# An skeleton assessment for Bristol Bay Red King crab in GMACS

#### Cody Szuwalski & Matthieu Veron

#### June 2022 - GMACS version 2.01.K

### Contents

A. Summary of Major Changes

B. Comments, responses, and assessment summary

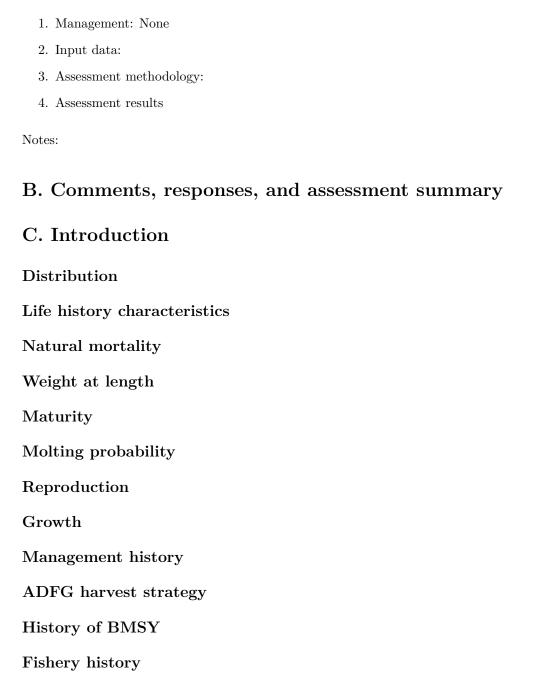
| С. | Introduction                             |
|----|--|
|    | Distribution                             |
|    | Life history characteristics             |
|    | Natural mortality                        |
|    | Weight at length                         |
|    | Maturity                                 |
|    | Molting probability                      |
|    | Reproduction                             |
|    | Growth                                   |
|    | Management history                       |
|    | ADFG harvest strategy                    |
|    | History of BMSY                          |
|    | Fishery history                          |
| D. | Data                                     |
|    | Catch data                               |
|    | Survey biomass and size composition data |
|    | Spatial distribution                     |
| Ε. | Analytic approach                        |
|    | History of modeling approaches           |
|    | Model description                        |

| F.                              | Calculation of the OFL  |  |  |  |  |  |  |
|---------------------------------|---|--|--|--|--|--|--|
|                                 | Methodology of the OFL $\ \ldots \ \ldots \ \ldots \ \ldots \ \ldots \ \ldots \ \ldots$ |  |  |  |  |  |  |
|                                 | Calculated OFLs and interpretation  |  |  |  |  |  |  |
|                                 | Projections under harvest strategies  |  |  |  |  |  |  |
| $\mathbf{G}$                    | Calculation of the ABC  |  |  |  |  |  |  |
|                                 | Uncertainty in the ABC  |  |  |  |  |  |  |
|                                 | Author recommendations  |  |  |  |  |  |  |
| Η.                              | Data gaps and research priorities   |  |  |  |  |  |  |
|                                 | Methodology   |  |  |  |  |  |  |
|                                 | Data sources  |  |  |  |  |  |  |
|                                 | Scientific uncertainty  |  |  |  |  |  |  |
| I.                              | Ecosystem considerations  |  |  |  |  |  |  |
| Appendix A: Population dynamics |   |  |  |  |  |  |  |

- 1. Stock: Bristol Bay red king crab.
- 2. Catches: trends and current levels
- 3. Stock Biomass:
- 4. Recruitment

- 5. Management
- 6. Basis for the OFL
- 7. Probability Density Function of the  $\operatorname{OFL}$
- 8. Basis for ABC

### A. Summary of Major Changes



### D. Data

Catch data

Survey biomass and size composition data

Spatial distribution

## E. Analytic approach

History of modeling approaches

Model description

Model selection and evaluation

Results

Fits to data

Estimated population processes and derived quantities

### F. Calculation of the OFL

Methodology of the OFL

Calculated OFLs and interpretation

Projections under harvest strategies

### G. Calculation of the ABC

Uncertainty in the ABC

Author recommendations

H. Data gaps and research priorities

Methodology

Data sources

Scientific uncertainty

I. Ecosystem considerations

Appendix A: Population dynamics

Table 1: Changes in management quantities for each scenario considered. Reported management quantities are derived from maximum likelihood estimates.

| Model             | MMB      | B35       | F35   | FOFL  | OFL       |
|-------------------|----------|-----------|-------|-------|-----------|
| Version 2.01.F    | 14113.97 | 303.821   | 1.961 | 1.961 | 13118.822 |
| Version 2.01.G    | 14113.97 | 303.821   | 1.961 | 1.961 | 13118.822 |
| Version 2.01.H    | 14113.97 | 303.821   | 1.961 | 1.961 | 13118.822 |
| Version 2.01.I    | 14113.97 | 22534.976 | 0.298 | 0.187 | 2458.485  |
| $Version\ 2.01.L$ | 14113.97 | 22534.976 | 0.298 | 0.187 | 2441.635  |

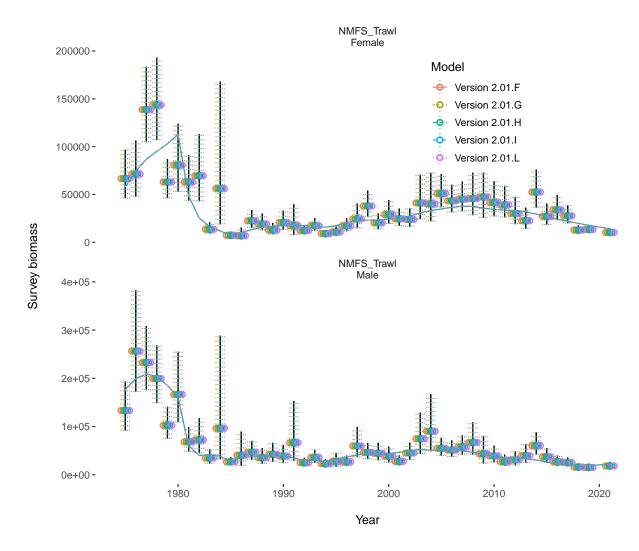


Figure 1: Model fits to the NMFS trawl survey.

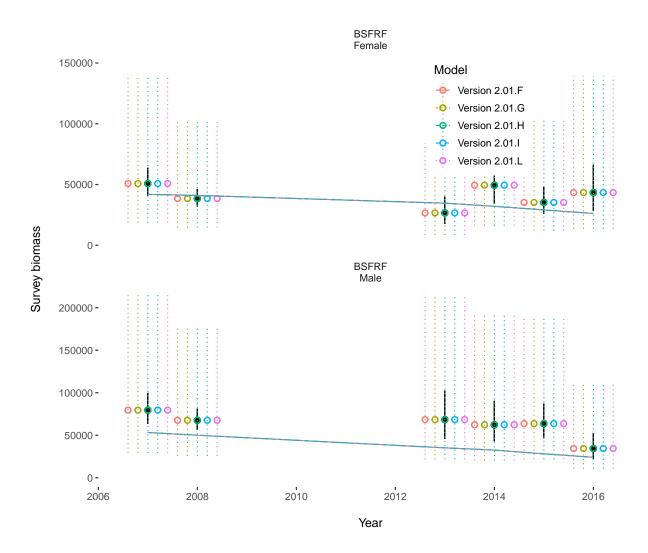


Figure 2: Model fits to the BSFRF survey.

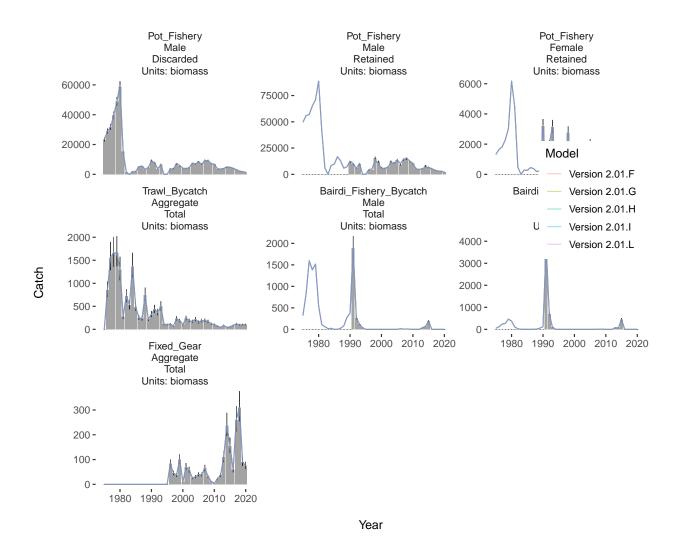


Figure 3: Model fits to the catch data.

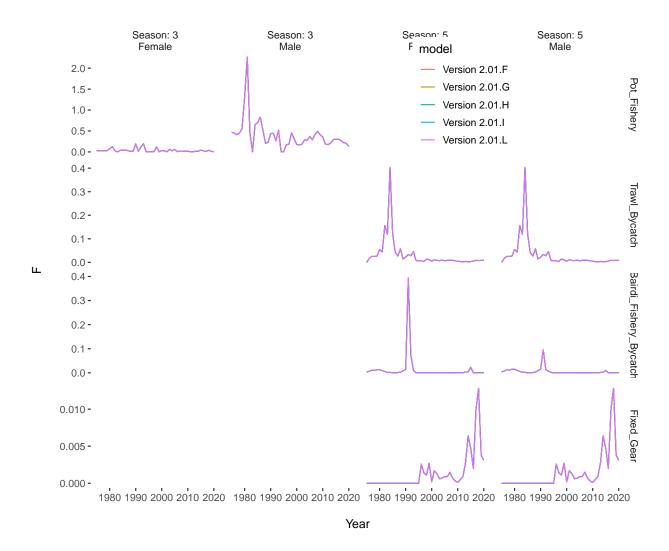


Figure 4: Estimated fishing mortality by fleet.

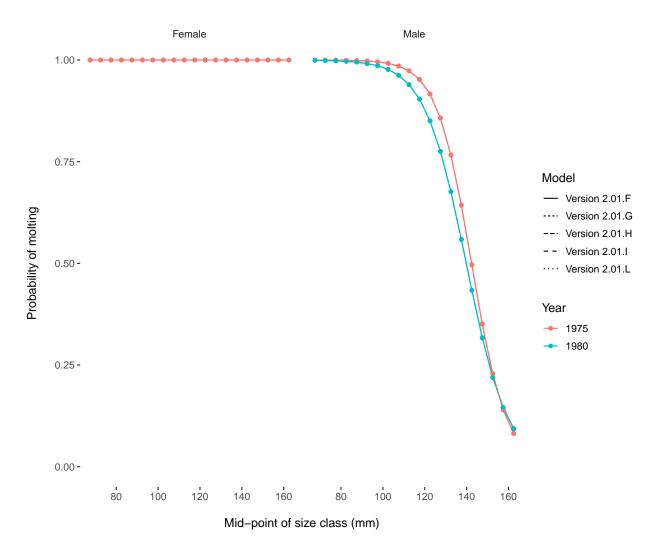


Figure 5: Estimated probability of molting.

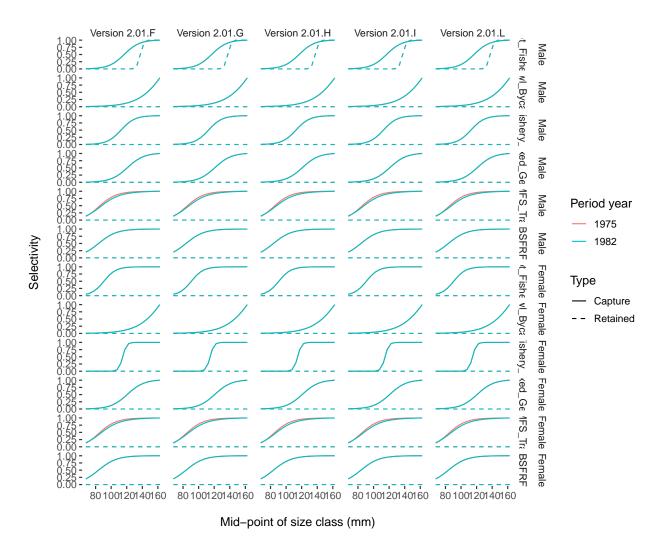


Figure 6: Estimated selectivity.

Male

Year

Figure 7: Estimated recruitment.

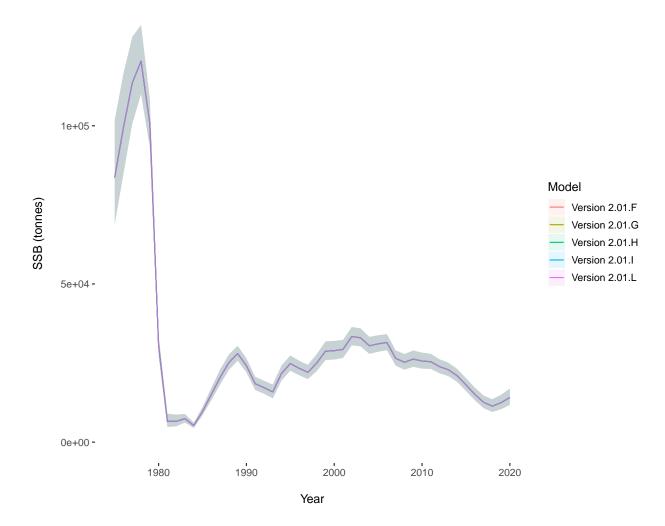


Figure 8: Estimated mature biomass



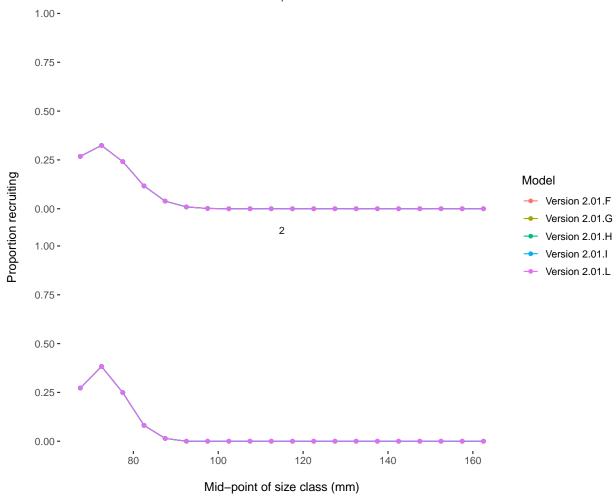


Figure 9: Estimated size at recruitment