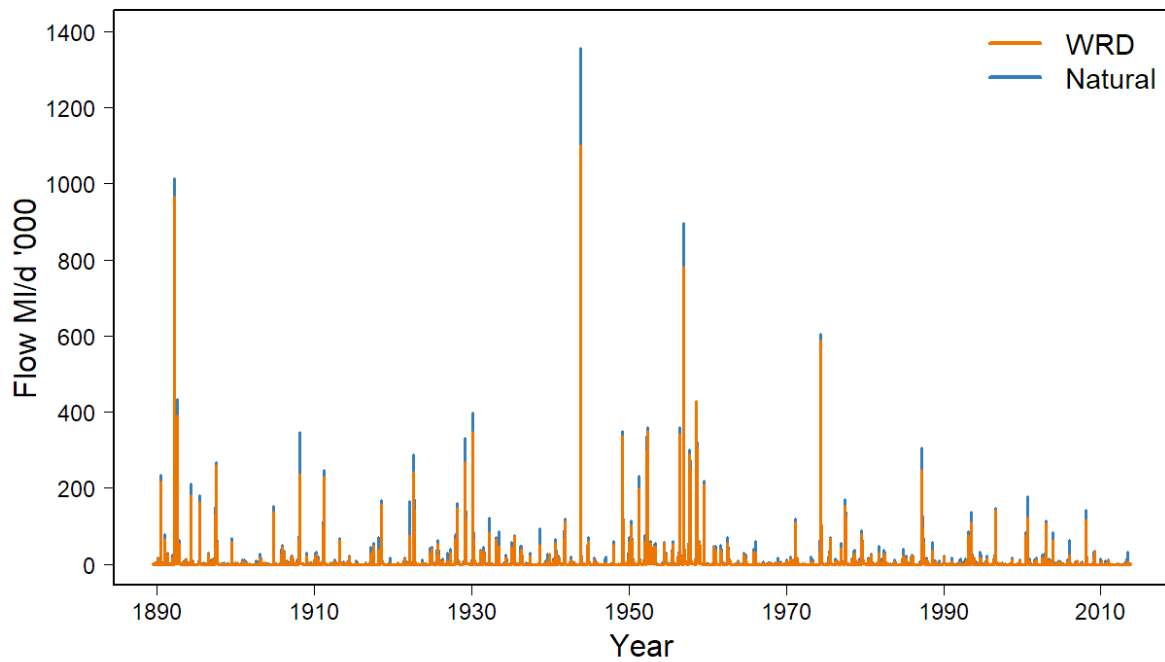
**Figure S4:** Age specific fecundity increasing from age 10 with a maximum fecundity of 75,000 eggs.



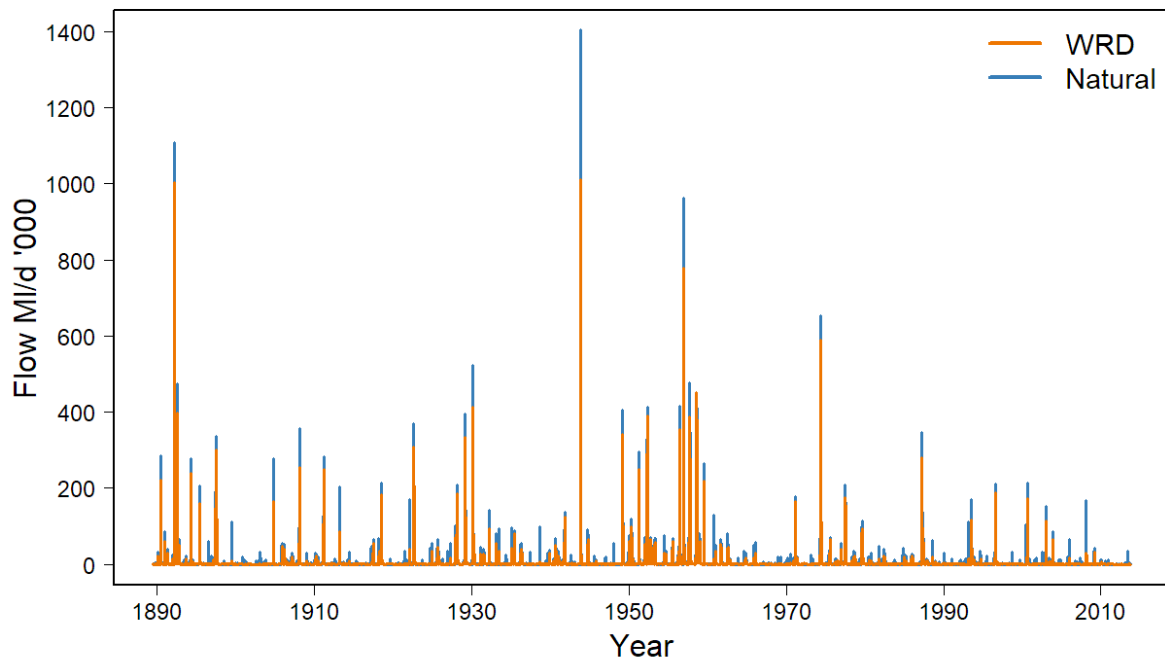
**Figure S5:** Proportion of macrophyte cover lost after large flows in the Burnett River, there is no loss of macrophyte cover for flows less than 40,000 ML/day.



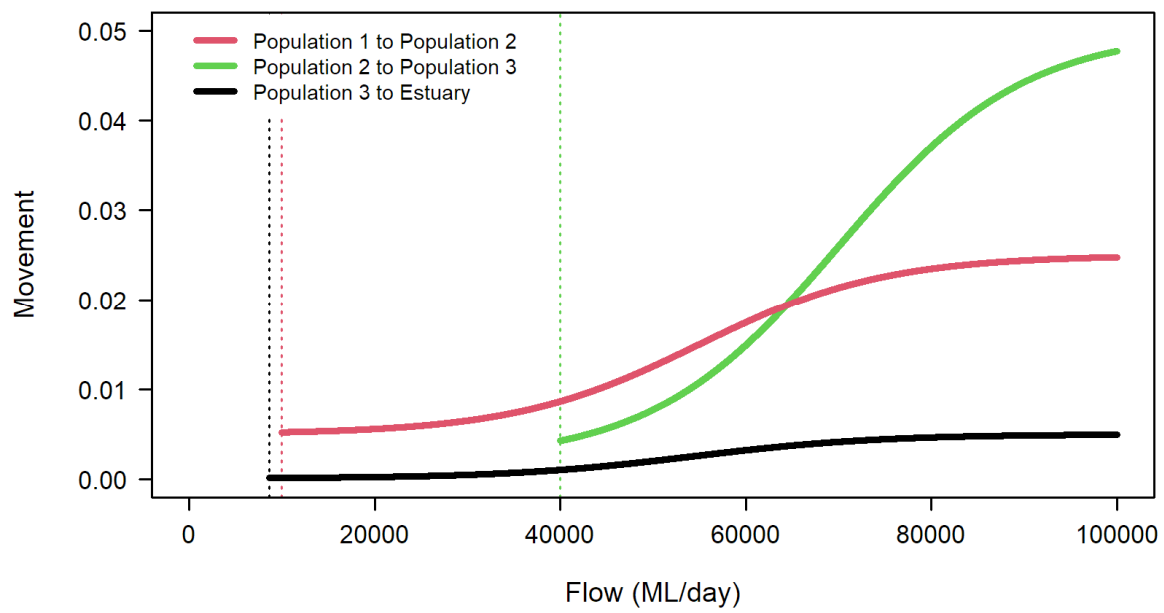
**Figure S6:** Probability of spawning on a given day in the spawning season (August 1 to November 30).



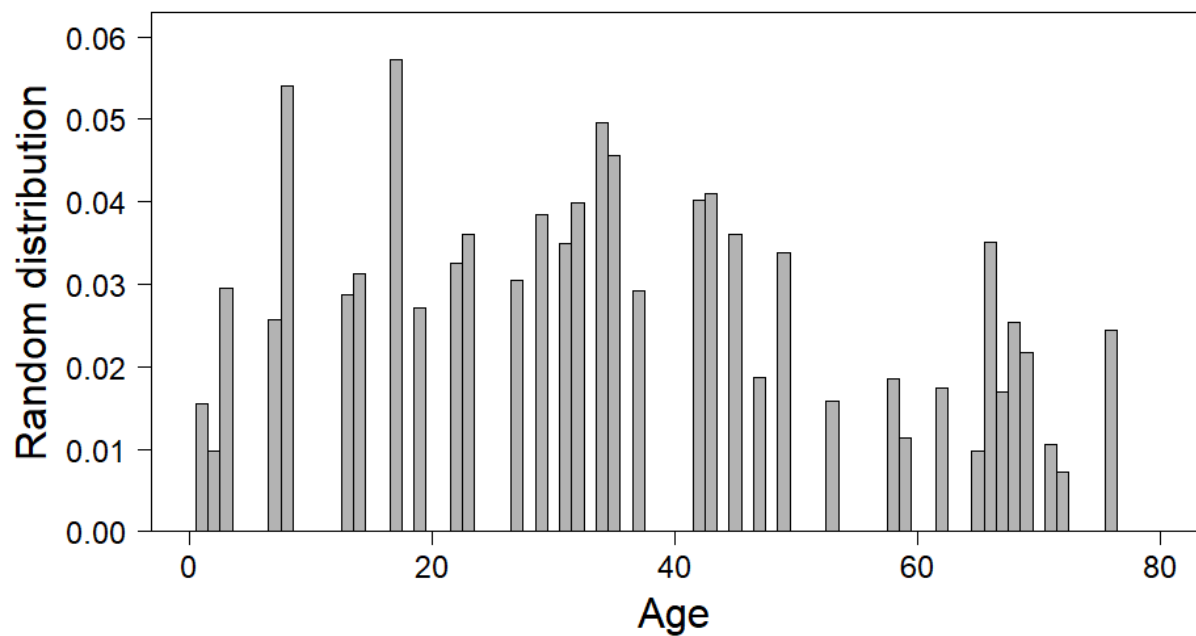
**Figure S7:** Daily flow for the Burnett River at Mt Lawless: orange – modelled *WRD* flow and blue – modelled *Natural* flow.



**Figure S8:** Daily flow for the Burnett River at Figtree: orange – modelled *WRD* flow and blue – modelled *Natural* flow.

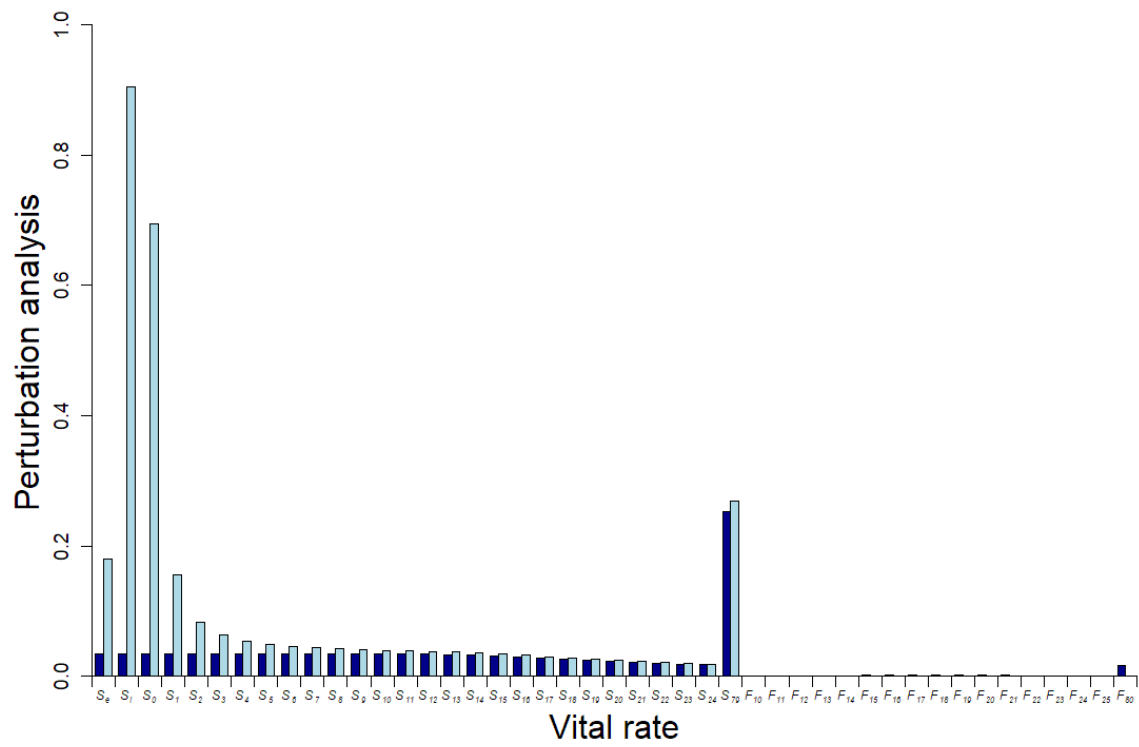


**Figure S9:** Daily downstream movement from each population in the Burnett River, there is no movement for flows to the left of the dotted lines.

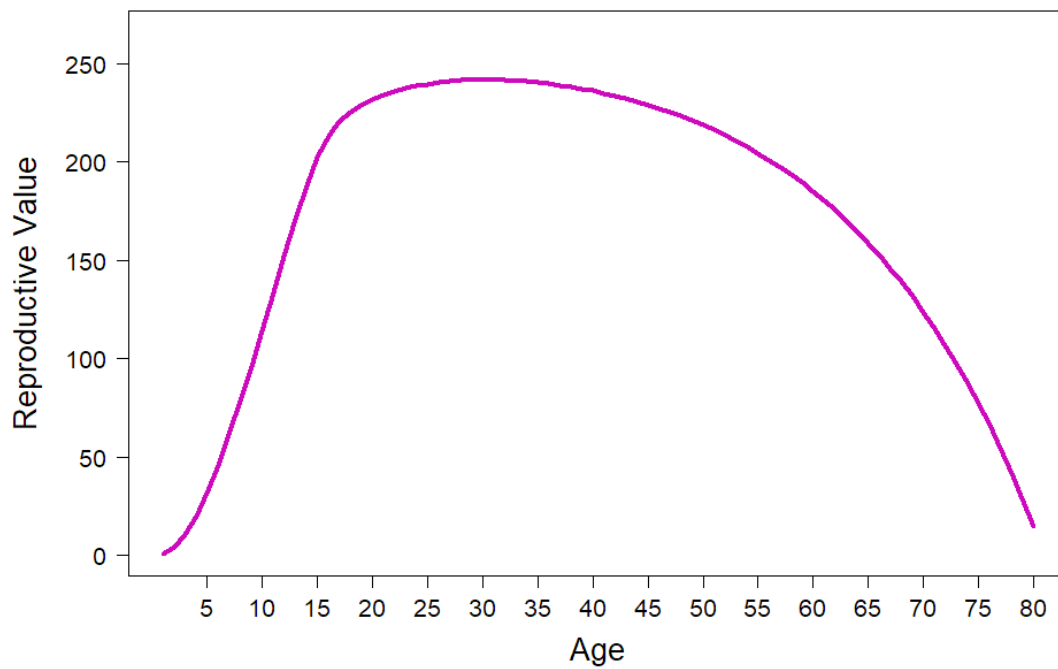


**Figure S10:** Random relative frequency initial age distribution

a)



b)



**Figure S11:** Perturbation analysis (a) with light blue depicting sensitivity analysis and dark blue depicting elasticity analysis; and (b) reproductive values.