

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



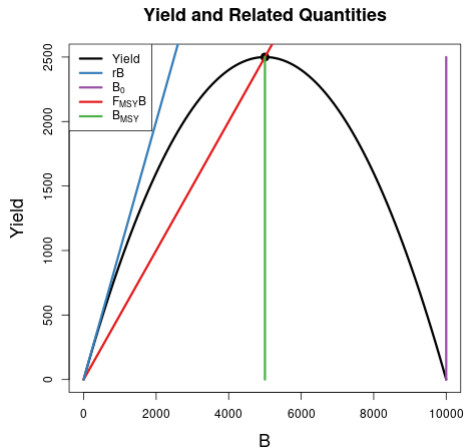
15 Aug 2022



$$I_t = qB_t e^{\epsilon} \quad \epsilon \sim N(0, \sigma^2)$$

$$\frac{dB(t)}{dt} = P(B(t); \theta) - Z(t)B(t)$$

$$RP : MSY, \frac{F_{MSY}}{M}, \frac{B_{MSY}}{B_0}$$

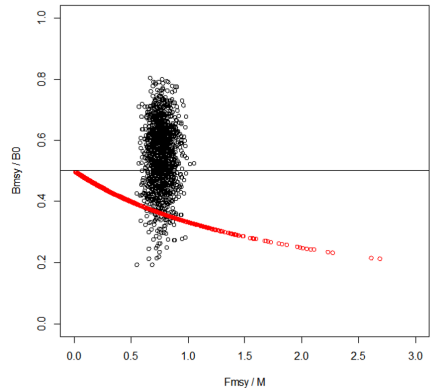


Conceptually:

$$\frac{F_{MSY}}{M} \in \mathbb{R}^+ \quad \frac{B_{MSY}}{B_0} \in (0, 1)$$

Mangel et al. 2013, CJFAS:

- BH Model:
 $F_{MSY} \in \mathbb{R}^+ \quad \frac{B_{MSY}}{B(0)} = \frac{1}{F_{MSY}/M+2}$
- Similar Constraints for other Two-Parameter Curves

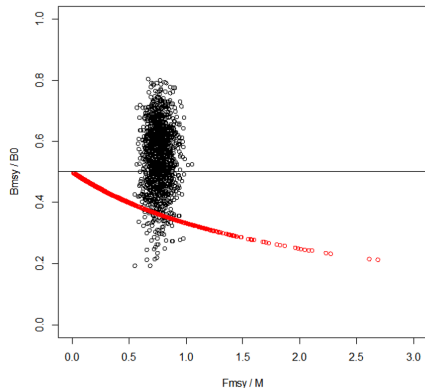


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- Similar Constraints for other Two-Parameter Curves
- Three-Parameter Relationships Allow Independent RP Estimation



Schnute 1985, CJFAS

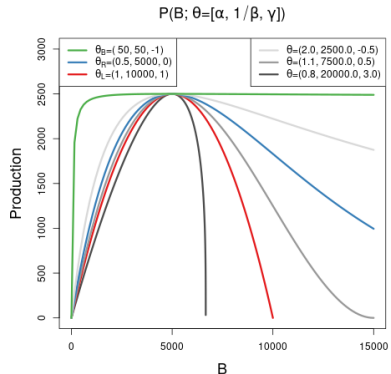
$$\frac{dB}{dt} = P(B; \theta) - (M + F)B$$

$$P(B; [\alpha, \beta, \gamma]) = \alpha B(1 - \beta\gamma B)^{\frac{1}{\gamma}}$$

$\gamma = -1 \Rightarrow$ Beverton-Holt

$\gamma \rightarrow 0 \Rightarrow$ Ricker

$\gamma = 1 \Rightarrow$ Logistic



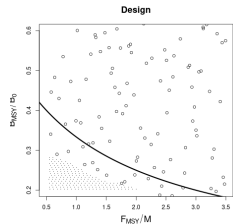
Introish Ideas list

- PT/Schaffer work (link)
- Computational Difficulties
- Schnute Space Filling
- Catch/Contrast

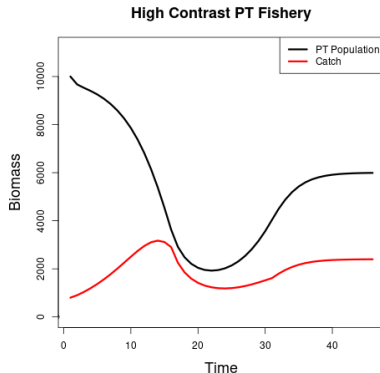
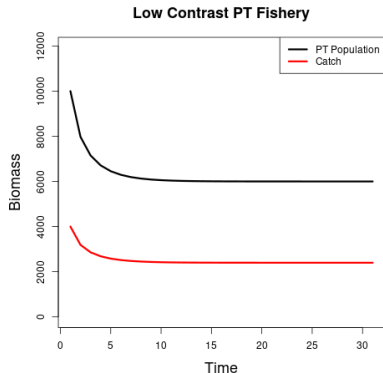
$$\frac{B_{MSY}}{B_0} = \frac{1 - \left(\frac{M+F_{MSY}}{\alpha}\right)^\gamma}{1 - \left(\frac{M}{\alpha}\right)^\gamma}$$

$$\alpha = (M + F_{MSY}) \left(1 + \frac{\gamma F_{MSY}}{M + F_{MSY}}\right)^{1/\gamma}$$

$$\beta = \frac{1}{\gamma B_0} \left(1 - \left(\frac{M}{\alpha}\right)^\gamma\right)$$

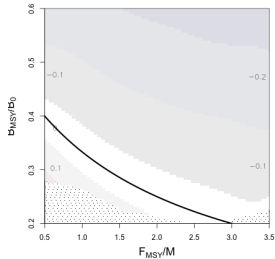
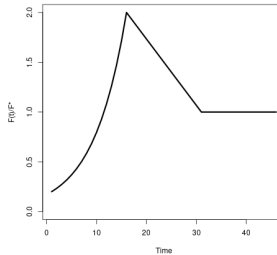
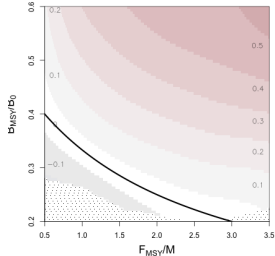
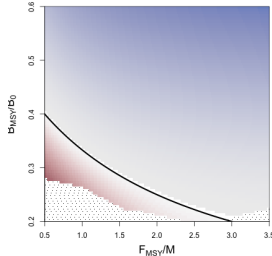
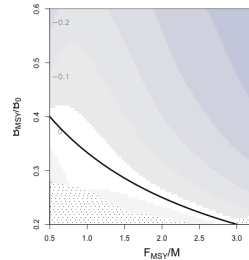


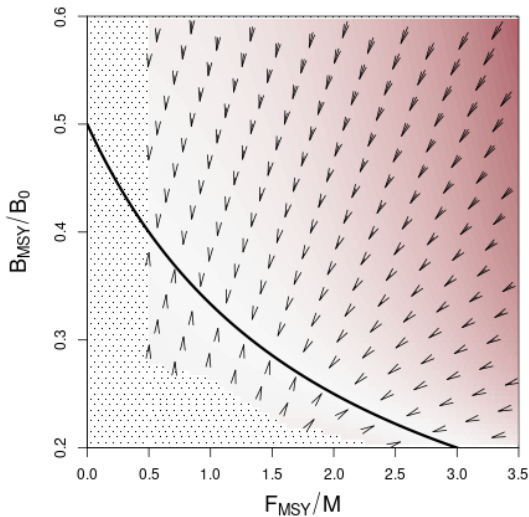
Catch

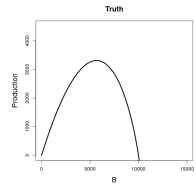
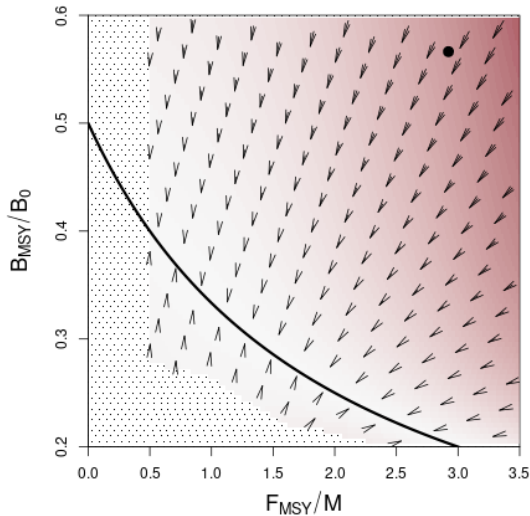


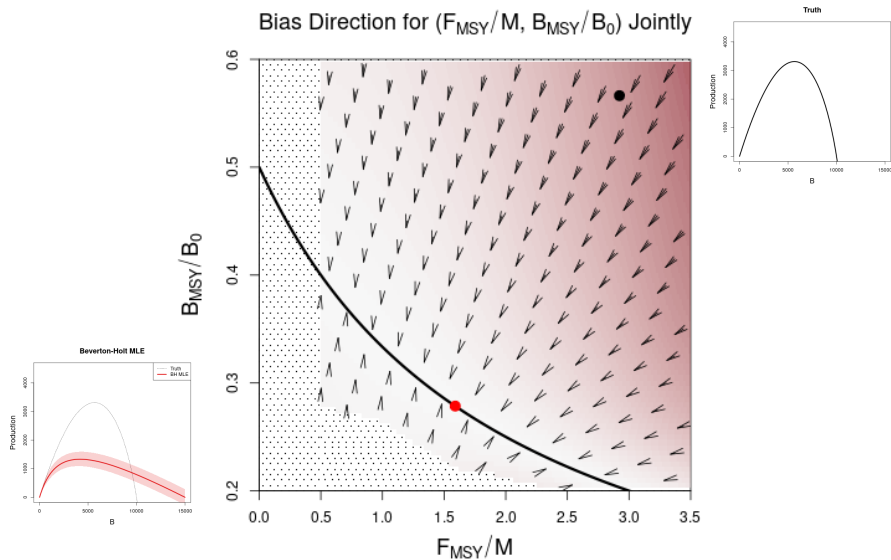
Results Idea List

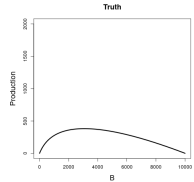
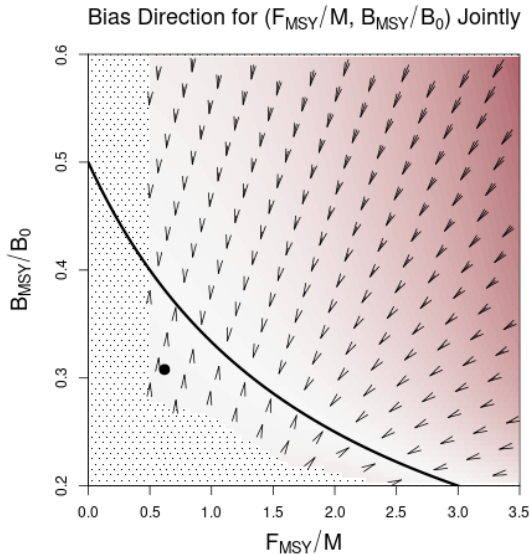
- contrast
 - components
 - animated arrows and yeild curves
- flat
 - animated arrows and yeild curves

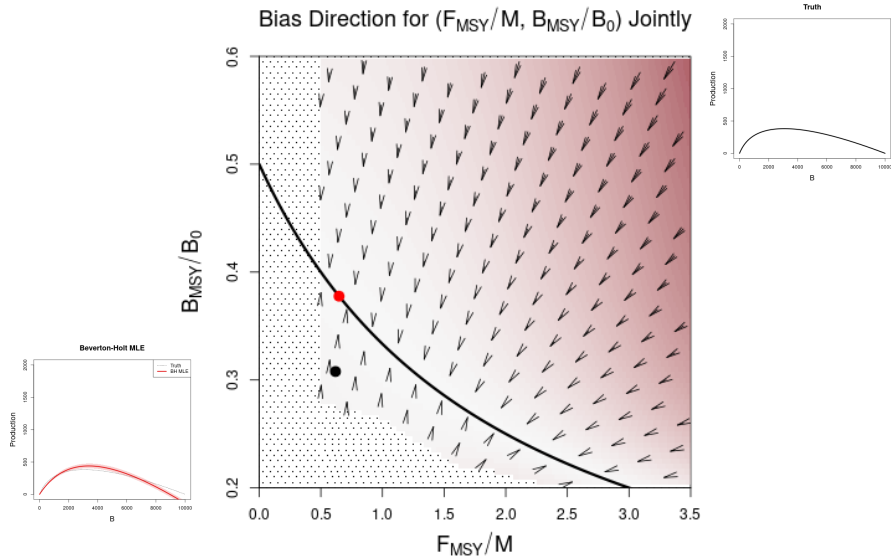
Relative Bias in Estimated B_{MSY} Catch = $F^* (F(t)/F^*) B(t)$ Relative Bias in Estimated B_0 Bias in Estimated B_{MSY}/B_0 Relative Bias in Estimated F_{MSY} 

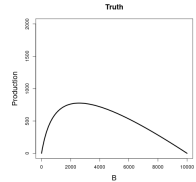
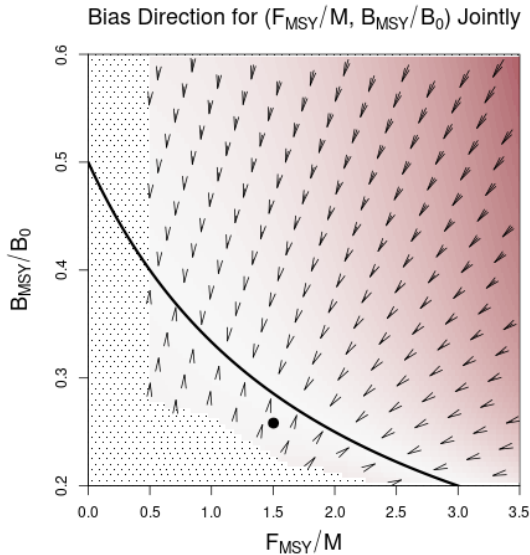
Bias Direction for $(F_{\text{MSY}}/M, B_{\text{MSY}}/B_0)$ Jointly

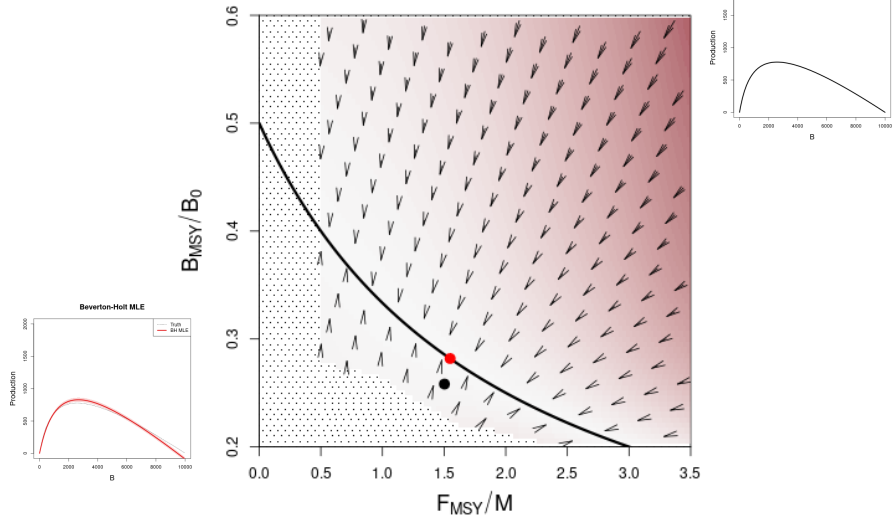
Bias Direction for (F_{MSY}/M , B_{MSY}/B_0) Jointly

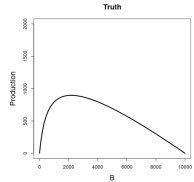
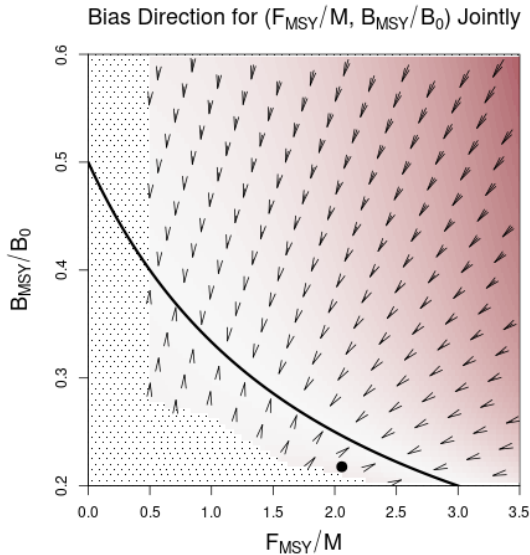
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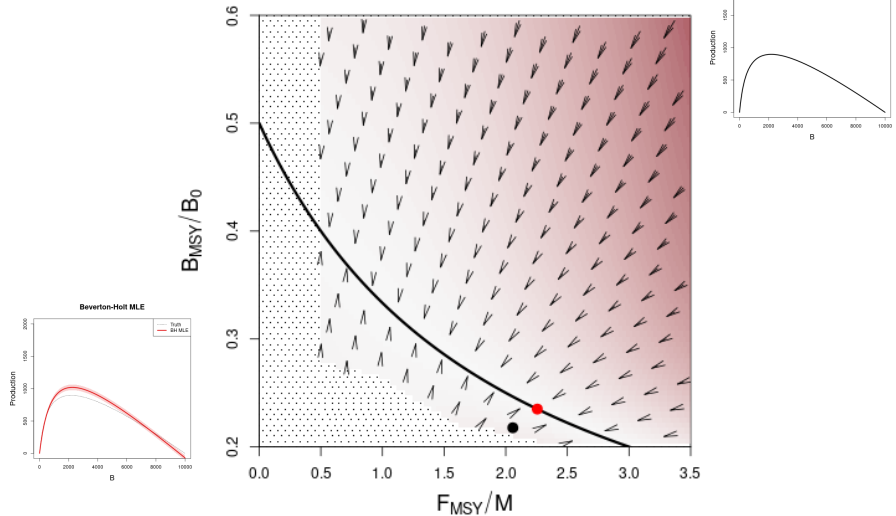


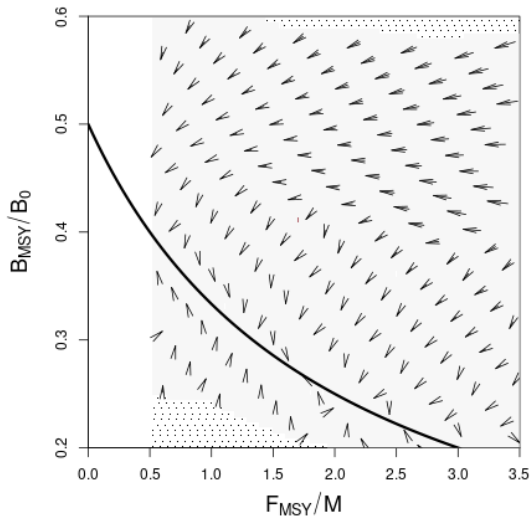
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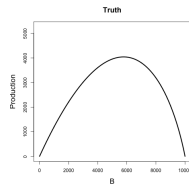
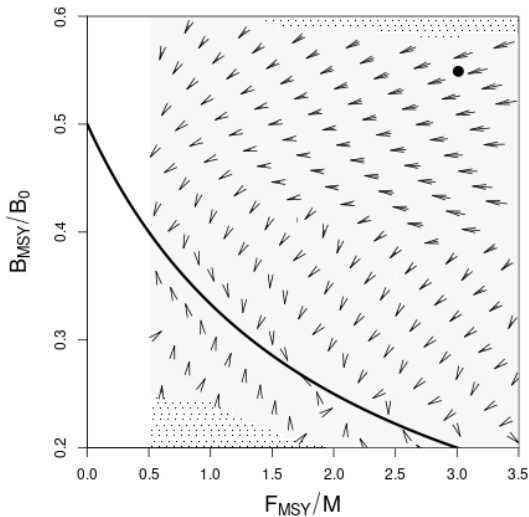


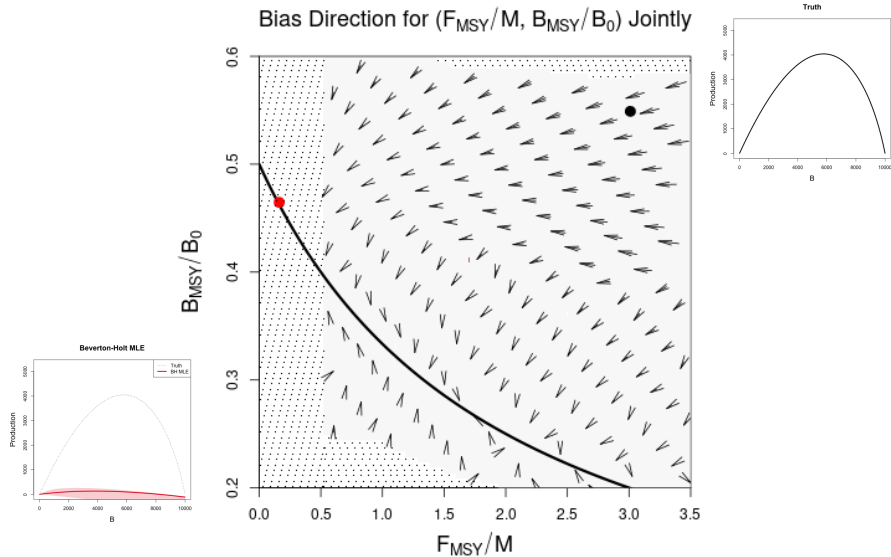
Bias Direction for $(F_{MSY}/M, B_{MSY}/B_0)$ Jointly



Bias Direction for $(F_{MSY}/M, B_{MSY}/B_0)$ Jointly

Bias Direction for (F_{MSY}/M , B_{MSY}/B_0) Jointly

Bias Direction for (F_{MSY}/M , B_{MSY}/B_0) Jointly

Bias Direction for $(F_{MSY}/M, B_{MSY}/B_0)$ Jointly

Conclusions

- Contrast story
- Importance of getting the computational details correct for moving to analysis of Delay Difference and age structure