

# Bias Estimation of Biological Reference Points Under Two-Parameter SRRs

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In collaboration with:

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Dr. H. K.H. Lee



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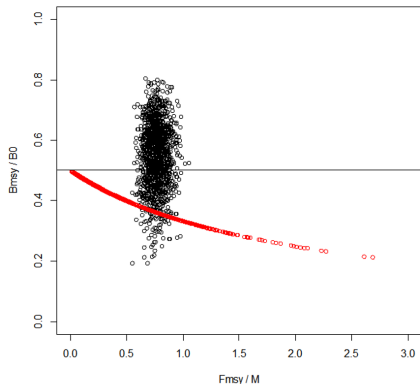
# Mangel et al. 2013, CJFAS

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

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

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

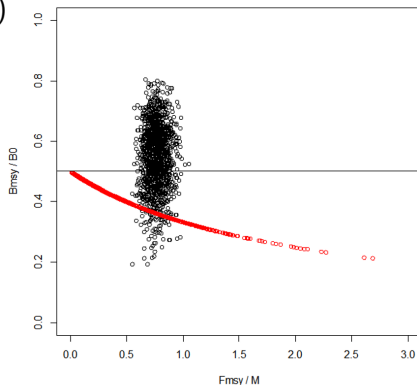
$$\frac{B^*}{B_0} = \frac{\sqrt{\frac{4h}{1-h}} - 1}{\frac{4h}{1-h} - 1}$$



# 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

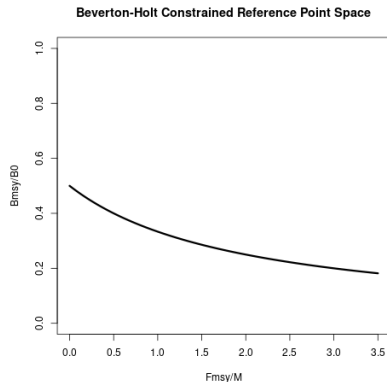
$$\frac{dB(t)}{dt} = \frac{\alpha B(t)}{1 + \beta B(t)} - (M + F(t))B(t)$$

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

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



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



# Pella-Tomlinson Production Model

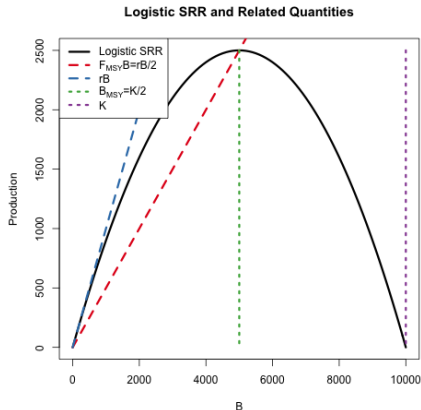
$$I(t) \sim LN(qB(t), \sigma^2)$$

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

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

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

$\gamma = 2 \Rightarrow$  Schaefer Model



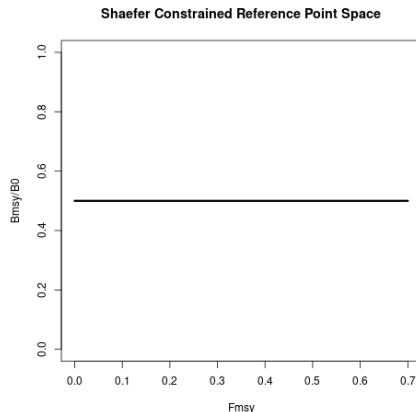
# Pella-Tomlinson Production Model

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

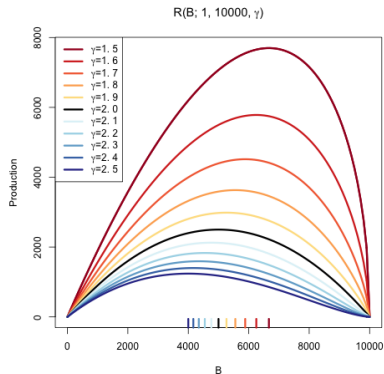
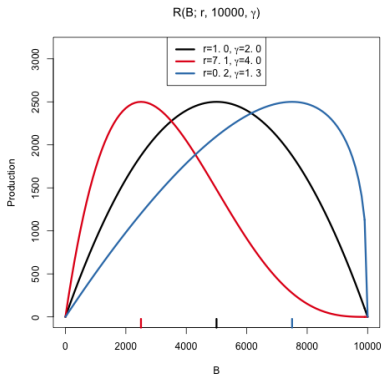
$$R_{\theta}(B) = \frac{rB}{\gamma - 1} \left(1 - \frac{B}{K}\right)^{\gamma-1}$$

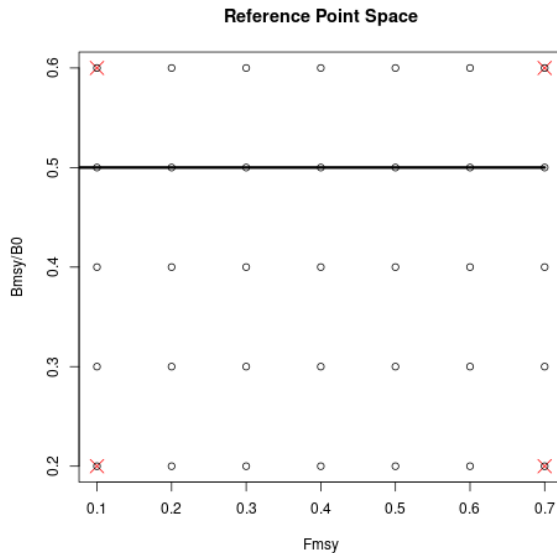
$$\theta = (r, K, \gamma)$$

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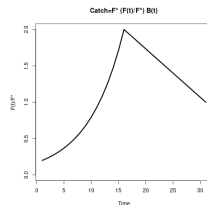
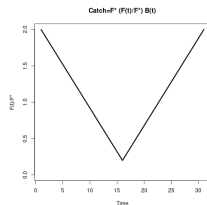
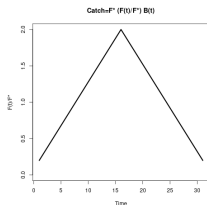
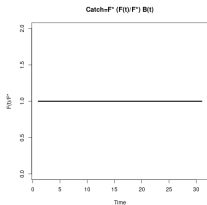
# Pella-Tomlinson Family of Curves



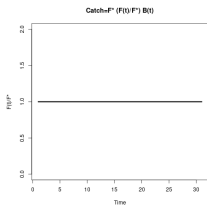




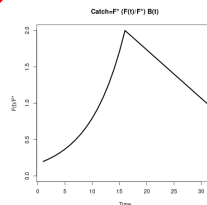
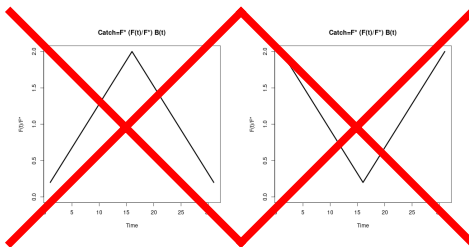
# Catch



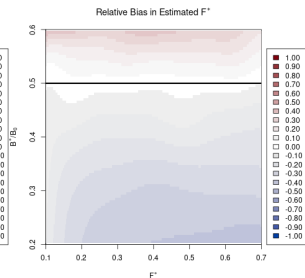
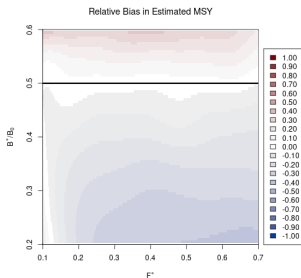
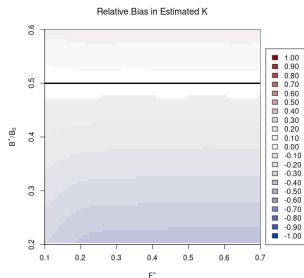
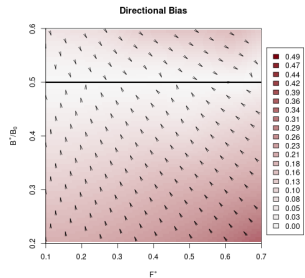
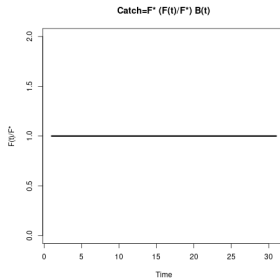
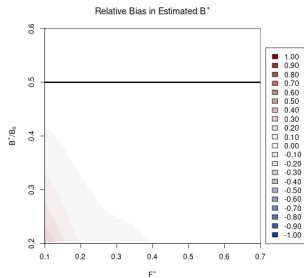
# Catch

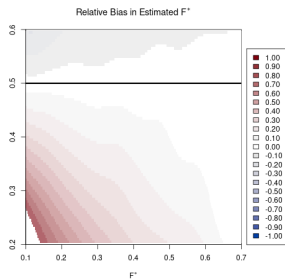
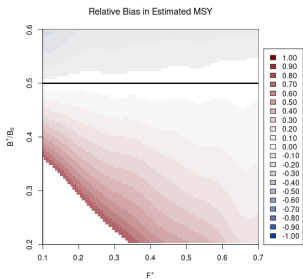
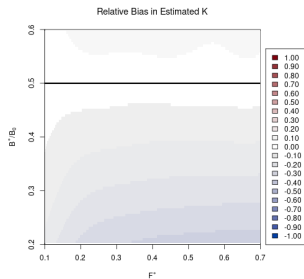
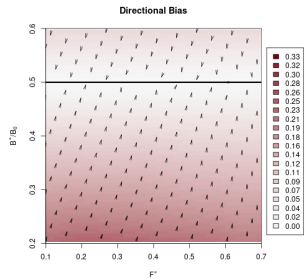
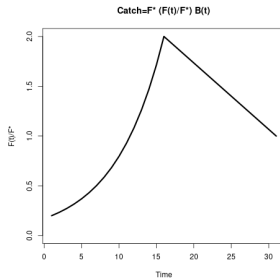
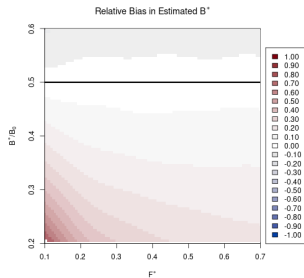


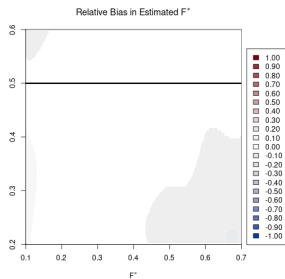
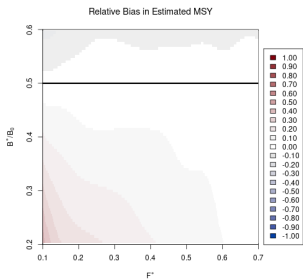
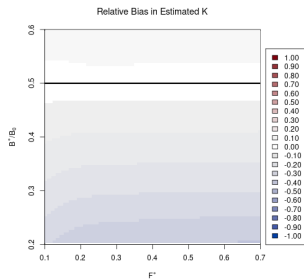
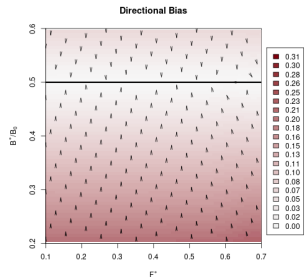
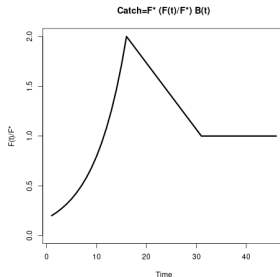
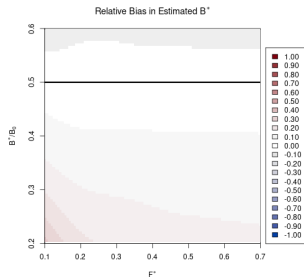
Flat

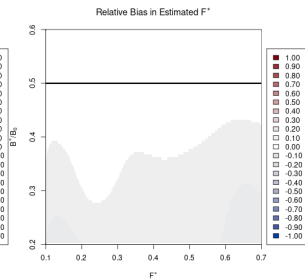
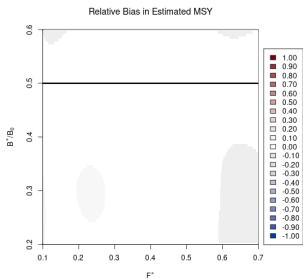
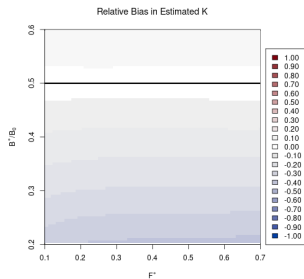
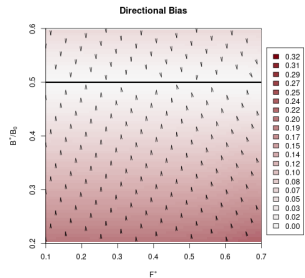
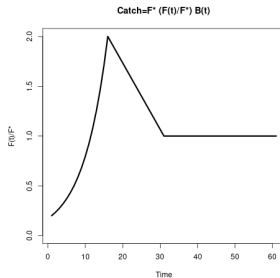
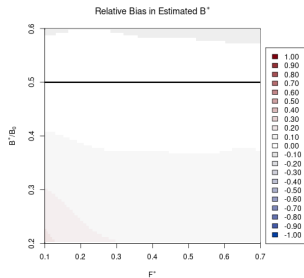


Contrast





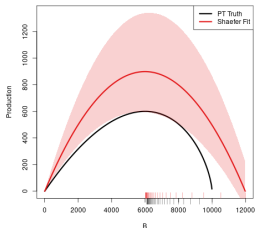
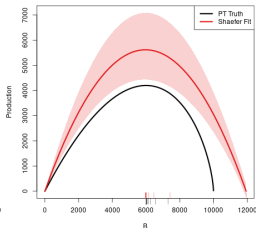
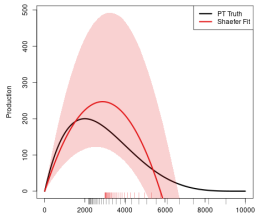
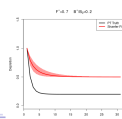
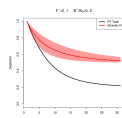
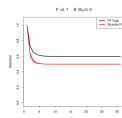
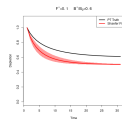
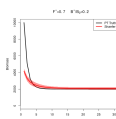
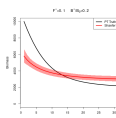
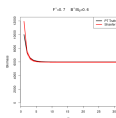
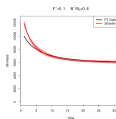
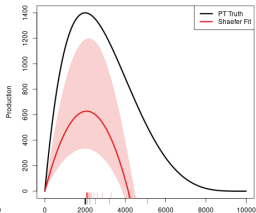




## Flat: Misspecified SRR

## Biomass

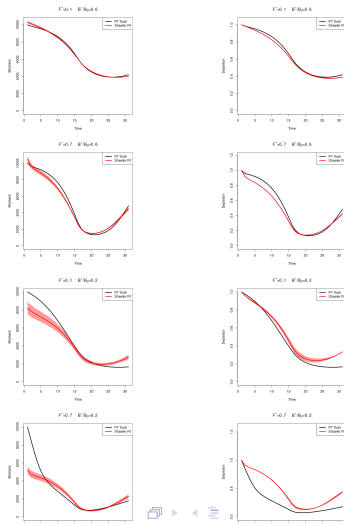
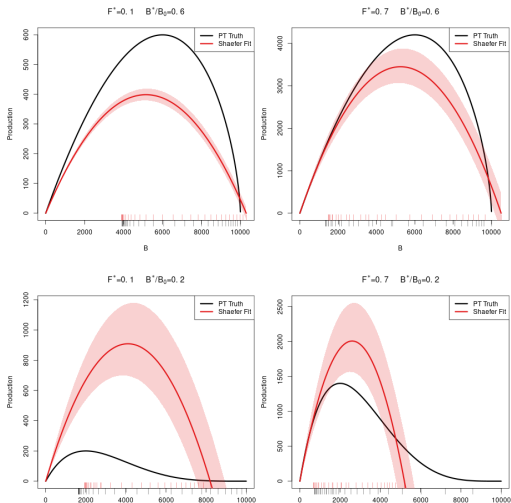
## Depletion

 $F^*=0.1$   $B^*/B_0=0.6$  $F^*=0.7$   $B^*/B_0=0.6$  $F^*=0.1$   $B^*/B_0=0.2$  $F^*=0.7$   $B^*/B_0=0.2$ 

## Contrast: Misspecified SRR

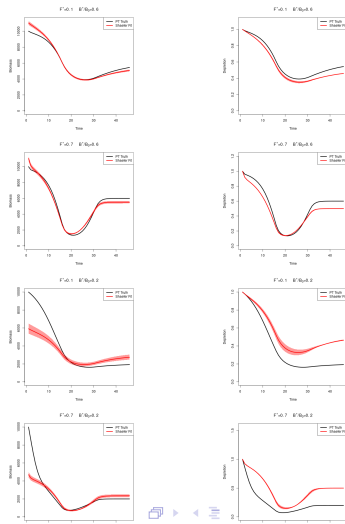
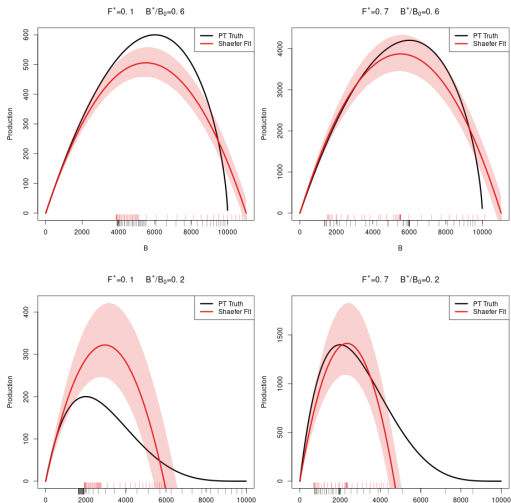
## Biomass

## Depletion

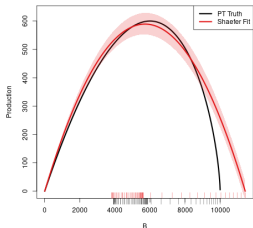
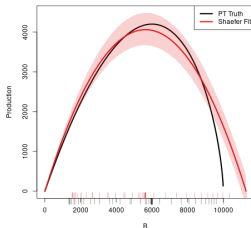
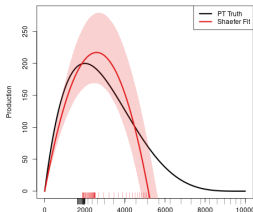




# ContrastT45: Misspecified SRR      Biomass      Depletion



# ContrastT60: Misspecified SRR      Biomass      Depletion

 $F^*=0.1$   $B^*/B_0=0.6$  $F^*=0.7$   $B^*/B_0=0.6$  $F^*=0.1$   $B^*/B_0=0.2$  $F^*=0.7$   $B^*/B_0=0.2$ 