

Bias Estimation of Biological Reference Points Under Two-Parameter SRRs

Nick Grunloh

In collaboration with:

Dr. E.J. Dick

Dr. H. K.H. Lee



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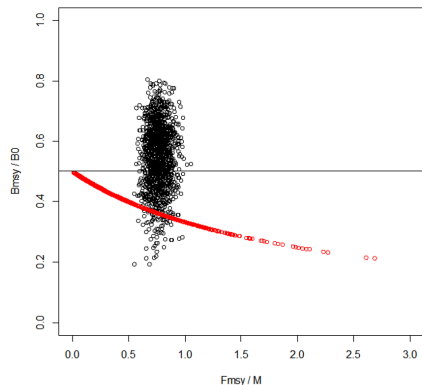
Mangel et al. 2013, CJFAS

$$\frac{dB(t)}{dt} = \frac{\alpha B(t)}{1 + \beta B(t)} - (M + F(t))B(t)$$

$$h = \frac{\frac{\alpha}{M}}{4 + \frac{\alpha}{M}}$$

$$\frac{F^*}{M} = \sqrt{\frac{4h}{1-h}} - 1$$

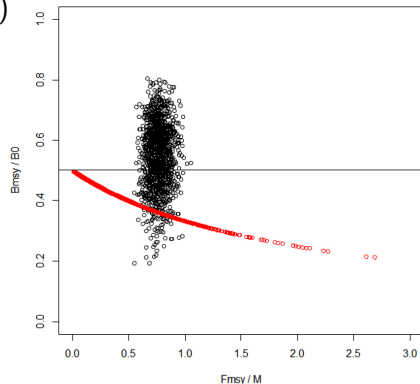
$$\frac{B^*}{B_0} = \frac{\sqrt{\frac{4h}{1-h}} - 1}{\frac{4h}{1-h} - 1}$$



Mangel et al. 2013, CJFAS

$$\frac{dB(t)}{dt} = \frac{\alpha B(t)}{1 + \beta B(t)^{\frac{1}{\gamma}}} - (M + F(t))B(t)$$

Mangel et al. (2013) suggest exploration of three parameter stock recruit relationships (SRRs) to avoid pre-determined reference points (RP) in assessments



A'Priori RP Prior Relationships

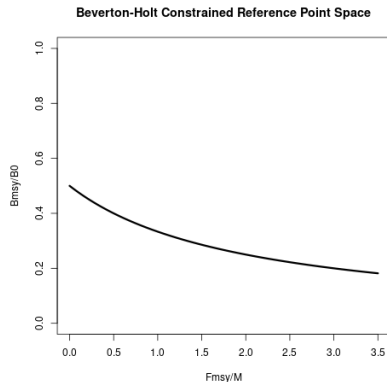
$$\frac{dB(t)}{dt} = \frac{\alpha B(t)}{1 + \beta B(t)} - (M + F(t))B(t)$$

$$\frac{B^*}{B_0} = \frac{1}{\frac{F^*}{M} + 2}$$

$$\log(F^*) \sim N(\mu, \sigma^2)$$



$$2 \frac{B^*}{B_0} \sim \text{logit-N}(\log(2M) - \mu, \sigma^2)$$



Pella-Tomlinson Production Model

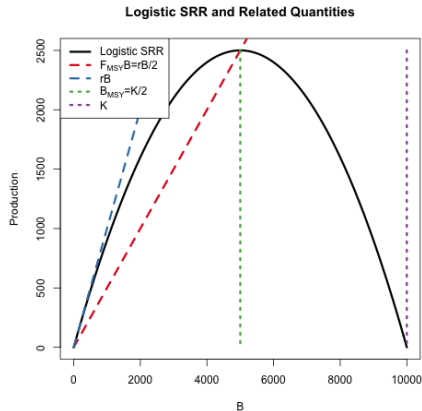
$$I(t) \sim LN(qB(t), \sigma^2)$$

$$\frac{dB(t)}{dt} = R_{\theta}(B(t)) - F(t)B(t)$$

$$R_{\theta}(B) = \frac{rB}{\gamma - 1} \left(1 - \frac{B}{K}\right)^{\gamma-1}$$

$$\theta = (r, K, \gamma)$$

$\gamma = 2 \Rightarrow$ Schaefer Model



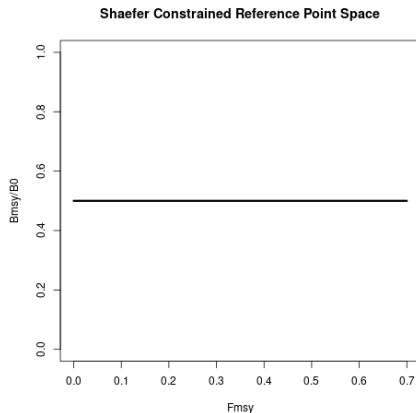
Pella-Tomlinson Production Model

$$I(t) \sim LN(qB(t), \sigma^2)$$
$$\frac{dB(t)}{dt} = R_{\theta}(B(t)) - F(t)B(t)$$

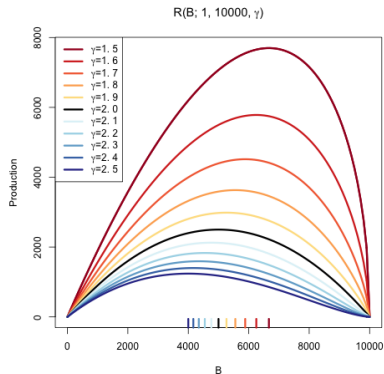
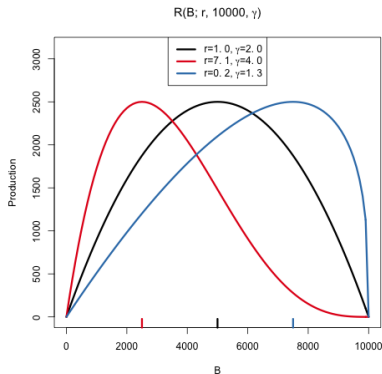
$$R_{\theta}(B) = \frac{rB}{\gamma - 1} \left(1 - \frac{B}{K}\right)^{\gamma-1}$$

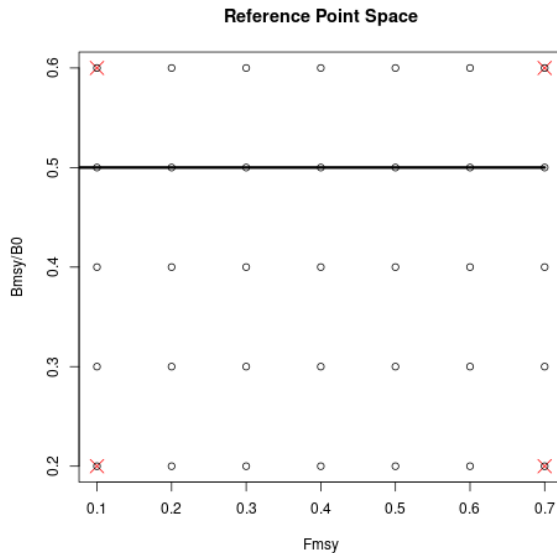
$$\theta = (r, K, \gamma)$$

$\gamma = 2 \Rightarrow$ Schaefer Model

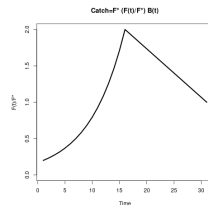
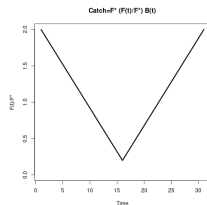
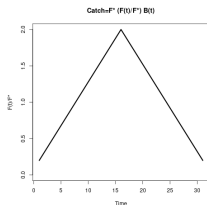
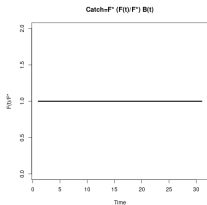


Pella-Tomlinson Family of Curves

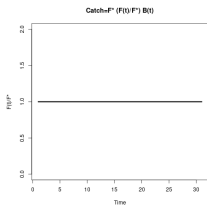




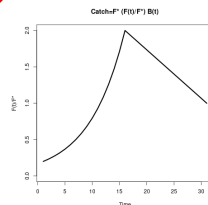
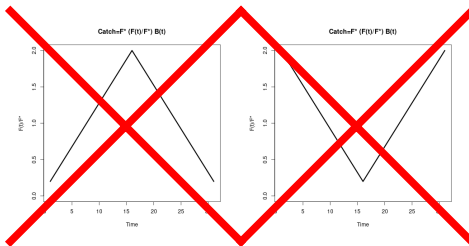
Catch



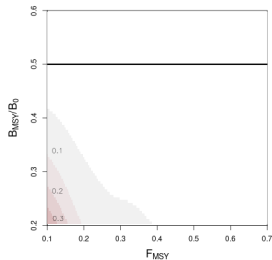
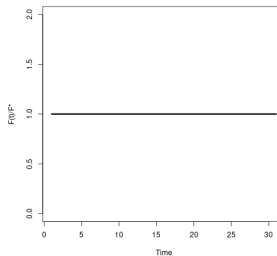
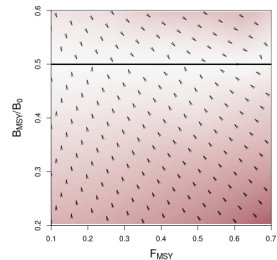
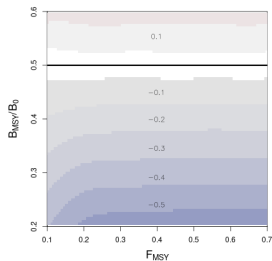
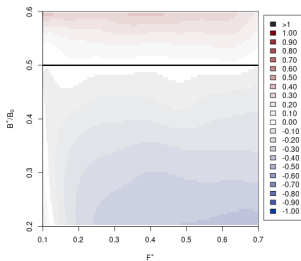
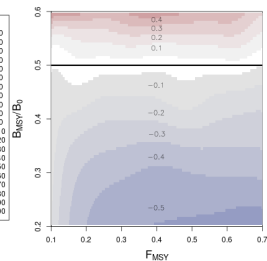
Catch

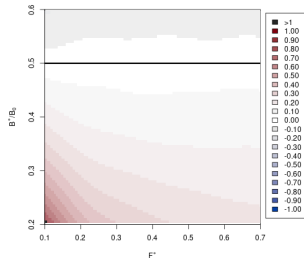
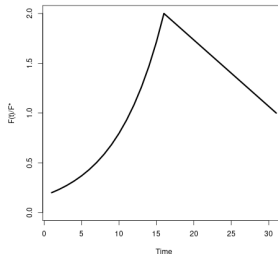


Flat

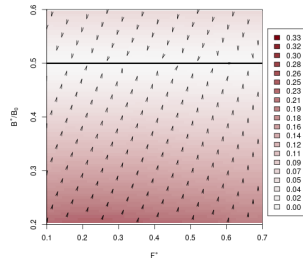
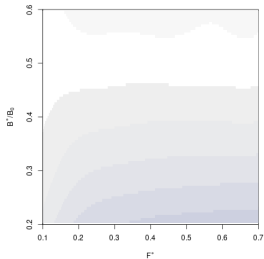
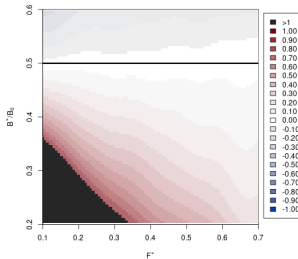
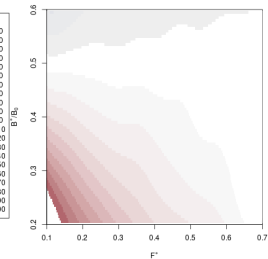


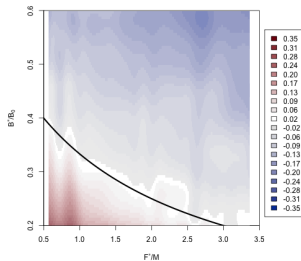
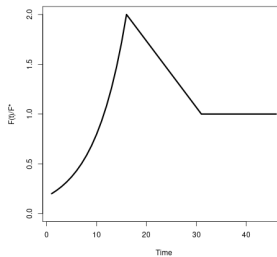
Contrast

Relative Bias in Estimated B_{MSY} Catch = $F^* (F(t)/F^*) B(t)$ Bias Direction for $(F_{MSY}, B_{MSY}/B_0)$ JointlyRelative Bias in Estimated B_0 Relative Bias in Estimated MSY Relative Bias in Estimated F_{MSY} 

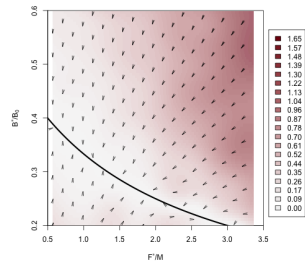
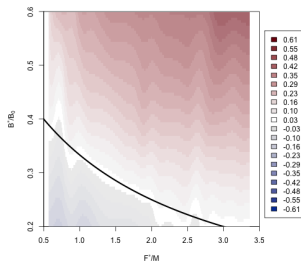
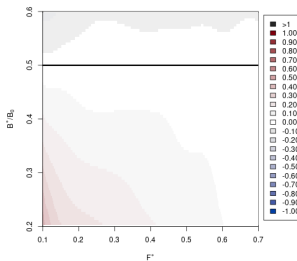
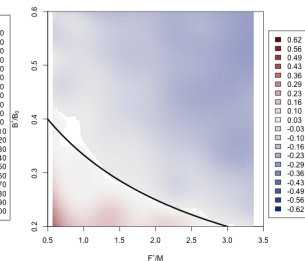
Relative Bias in Estimated B^* Catch = $F^* (F(t)/F^*) B(t)$ 

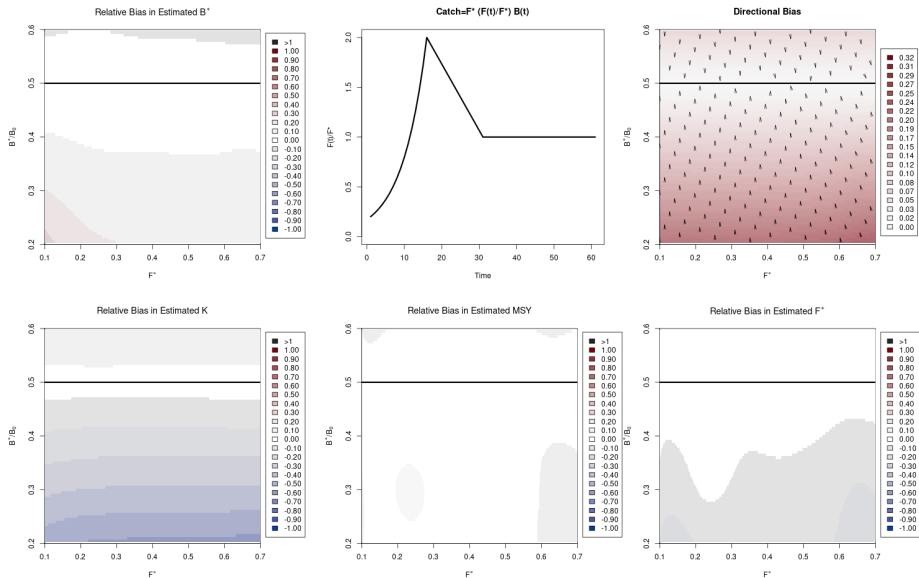
Directional Bias

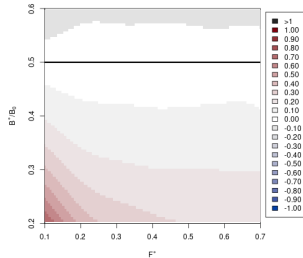
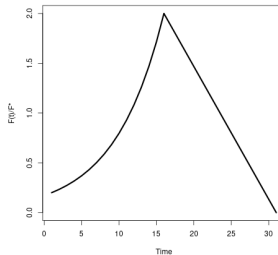
Relative Bias in Estimated K Relative Bias in Estimated MSY Relative Bias in Estimated F^* 

Relative Bias in Estimated B^* Catch = $F^* (F(t)/F^*) B(t)$ 

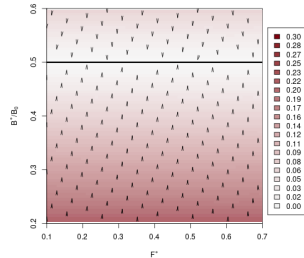
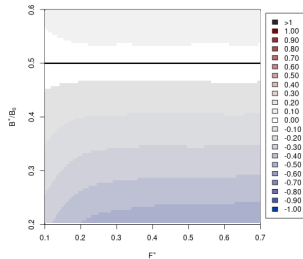
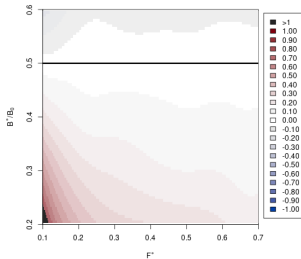
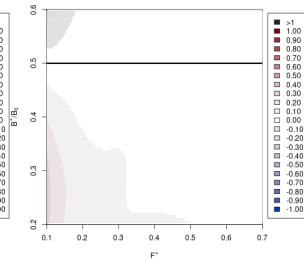
Directional Bias

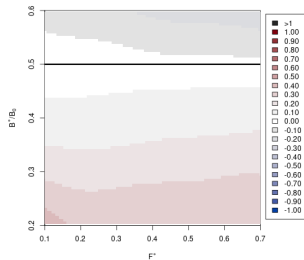
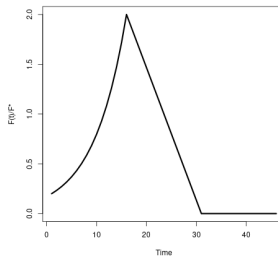
Relative Bias in Estimated K Relative Bias in Estimated MSY Relative Bias in Estimated F^* 



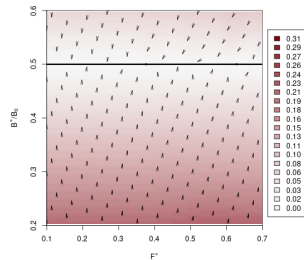
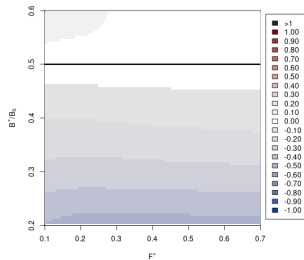
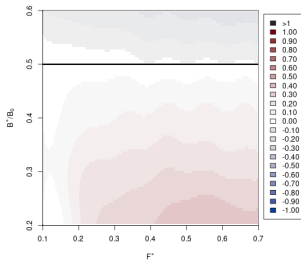
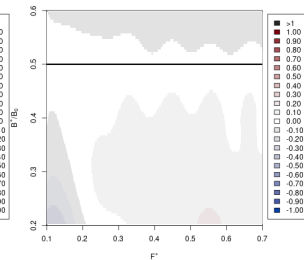
Relative Bias in Estimated B^* Catch = $F^*(t)/F^* B(t)$ 

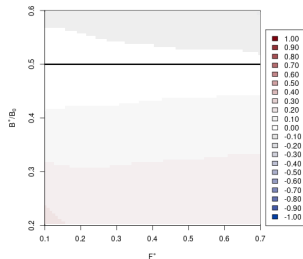
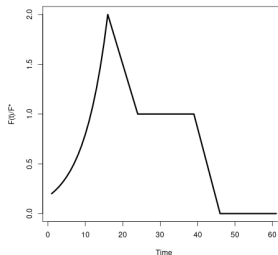
Directional Bias

Relative Bias in Estimated K Relative Bias in Estimated MSY Relative Bias in Estimated F^* 

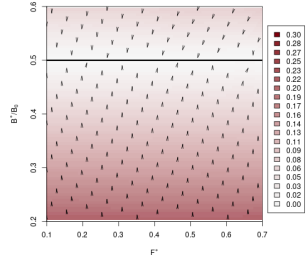
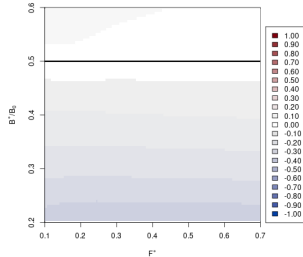
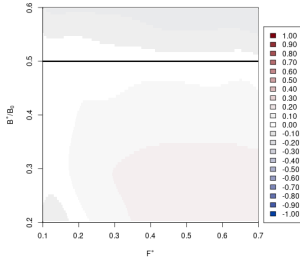
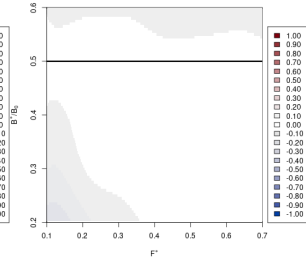
Relative Bias in Estimated B^* Catch = $F^* (F(t)/F^*) B(t)$ 

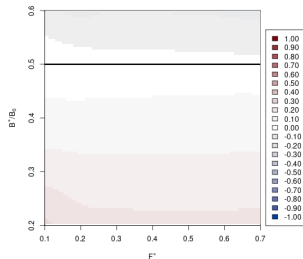
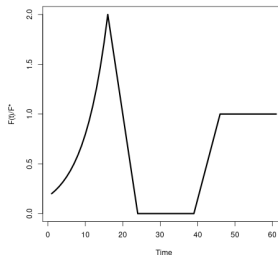
Directional Bias

Relative Bias in Estimated K Relative Bias in Estimated MSY Relative Bias in Estimated F^* 

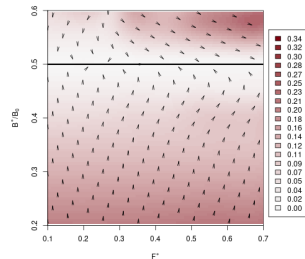
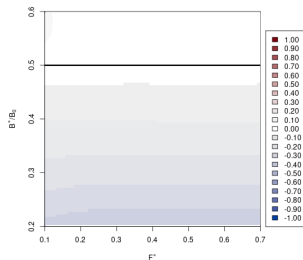
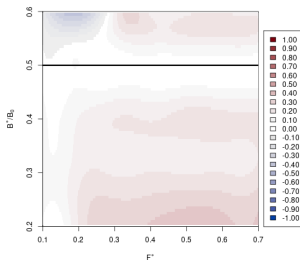
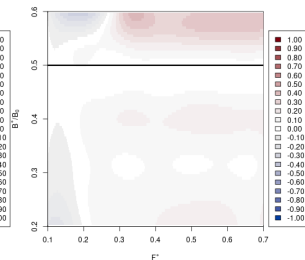
Relative Bias in Estimated B^* Catch = $F^* (F(t)/F^*) B(t)$ 

Directional Bias

Relative Bias in Estimated K Relative Bias in Estimated MSY Relative Bias in Estimated F^* 

Relative Bias in Estimated B^* Catch = $F^* (F(t)/F^*) B(t)$ 

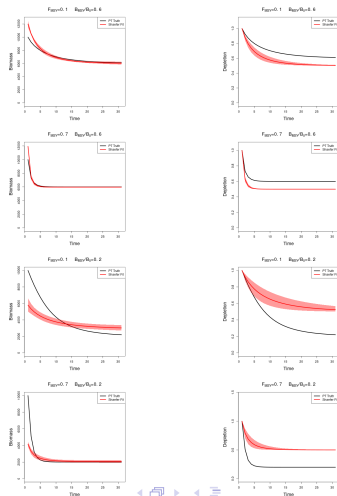
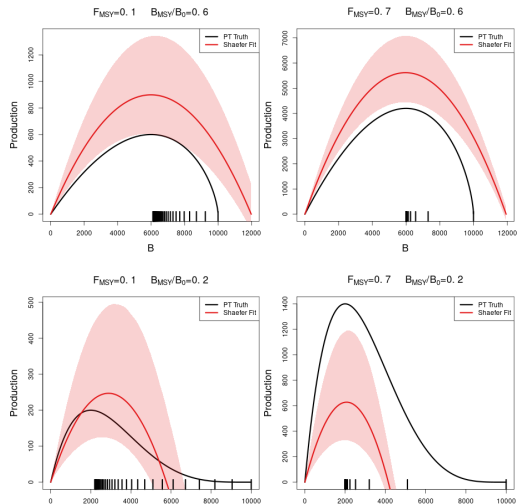
Directional Bias

Relative Bias in Estimated K Relative Bias in Estimated MSY Relative Bias in Estimated F^* 

Flat: Misspecified SRR

Biomass

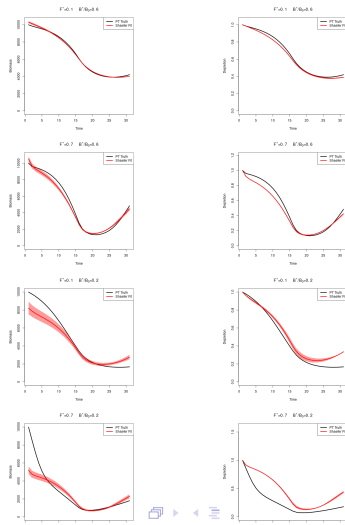
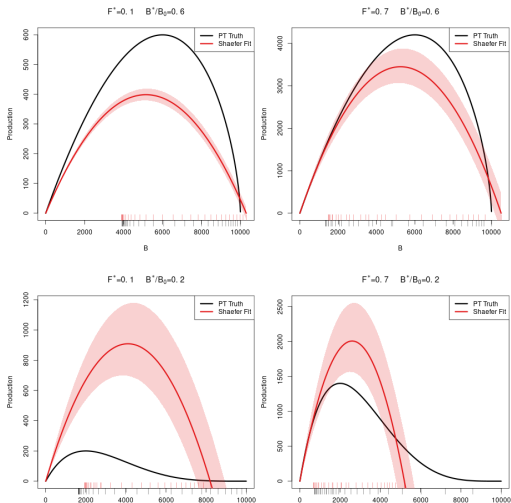
Depletion



Contrast: Misspecified SRR

Biomass

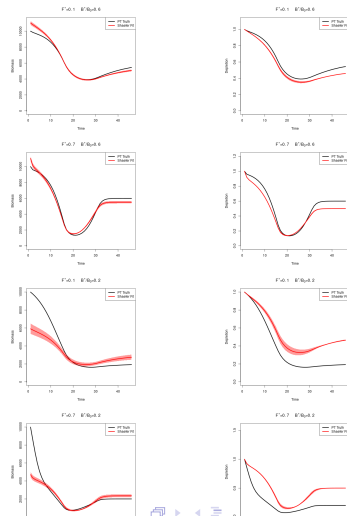
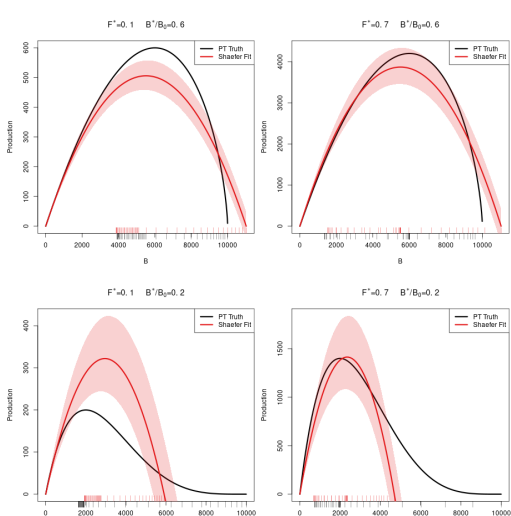
Depletion



ContrastT45: Misspecified SRR

Biomass

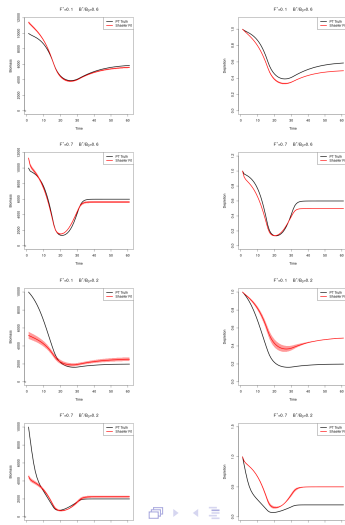
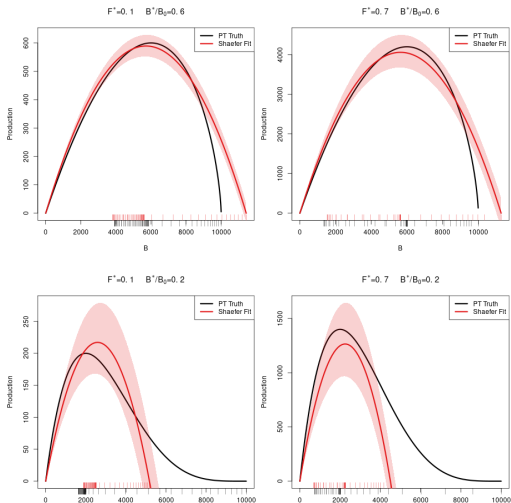
Depletion



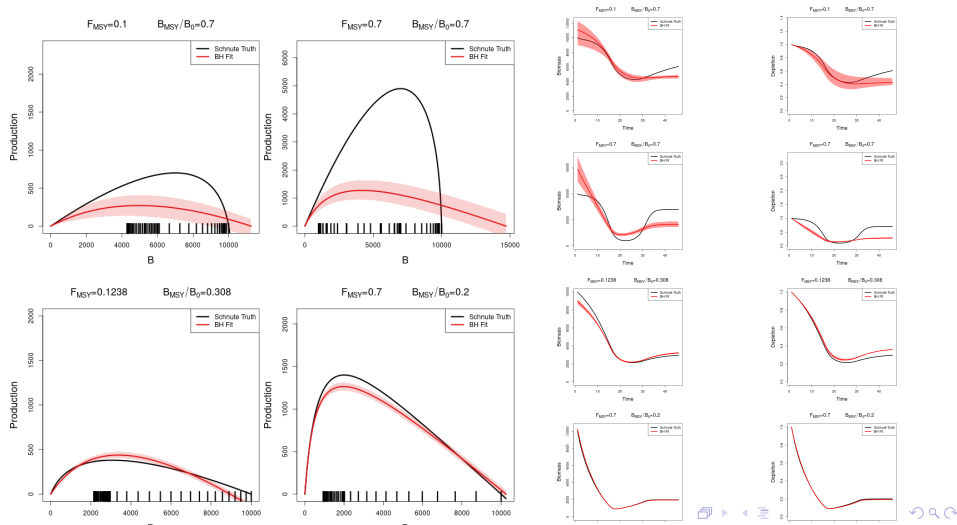
ContrastT60: Misspecified SRR

Biomass

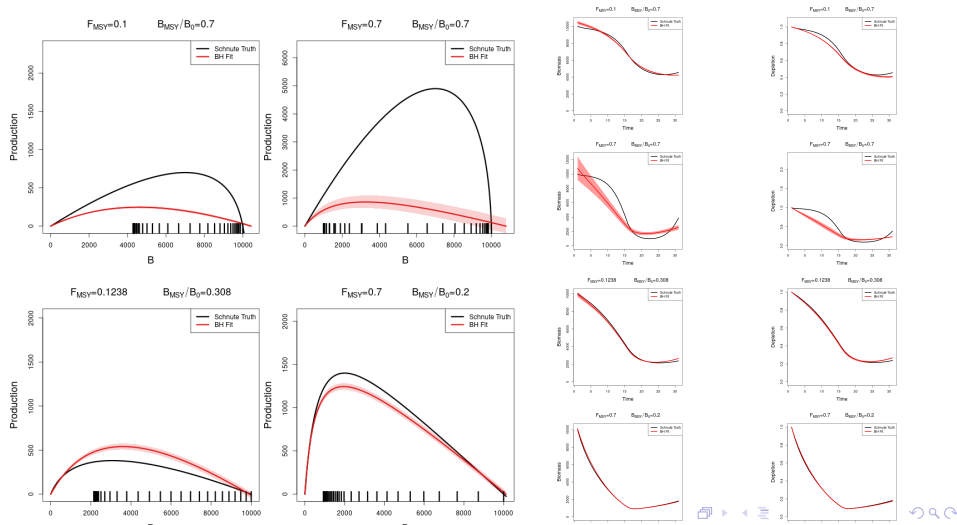
Depletion



SchnuteExpT45: Misspecified SRR Biomass Depletion



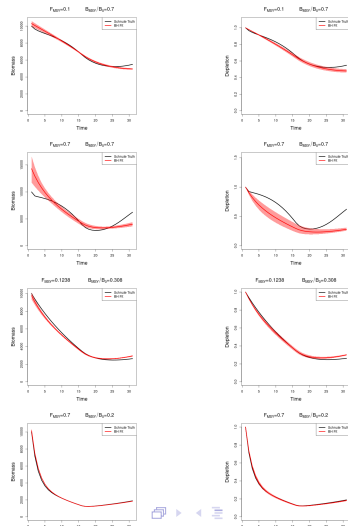
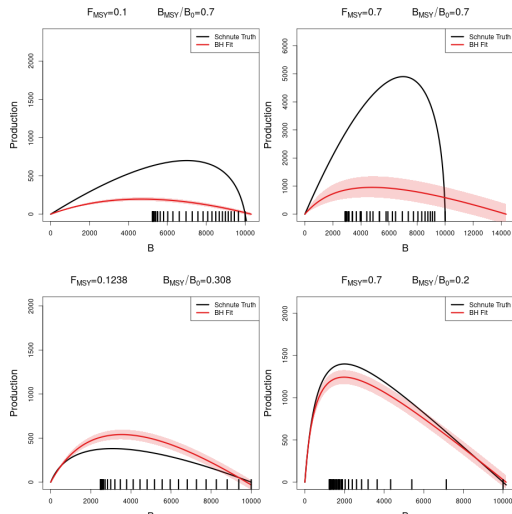
SchnuteExpT30: Misspecified SRR Biomass Depletion



SchnuteExpT30L2: SRR

Biomass

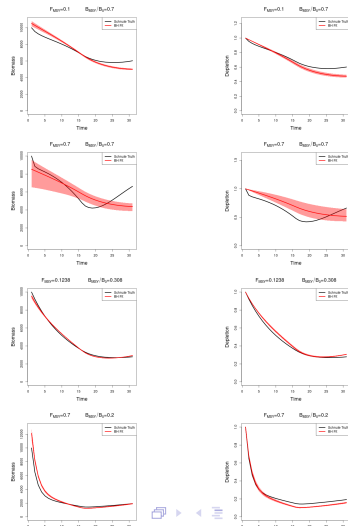
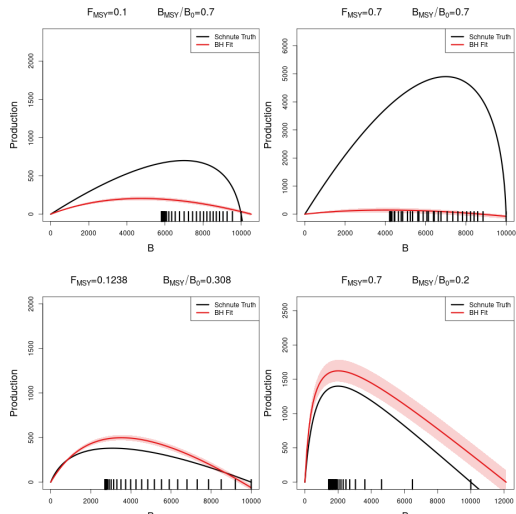
Depletion



SchnuteExpT30L3: SRR

Biomass

Depletion



SchnuteFlatT30: SRR

Biomass

Depletion

