Stock status evaluation progress update for red swimming crab FIP, Dongshan, Fujian Province, China

Compiled by Dr. Ming Sun, Dr. Jocelyn Drugan, Ms. Lu Fang

December 2022

Objective

This report was completed as part of the work plan for the China Fujian Zhangzhou red swimming crab (RSC)- bottom trawl & pot/trap FIP. Specifically, it describes progress being made on Action 3: Regular stock assessment.

Summary

Ocean Outcomes contracted Dr. Ming Sun, a post-doctoral associate and stock assessment scientist at Stonybrook University, to evaluate the stock status of the Fujian red swimming crab (*Portunus haanii*) stock using fishery catch and research data collected by the FIP stakeholders, notably Dr. Liu Min and her students at Xiamen University. See Lin et al. 2021 for additional details on data collection methods. The evaluation includes estimation of CPUE (catch per unit effort) over time, various fishery parameters (e.g. fishing mortality), and length-based spawning potential ratio. Some example results are provided below, noting that these are preliminary. We are in the process of checking results, discussing them with FIP stakeholders, and writing a complete report.

Preliminary results

These are draft results and are not to be replicated or used by parties other than the FIP stakeholders. We are still the process of interpreting the results and what they indicate about the status of the stock.

Fishery-dependent analysis

Table 1 shows estimated CPUE based on fishery data collected from 2019-2022. The grey bars represent time periods when no data were collected.

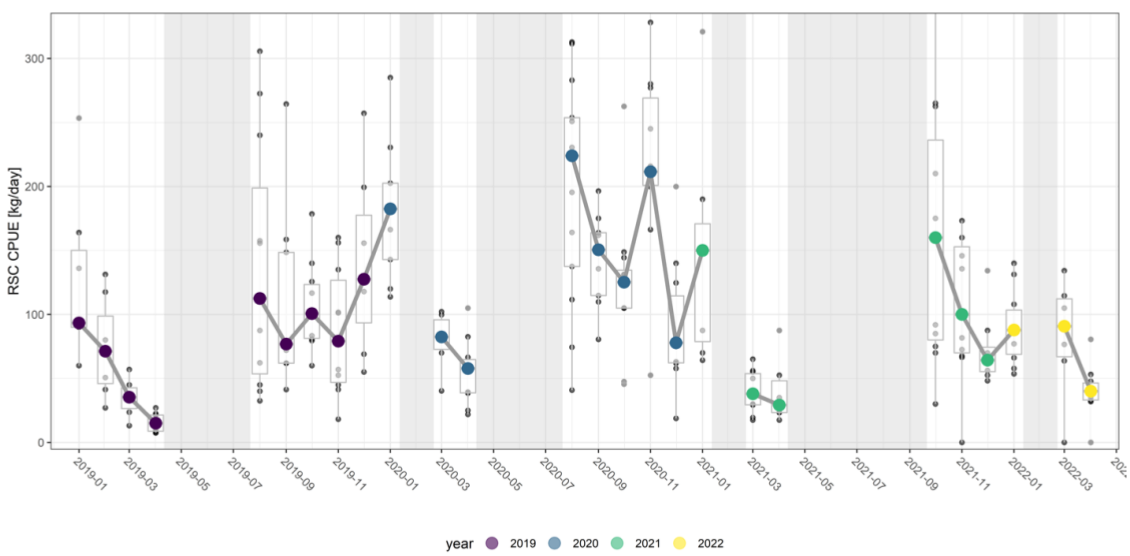

Figure 1. RSC CPUE over time.

Model-based analyses

Figure 2 shows estimated RSC size structure for different months and years.

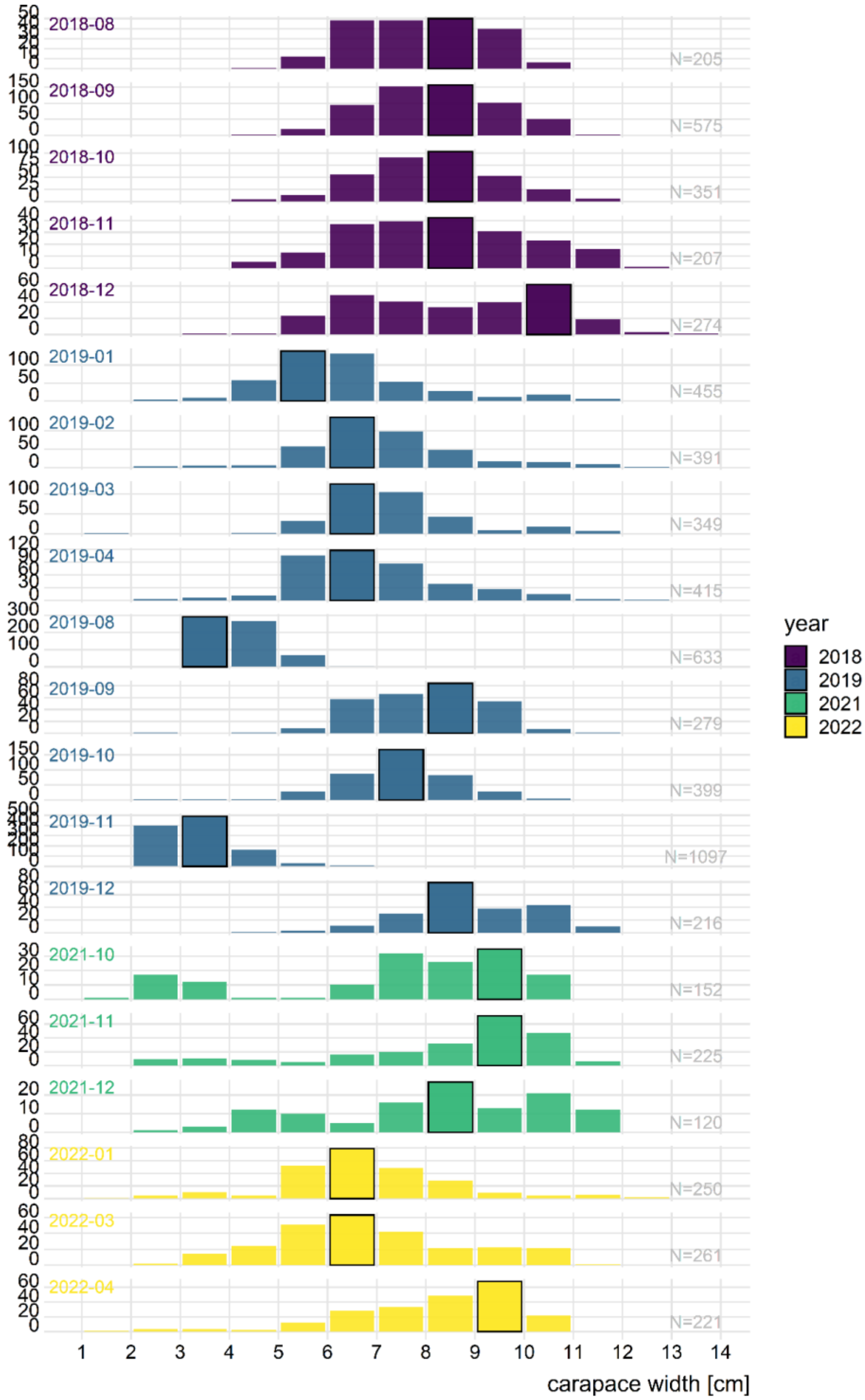

Figure 2. RSC size structure histograms by year, for both sexes combined.

Dr. Sun took a length-based Bayesian (LBB) approach (see Froese et al., 2018) to estimate various biological and fishery parameters (Table 1).

Table 1. Fishery parameter estimates obtained from length-based Bayesian method.

Parameter	estimates	
General reference points [median across years]		
Linf	12.9 cm (12.8-13)	
Lopt	8.7	Lopt/Linf = 0.67
Lc_opt	6.4	Lc_opt/Linf = 0.5
M/K	1.46 (0.775-1.7)	
F/K	0.406 (0.172-0.135)	
Z/K	1.9 (1.79-2.35)	
F/M	0.264 (0.105-1.23)	
B/B0	0.711 (-0.00147-1.37)	
Y/R'	0.018 (0.00204-0.0609) (linearly reduced if B/B0 < 0.25)	
Estimates for last year 2022:		
Lc	6.28 (6.18-6.43) cm	
Lc/Linf	0.49 (0.478-0.496)	
alpha	14.3 (13.8 - 14.8)	
Lmean/Lopt	0.94	
Lc/Lc_opt	0.98	
L95th	12.5	
L95th/Linf	0.97	
Lm50	6.3	
Mature	78%	
F/K	0.28 (0.0782 - 0.471)	
F/M	0.18 (0.0463 - 0.332)	
Z/K	1.78 (1.68 - 1.98)	
Y/R'	0.018 (-0.000781 - 0.0367) (linearly reduced if B/B0 < 0.25)	
B/B0	0.77 (-0.0338 - 1.59)	
B/Bmsy	2.1 (-0.0919 - 4.32)	Year-specific

A data-limited approach (length based spawning potential ratio; LBSPR) was used to estimate the stock's spawning potential ratio, the ratio of the amount of spawn produced by a cohort over its lifespan under a specific fishing regime relative to the spawn that would have been produced over the cohort's lifespan if there were no fishing. SL50 and SL95 are the lengths at which 50% and 95% of the fish are vulnerable to the fishery, respectively.

This LBSPR method uses maximum likelihood methods to estimate values of relative fishing mortality (F/M) and selectivity-at-length that minimize the difference between the observed and the expected length composition of the catch, and calculates the resulting SPR (see Hordyk et al. 2015).

Initial LBSPR results are shown below for the different sampling years.

year	rawSL50	rawSL95	rawFM	rawSPR
2018	6.94	8.80	1.39	0.3744374
2019	2.54	3.11	0.67	0.3286564
2021	12.09	17.28	8.75	0.3744907
2022	6.12	8.96	1.44	0.2981926