

Guyana/Suriname Seabob Stock Assessment: Results Summary

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Base Case Results

- Both Suriname and Guyana stocks are fluctuating at or above their MSY level (Figure 1).
- However, both stocks are low compared to the unexploited state and on average is below the 40% SSB_0 (Figure 2), although this is precautionary for finfish rather than shrimp.
- There is some evidence of seasonality in spawning stock biomass (Figure 3). Although seasonality is present in the recruitment, this pattern is weaker. The seasonality is opposite between Suriname and Guyana.
- There is no evidence that recruitment has been reduced significantly by fishing (Figure 4).
- Fishing mortality has tended to be higher than F_{MSY} for Suriname, but fluctuating around or lower than F_{MSY} for Guyana in recent years.
- Suriname has dome-shaped, but highly uncertain, selectivity. Guyana selectivity is logistic in shape and appears more typical for trawl.

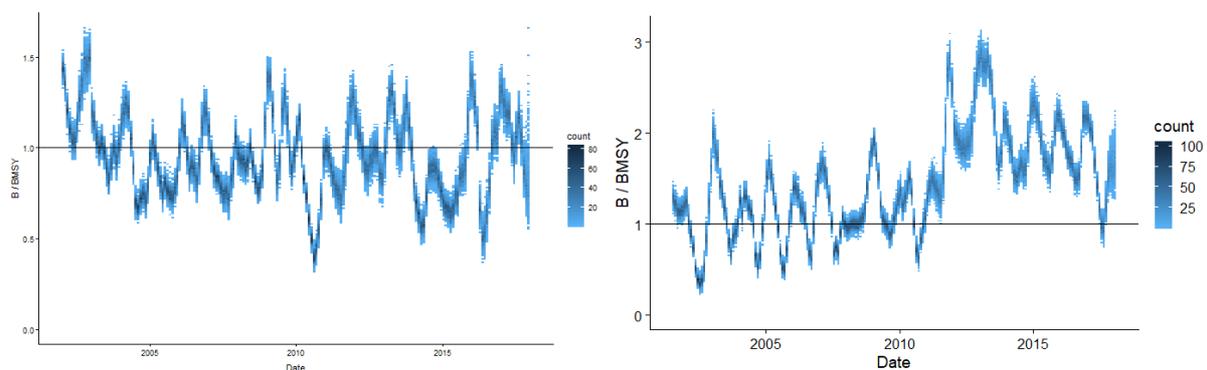


Figure 1 Suriname (left) and Guyana (right) stock status.

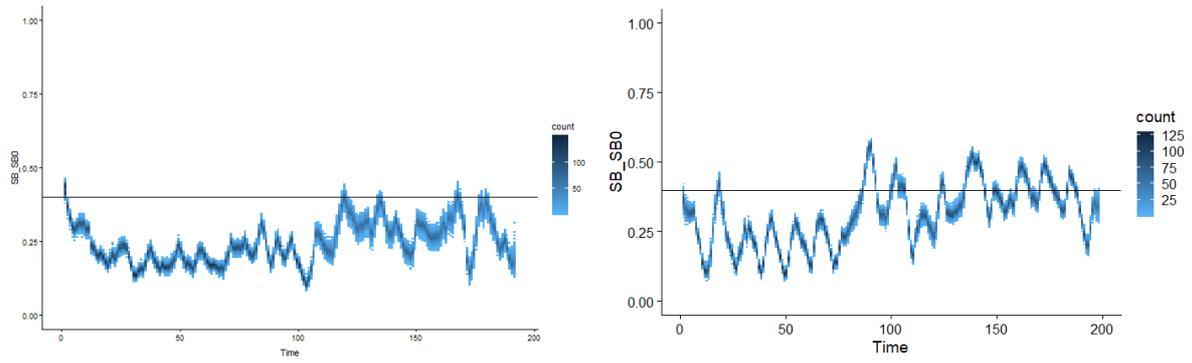


Figure 2 Suriname (left) and Guyana (right) stock status relative to the unexploited state.

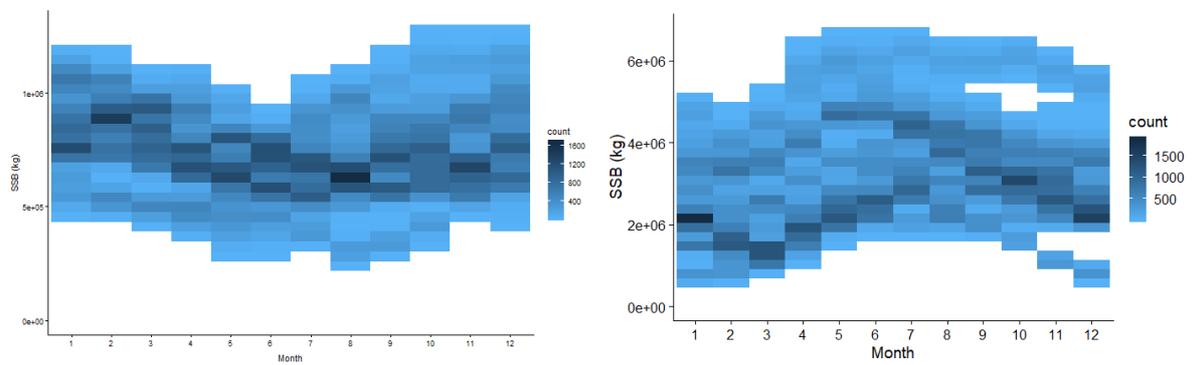


Figure 3 Suriname (left) and Guyana (right) spawning stock biomass by month January (1) – December (12).

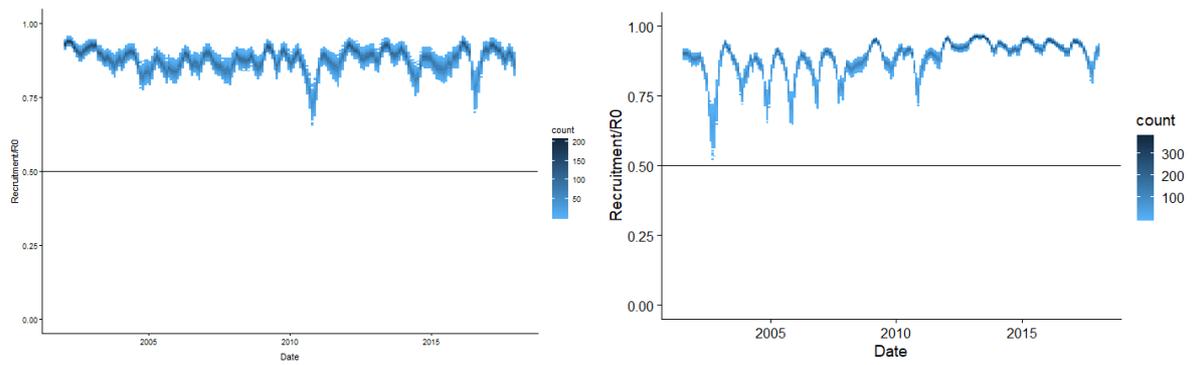


Figure 4 Suriname (left) and Guyana (right) recruitment relative to the unexploited state.

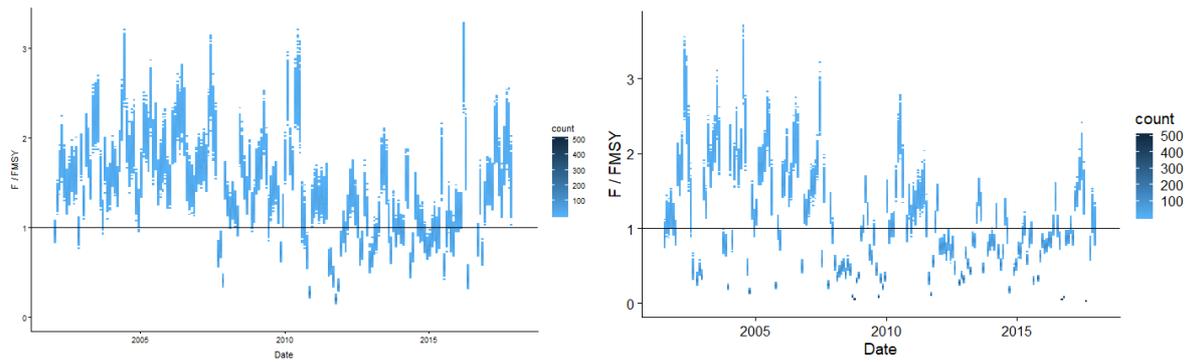


Figure 5 Suriname (left) and Guyana (right) fishing mortality relative to the F_{MSY} .

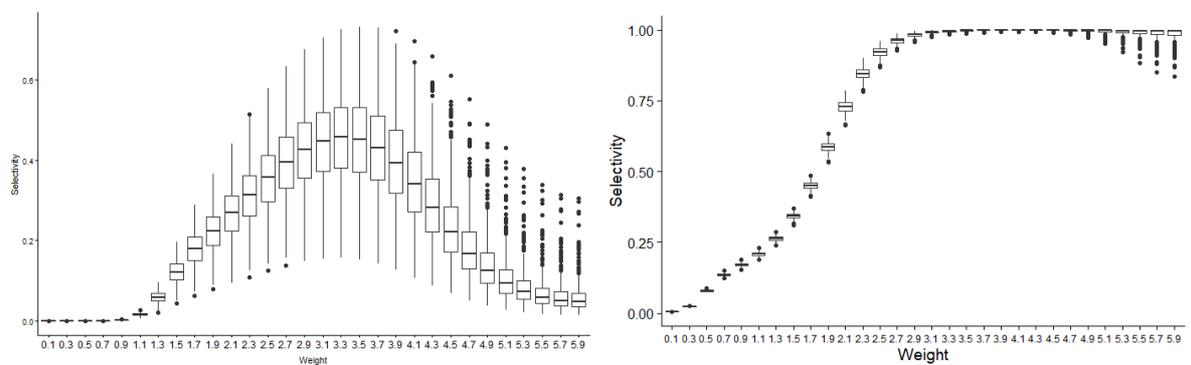


Figure 6 Suriname (left) and Guyana (right) selectivity ogives.

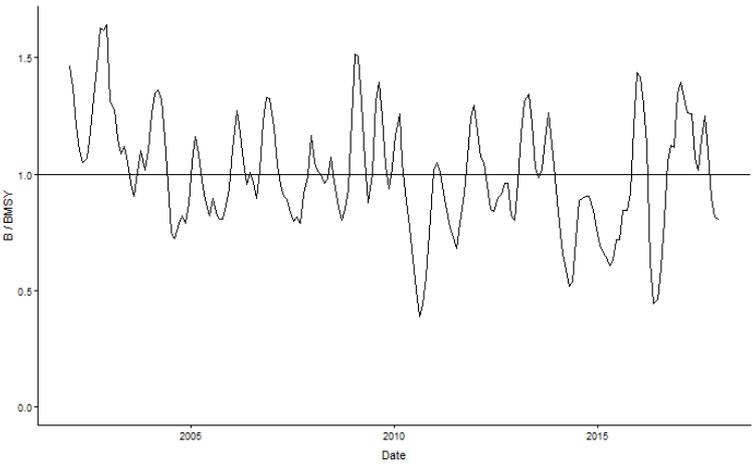
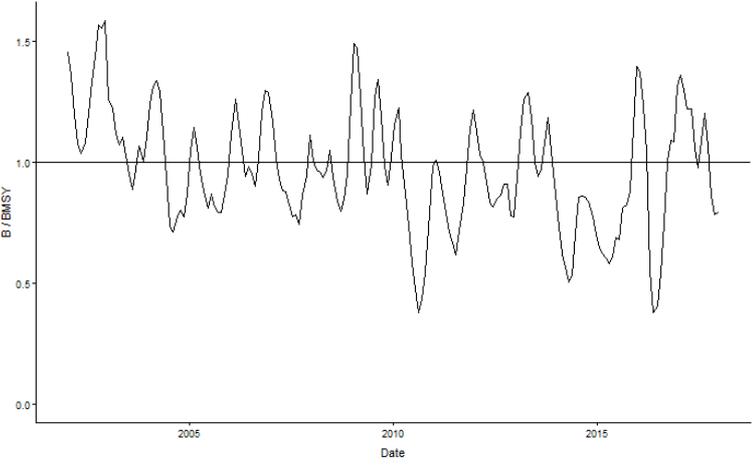
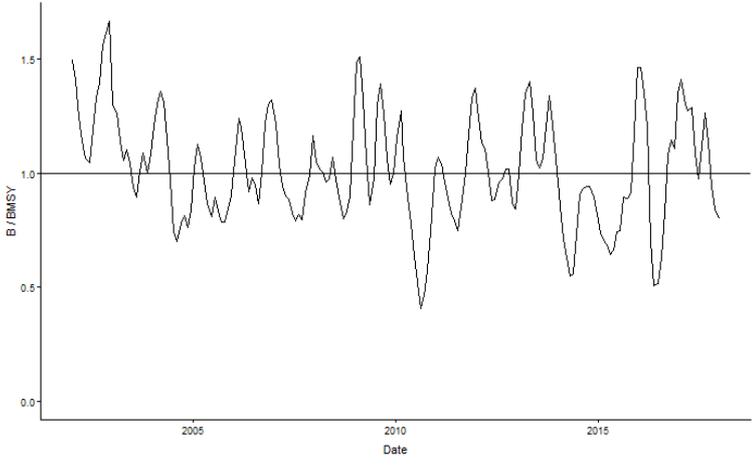
Sensitivity Analyses

The base case was determined through the review process. The review used information from the sensitivity analyses to make its decisions (Table 1). The general results are outlined below:

- The results were broadly unaffected by the growth rate (K). The growth rate is partially estimated by one of the parameters (G_{sig}) used to define the transition matrix.
- Results were sensitive to the natural mortality, with a significant change in status resulting over a plausible range of natural mortality. The choice of natural mortality is discussed further below.
- There were very slightly better fits to the data with higher growth rate and higher natural mortality rate.
- Forcing the model to fit the average count data improved the stock status slightly for Suriname and made it slightly worse for Guyana. In both cases, the fit to the other data deteriorated.
- Removing the smallest size category, which included “broken” shrimp, and including a factor that accounted for artisanal catch made no significant difference to stock status.

On balance, the final choices suggested that the model and determined stock status were precautionary in the base case.

Table 1 Suriname sensitivity analysis results: Positive change in log probability indicates a better fit. Log probability for the base case model was -944171.96.

Sensitivity	Change in log probability	Stock Status
Base: M=0.2, K=0.2	0.00	
Fixed parameters: M=0.2, K=0.15	-47.79	
Fixed parameters: M=0.2, K=0.25	36.37	

Sensitivity	Change in log probability	Stock Status
Fixed parameters: M=0.1, K=0.20	-96.18	
Fixed parameters: M=0.3, K=0.20	26.36	
Artisanal catch	5.11	

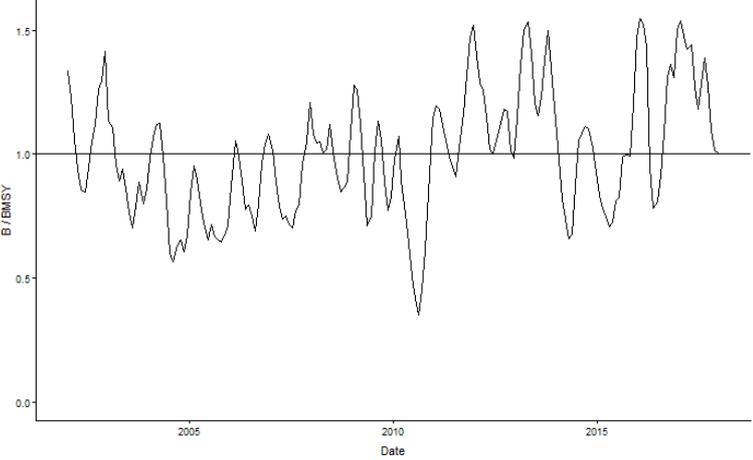
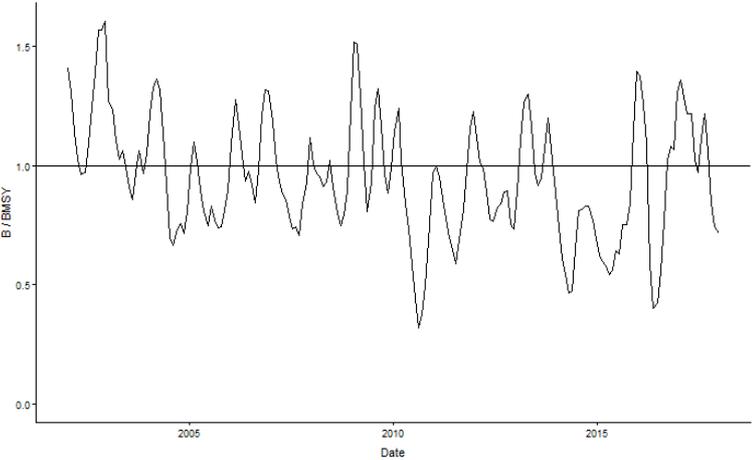
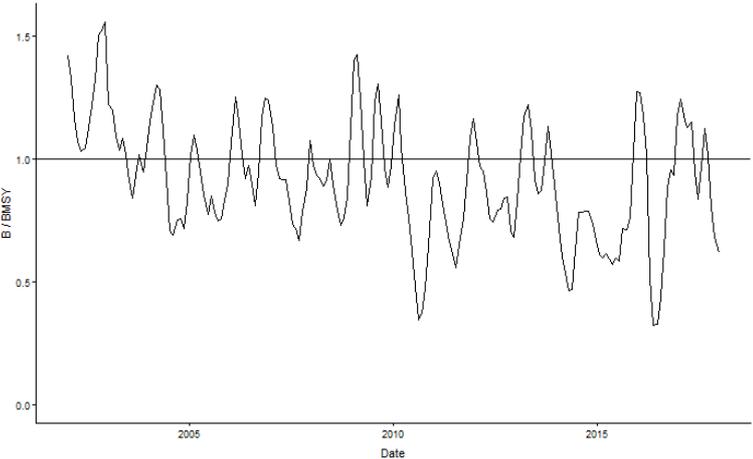
Sensitivity	Change in log probability	Stock Status
Force fit to average count data	-1508.23	
Nominal days-at-sea	-136.86	
Remove smallest size grade	NA	

Table 2 Guyana sensitivity analysis results: Positive change in log probability indicates a better fit. Log probability for the base case model was -4004954.14.

Sensitivity	Change in log probability	Stock Status
Base: M=0.2, K=0.2	0.00	
Fixed parameters: M=0.2, K=0.15	43.78	
Fixed parameters: M=0.2, K=0.25	27.14	

Sensitivity	Change in log probability	Stock Status
Fixed parameters: $M=0.1$, $K=0.20$	-37.34	
Fixed parameters: $M=0.3$, $K=0.20$	-66.88	
Artisanal catch	9.18	

Sensitivity	Change in log probability	Stock Status
Force fit to average count data	-253.97	
Nominal days-at-sea	-22.06	
Remove smallest size grade	NA	

Natural Mortality

Consistent with methods used elsewhere (Ribeiro De Campos et al. 2011), natural mortality was estimated based on growth and maturity parameters derived from the stock assessment (Table 3). Variation in the parameter estimates was very low, so only the mean MCMC runs are reported here. Natural mortality estimates ranged from 0.093 to 0.29 per month dependent on the methodology. Other simpler approaches suggested that natural mortality would be around 0.2 /month (based on $M=1.5*K$), which would be in the mid-range of methods in Table 3. Therefore, 0.2 /month was used in the base case.

Table 3 Mean growth and natural mortality parameter estimates from 500 MCMC runs.

PARAMETER	SURINAME	GUYANA
Female L_{∞} (CL mm)	32.29	32.32
Female K (/month)	0.14	0.13
Age 50% Maturity (months)	15.41	15.33
Male L_{∞} (CL mm)	29.54	27.81
Male K (/month)	0.12	0.093
M: female (Pauly 1980)	0.29	0.27
M: female (Rikhter & Efanov 1976)	0.093	0.093
M: male (Pauly 1980)	0.26	0.22