Gmacs

BBRKC model comparisons

The Gmacs Development Team

June 29, 2015

Outline

1. Introduction
    - Indices
    - Leading model parameters
    - Growth parameters
    - Latent states
    - Other variables
2. Size, weight and growth
    - Size-weight ($w_{h,\ell}$)
    - Growth
    - Molting
3. Natural mortality and survival
    - Natural mortality
4. Selectivity, retention, fishing
5. Recruitment
6. Initialization
    - Initialization
7. Fits to data
    - Survey

Introduction

This presentation provides a comparison between three different Bristol Bay Red King Crab (BBRKC) stock assessment models. These models inlcude:

- OneSex
- TwoSex
- Zheng

Leading model parameters

Symbol	Support	Description
M_0	$0 < M_0 < \infty$	Initial instantaneous natural mortality rate
R_0	$0 < R_0 < \infty$	Unfished average recruitment
$\ddot{R}$	$0 < \ddot{R} < \infty$	Initial recruitment
$\bar{R}$	$0 < \bar{R} < \infty$	Average recruitment
α_r	$\alpha_r > 0$	Mode of size-at-recruitment
β_r	$\beta_r > 0$	Shape parameter for size-at-recruitment
κ	$\kappa > 1$	Recruitment compensation ratio

We group the leading model parameters into the vector

$$\boldsymbol{\theta} = \{M_0, R_0, \ddot{R}, \bar{R}, \alpha_r, \beta_r, \kappa\}.$$

Growth parameters

Symbol	Support	Description
α_h	$\alpha_h > 0$	Mode of size-at-recruitment
β_h	$\beta_h > 0$	Shape parameter for size-at-recruitment
φ_h	$\varphi_h > 0$	Instantaneous natural mortality rate
μ_h	$\mu_h > 0$	Length at 50% molting probability
c_h	$c_h > 0$	Coefficient of variation of molting probability

We group the growth parameters into the vector

$$\boldsymbol{\psi} = \{\alpha_h, \beta_h, \varphi_h, \mu_h, c_h\}.$$

Latent states

Symbol	Support	Description
$\boldsymbol{\nu}$	$\ell \times 1$	Initial recuitment deviates
$\boldsymbol{\xi}$		Discard mortality rate

We group the latent states into the vector

$$\boldsymbol{\omega} = \{\boldsymbol{\nu}, \boldsymbol{\xi}\}.$$

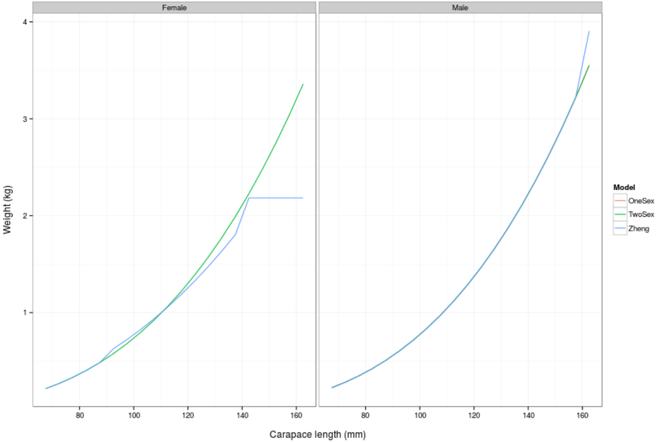
Other variables

Symbol	Dimensions	Description
$\boldsymbol{w}_h$	$\ell \times 1$	Mean weight at length (ℓ) by sex (h)
$\boldsymbol{m}_h$	$\ell \times 1$	Average proportion mature at length (ℓ) by sex

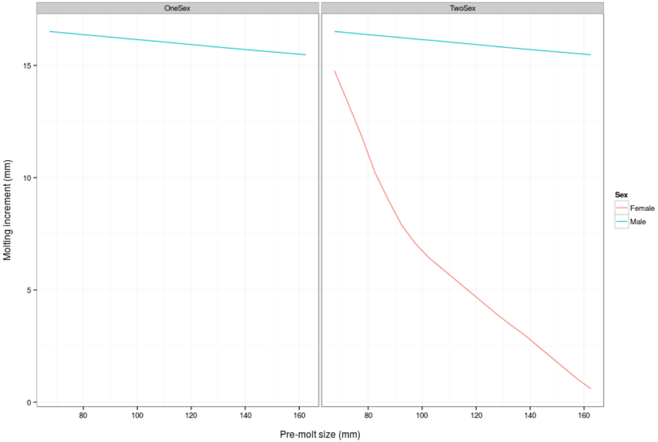
$$\boldsymbol{w}_h = f_w(\ell, \theta)$$

$$\boldsymbol{m}_h = f_m(\ell, \theta)$$

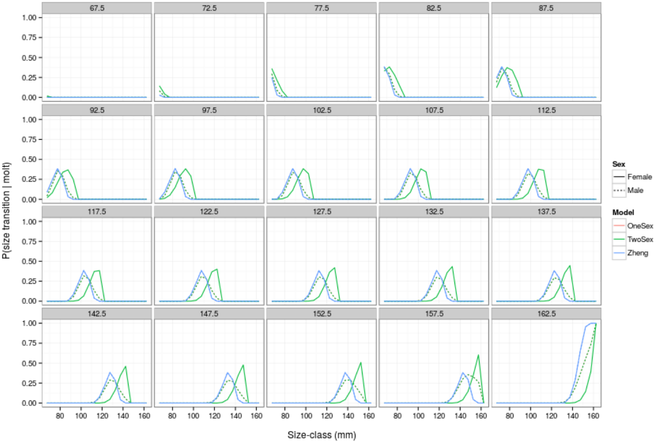
Size-weight ($w_{h,\ell}$)



Growth increments ($a_{h,\ell}$)

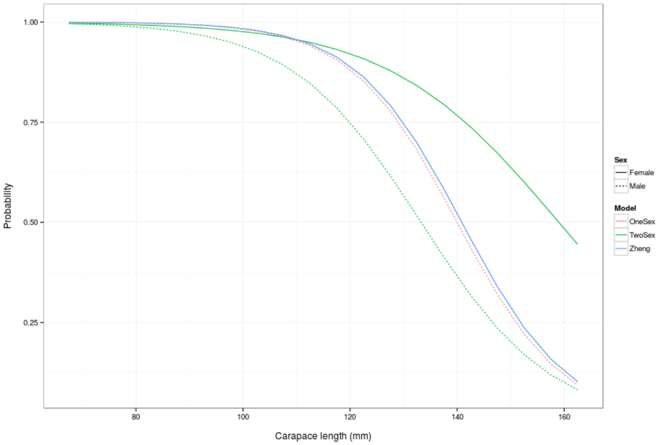


Growth transitions ($\boldsymbol{G}_h$)

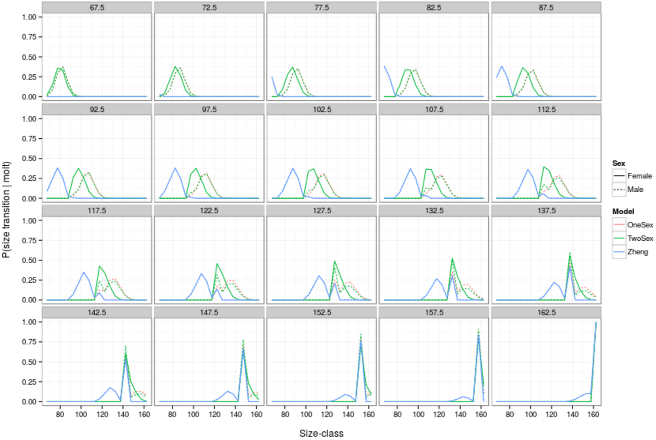


No comparison with Zheng on plot.

Molt probability ($\boldsymbol{P}_h$)

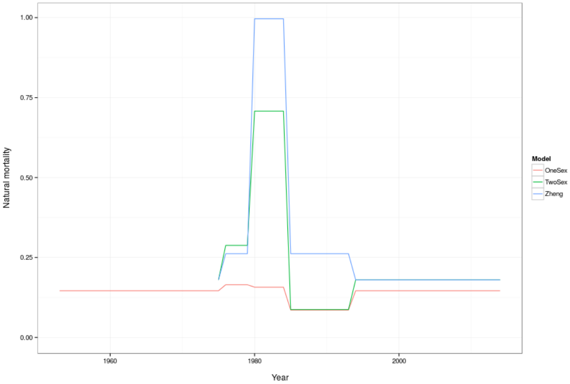


Size transitions ($\boldsymbol{P}_h \boldsymbol{G}_h$)



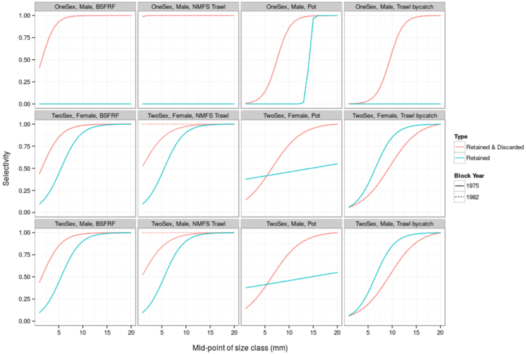
Natural mortality: option 4

If time-varying natural mortality is specified using the **blocked changes** option, the model constrains $M_{h,i}$ by the variance (σ_M^2). For example, setting $\sigma_M^2 = 0.04$ and four specific years (1976, 1980, 1985, 1994) we get

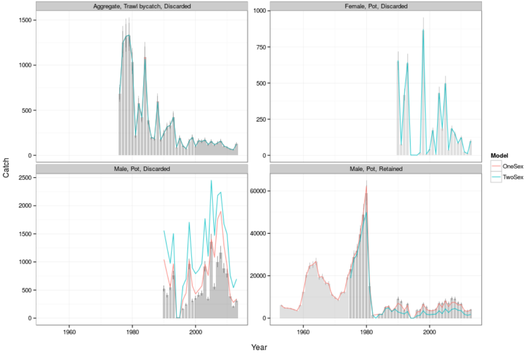


Selectivity and retention

Assuming that selectivity for the NMFS trawl fishery is split into two blocks (1975-1981 and 1982-2014) and that retention is constant with time $\boldsymbol{y}_{h,i,k} = \boldsymbol{y}_{h,k}$



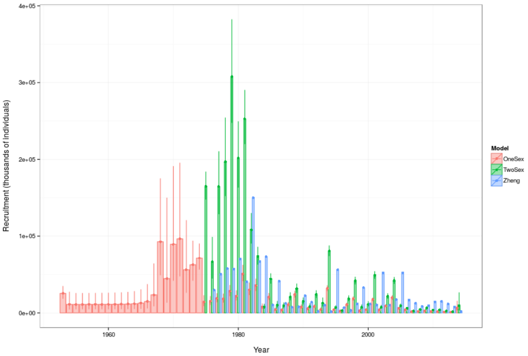
Catch



Aggregate, Trawl bycatch, Discarded
Female, Pot, Discarded
Male, Pot, Discarded
Male, Pot, Retained
Catch
Year
Model
OneSex
TwoSex

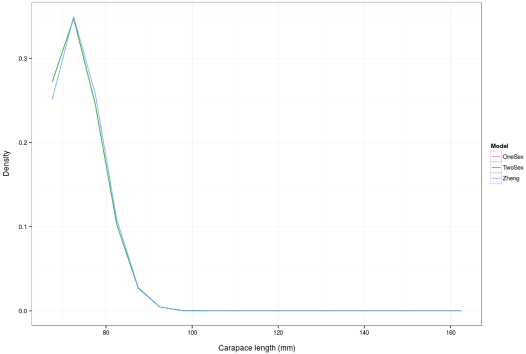
Recruitment

Recruitment size-distribution

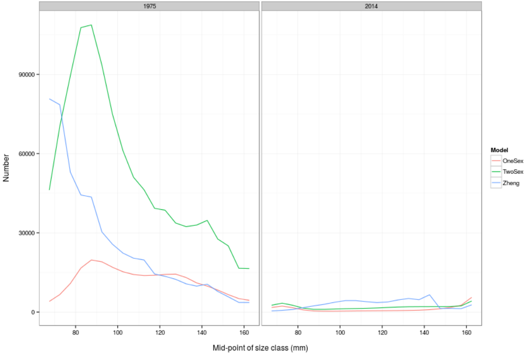


Initial recruitment

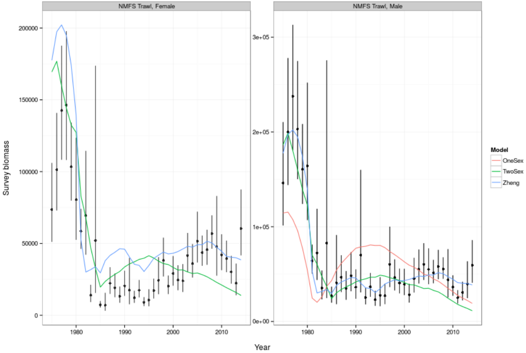
Recruitment size-distribution



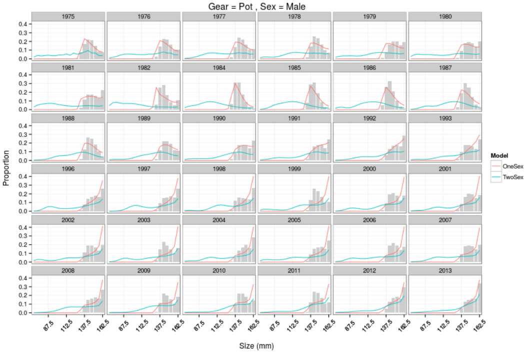
Initial numbers



Survey


NMFS Trawl, Female
NMFS Trawl, Male
Survey biomass
200000
150000
100000
50000
0
3e+05
2e+05
1e+05
0e+00
1980
1990
2000
2010
Year
Model
OneSex
TwoSex
Zheng

Size composition



Mature male biomass