

Metamodeling for Bias Estimation of Biological Reference Points Under Two-Parameter SRRs

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Outline

- 1 Introduction
- 2 The Schaefer Model
- 3 The Beverton-Holt Model
- 4 Delay Differential Growth Extension
- 5 End

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Many Thanks:

- Dr. Marc Mangel
- Collaborators at NOAA
- NMFS Sea Grant



Metamodel Details

$$\hat{\mu} = \widehat{\log(r)} \quad - \text{ or } - \quad \hat{\mu} = \widehat{\log(K)}$$

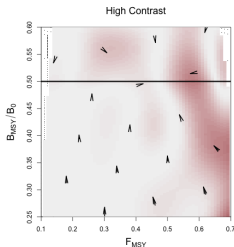
$$\mathbf{x} = \left(F_{MSY}, \frac{B_{MSY}}{\bar{B}(0)} \right)$$

$$\hat{\mu} = \beta_0 + \beta' \mathbf{x} + f(\mathbf{x}) + \epsilon$$

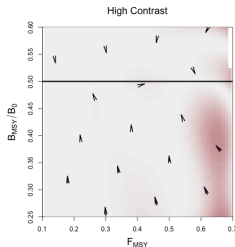
$$f(\mathbf{x}) \sim \text{GP}(0, \tau^2 R(\mathbf{x}, \mathbf{x}'))$$

$$\epsilon_i \sim \text{N}(0, \hat{\omega}_i).$$

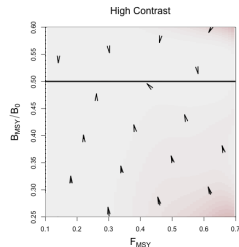
$$R(\mathbf{x}, \mathbf{x}') = \exp \left(\sum_{j=1}^2 \frac{-(x_j - x'_j)^2}{2\ell_j^2} \right)$$

High Contrast PT $\sigma = 0.12$ Data

1x Samples



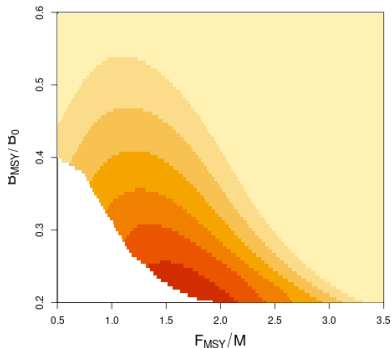
2x Samples



4x Samples

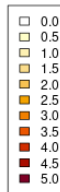
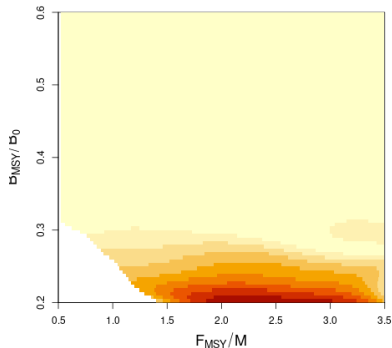
Contrast

Size of 1 SD Interval in RP Bias



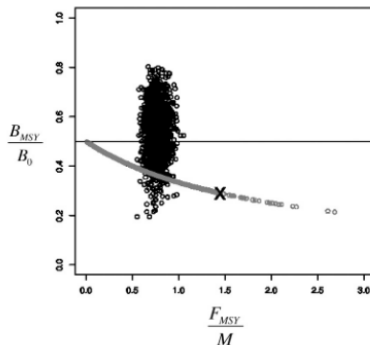
No Contrast

Size of 1 SD Interval in RP Bias



Mangel et al.

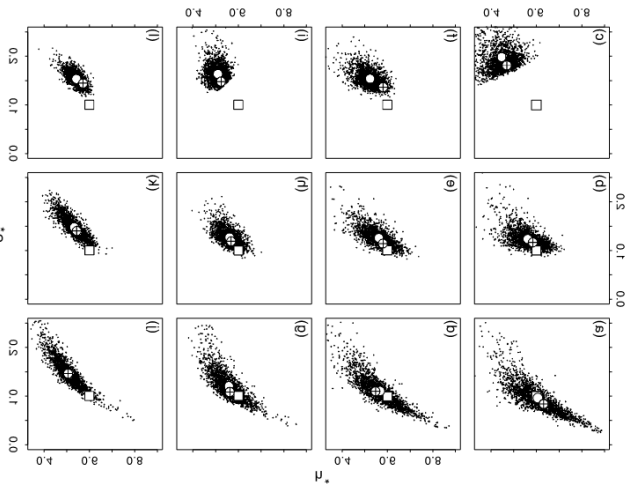
Fig. 4. DeYoreo et al. (2012) used both a BH-SRR and three-parameter SRR, similar to the S-SRR in a stock assessment of cowcod (*Sebastes levis*). We show samples from posterior distributions arising from different values of steepness. Unlike most stock assessments, we plot B_{MSY}/B_0 versus F_{MSY}/M . The grey circles show the results for the BH-SRR. This curve is another way of representing the constraint placed on a stock assessment by using a BH-SRR and specifying steepness — results must lie along this curve. The black circles represent the outcome of the three-parameter SRR. The black X represents the result when steepness is asserted to be 0.6.



Logistic

Ricker φ^*

BH



Schnute, J. T., & Kronlund, A. R. (2002). Estimating salmon stock recruitment relationships from catch and escape-ment data. *Canadian Journal of Fisheries and Aquatic Sciences*, 59(3), 433–449.