Gulf of Mexico Penaeid Shrimp Stock Assessment Update 2017 Fishing Year

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Gulf of Mexico Fisheries Management Council SSC
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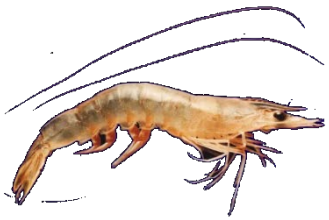
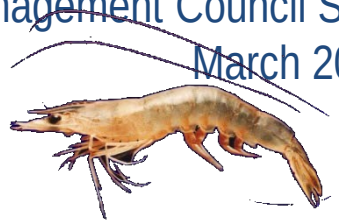
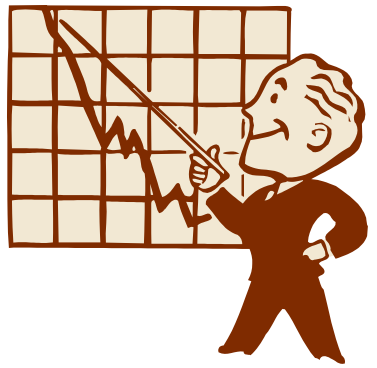


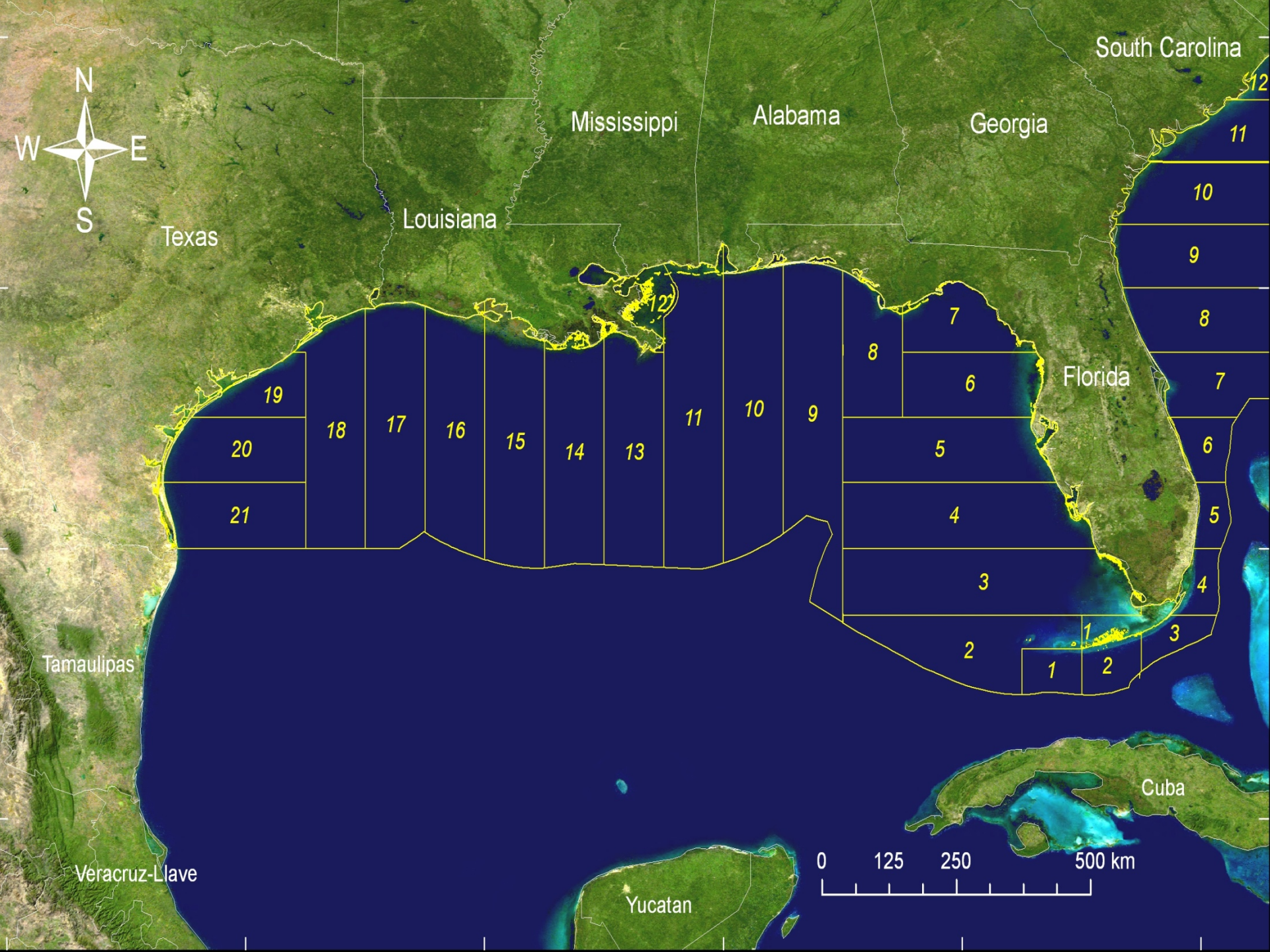


Assessment Updates



Stock Synthesis stock assessment update for SSBmsy and Fmsy estimates for:

- Pink Shrimp statistical zones 1-11
- Brown Shrimp statistical zones 7-21
- White Shrimp statistical zones 7-21


N
W
E
S
Texas
Louisiana
Mississippi
Alabama
Georgia
South Carolina
Florida
Tamaulipas
Veracruz-Llave
Yucatan
Cuba
0
125
250
500 km
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21

Pink Shrimp Model Inputs

- 1984-2017 GOM monthly catch (lbs. tails)
- 1984-2017 GOM monthly catch by size category
- 1984-2017 GOM monthly catch rate (CPUE)
- 1987-2017 SEAMAP Summer and Fall Survey Data
  - Catch by size
  - Nominal CPUE Index
- 2008-2017 SEAMAP Summer and Fall Survey Data
  - Delta lognormal CPUE Index

Brown Shrimp Model Inputs

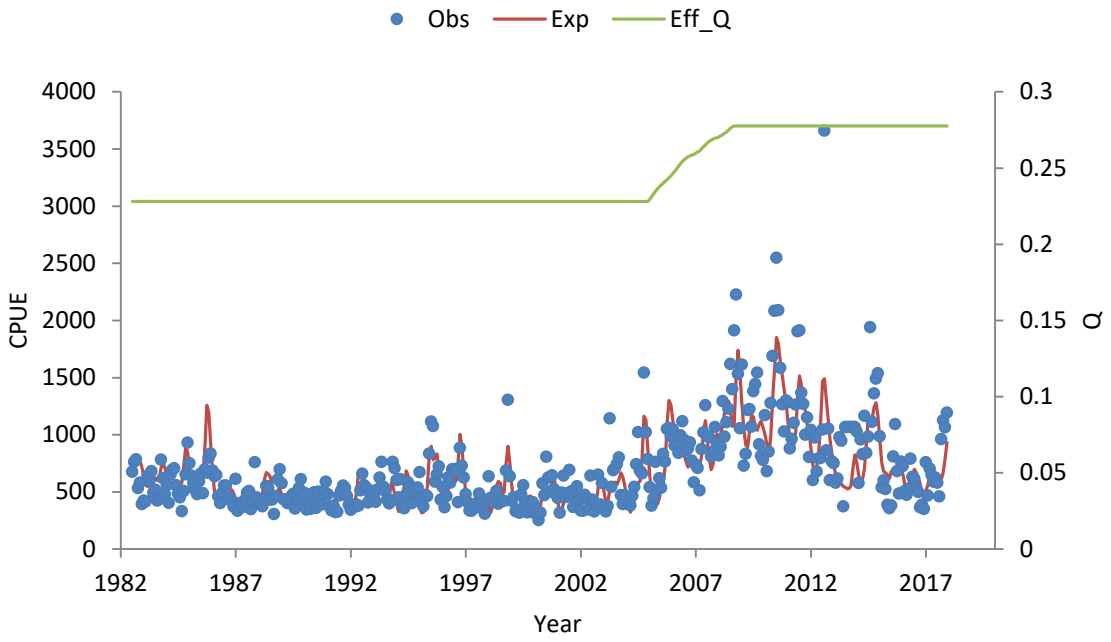
- 1984-2017 GOM monthly catch (lbs. tails)
- 1984-2017 GOM monthly catch by size category
- 1984-2017 GOM monthly catch rate (CPUE)
- 1984-2017 Louisiana monthly shrimp trawl surveys (Western subset)
  - Catch by size
  - Delta lognormal CPUE Index
- 1987-2017 SEAMAP Summer and Fall Survey Data
  - Catch by size
  - Delta lognormal CPUE Index

White Shrimp Model Inputs

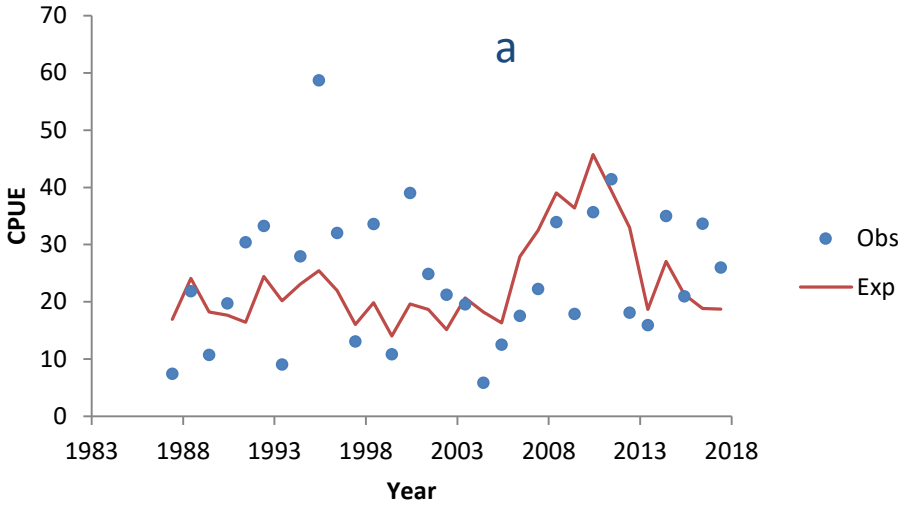
- 1984-2017 GOM monthly catch (lbs. tails)
- 1984-2017 GOM monthly catch by size category
- 1984-2017 GOM monthly catch rate (CPUE)
- 1984-2017 Louisiana monthly shrimp trawl surveys (Western subset)
  - Catch by size
  - Delta lognormal CPUE Index
- 1987-2017 SEAMAP Summer and Fall Survey Data
  - Catch by size
  - Delta lognormal CPUE Index

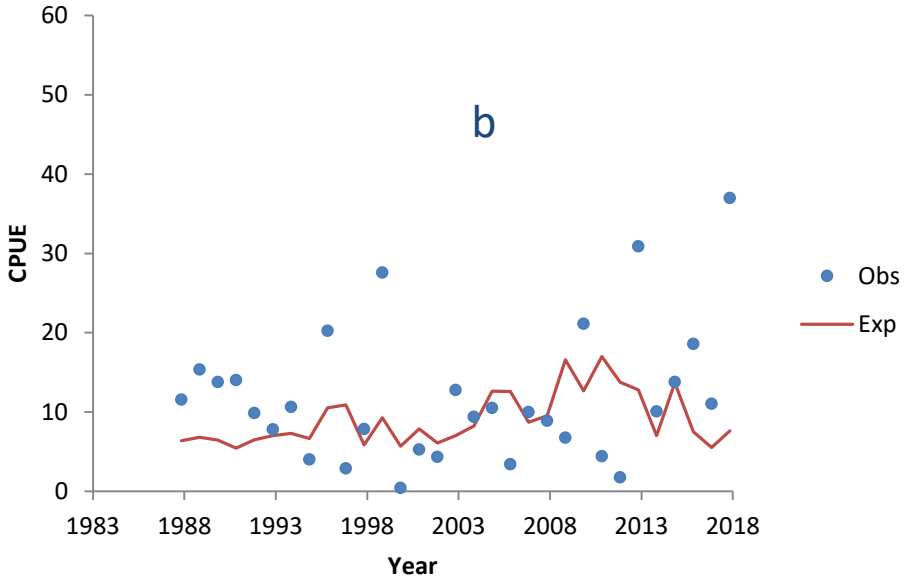
Pink Shrimp Model Output

- Fits to CPUE and size compositions as well as selectivity estimates were developed.
- Spawning biomass and fishing mortality estimated.

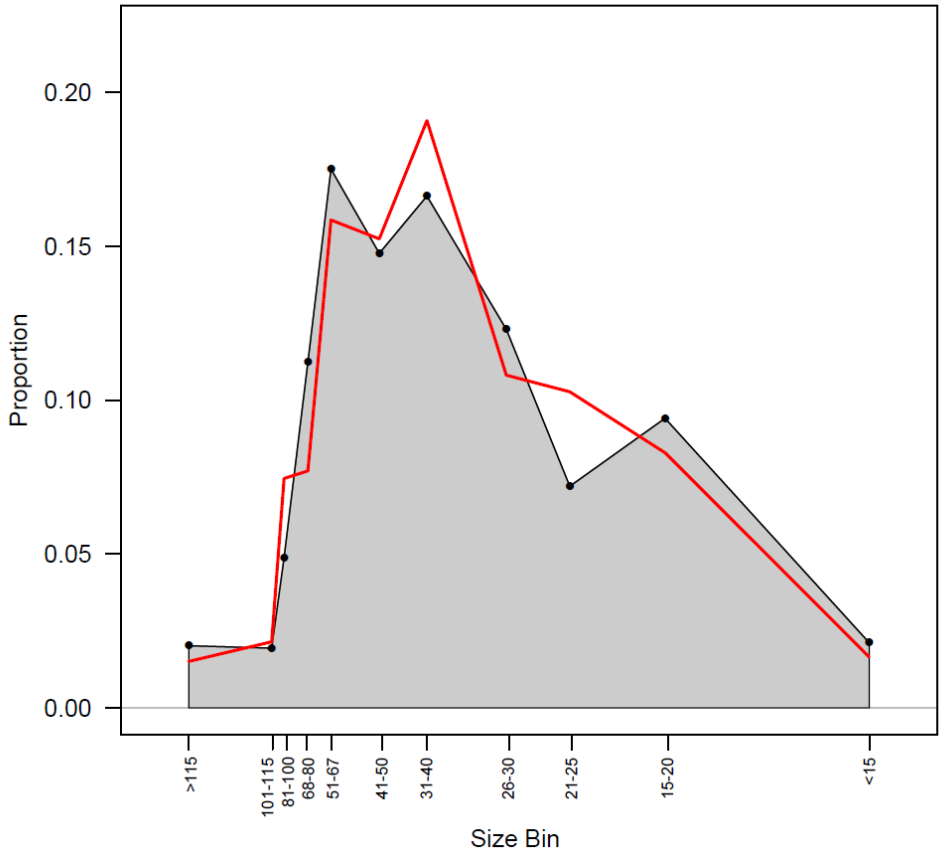


Pink shrimp CPUE and Q model fits, 1984-2017.

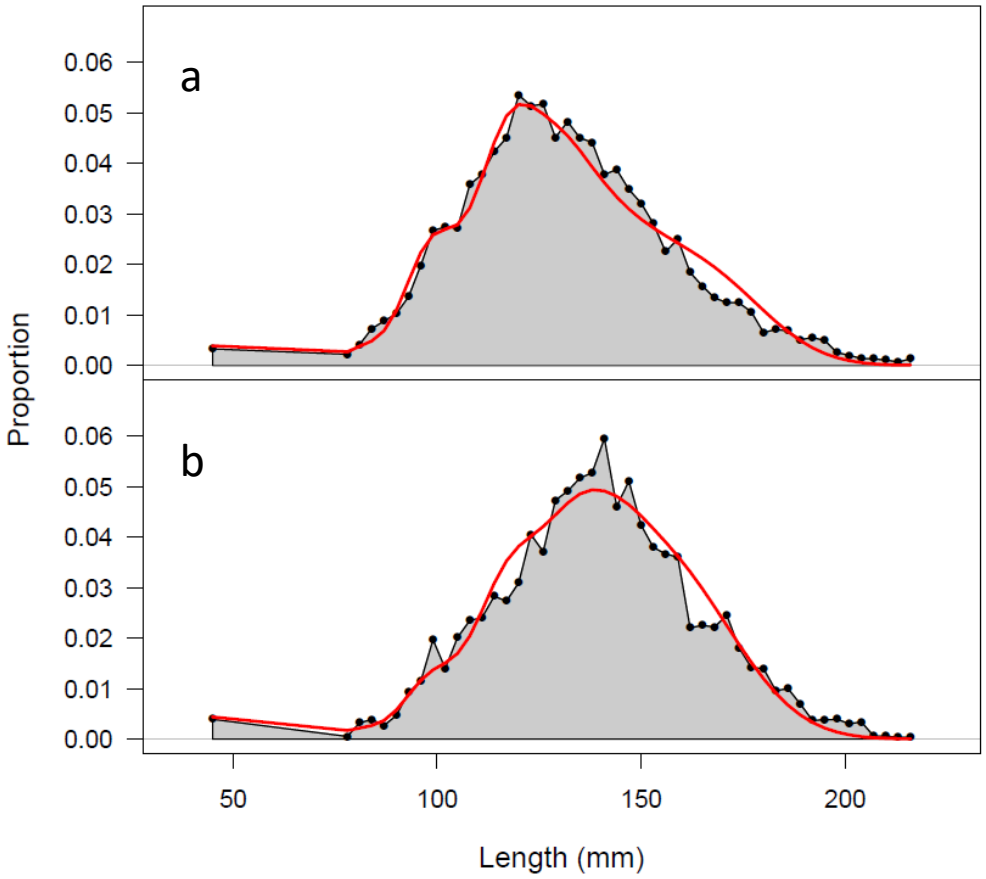




Pink shrimp survey fits for the Summer and Fall SEAMAP surveys, 1987-2017. Plot a is summer and plot b is fall survey.



Pink shrimp size composition fits for the commercial fleet.



Pink shrimp size composition fits for the Summer (panel a) and Fall (panel b) SEAMAP surveys.

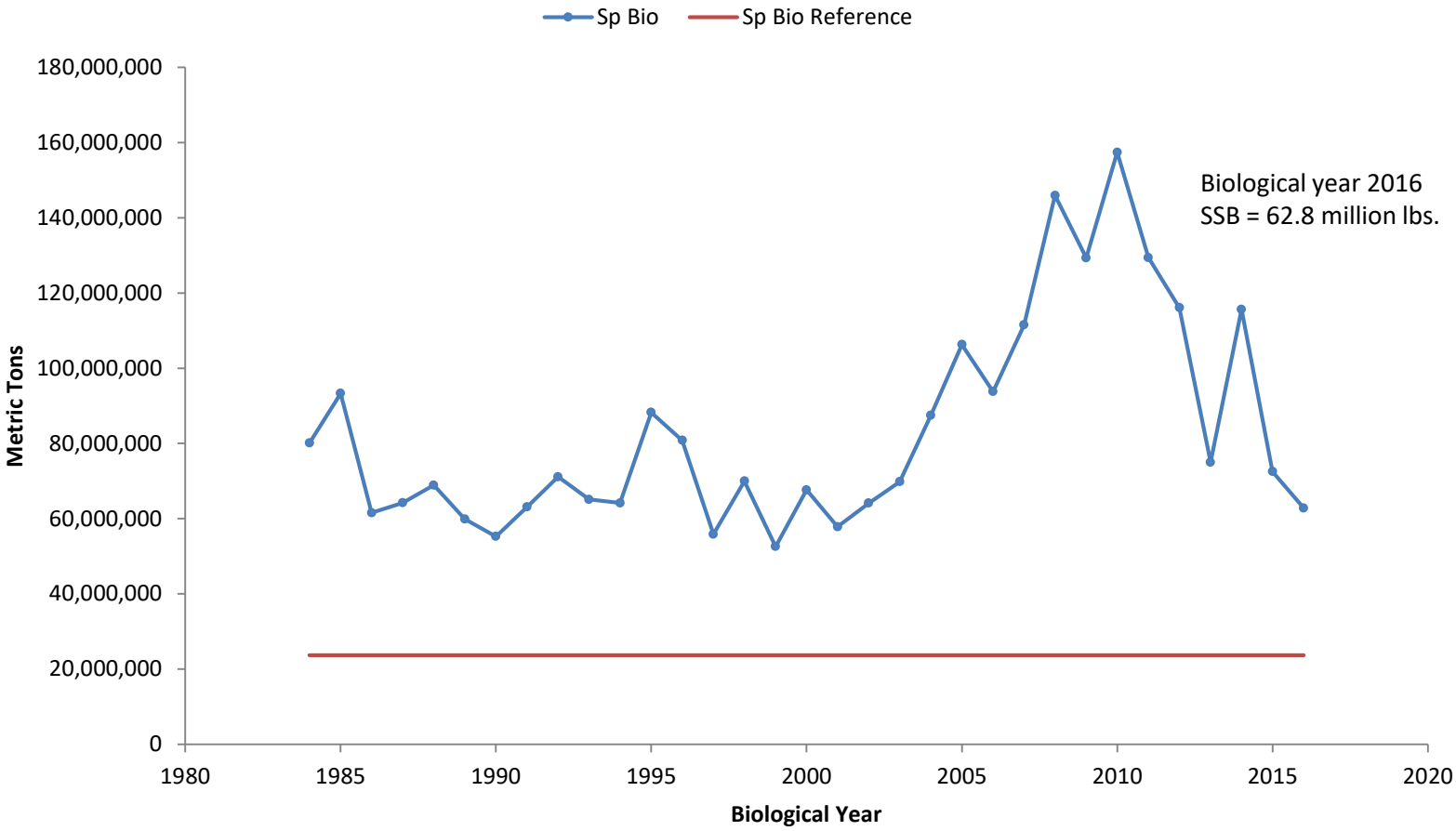
Pink Shrimp SSBmsy and Fmsy Estimates

SSBmsy - Pink shrimp spawn and recruit throughout the year. The current assessment method models these parameters on a continuous basis. Therefore we derive an annual SSBmsy by multiplying the terminal benchmark "year" SSBmsy estimate by 12.

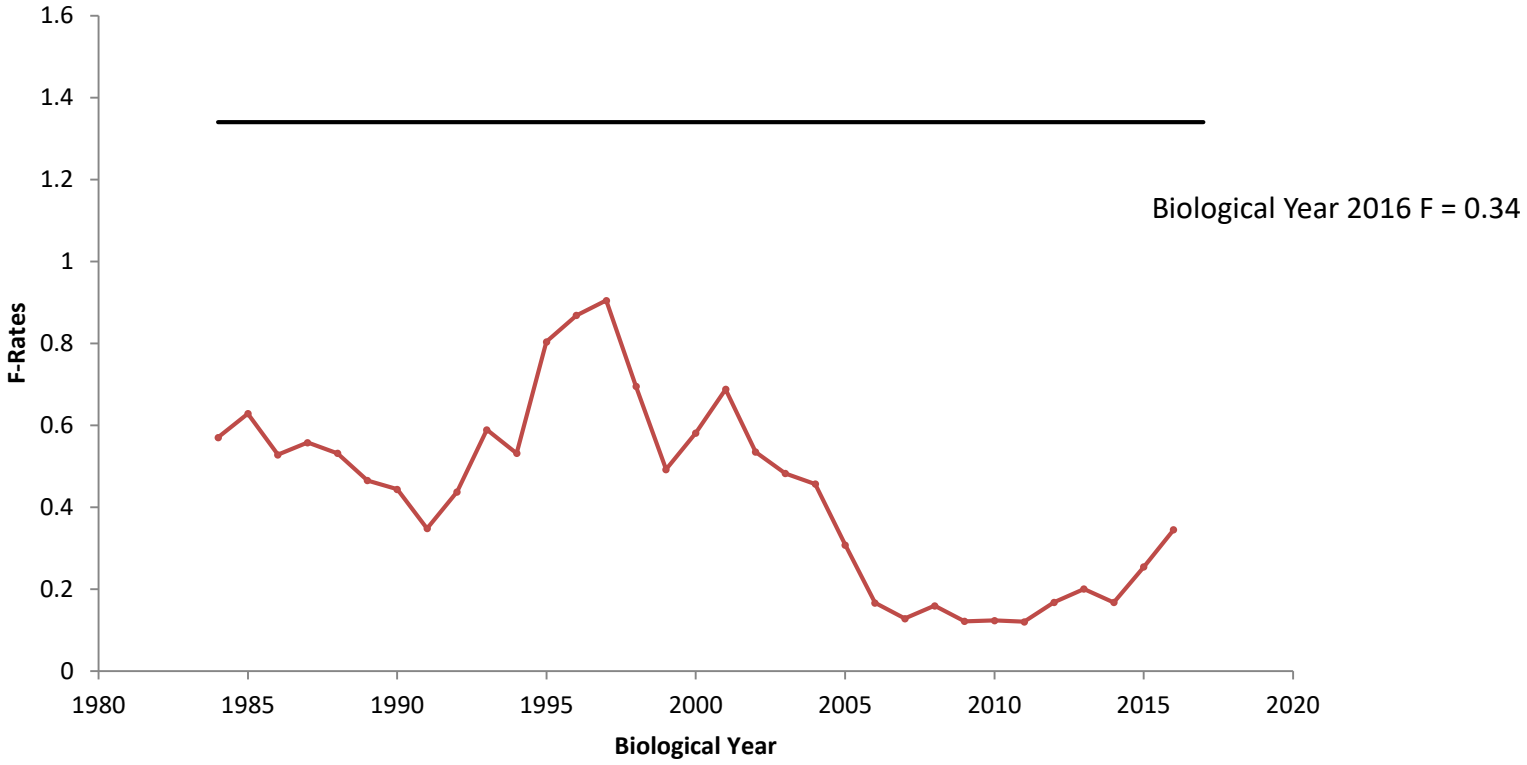
This results in an annual SSBmsy of 23,686,465 lbs. (10,744.2 metric tons) of tails.

Fmsy - The SS model also estimates an Fmsy value. The terminal benchmark "year" value is be multiplied by 12 to estimate an annual Fmsy. The sum of the monthly Fstd estimates calculated in the annual assessment is compared to this Fmsy estimate.

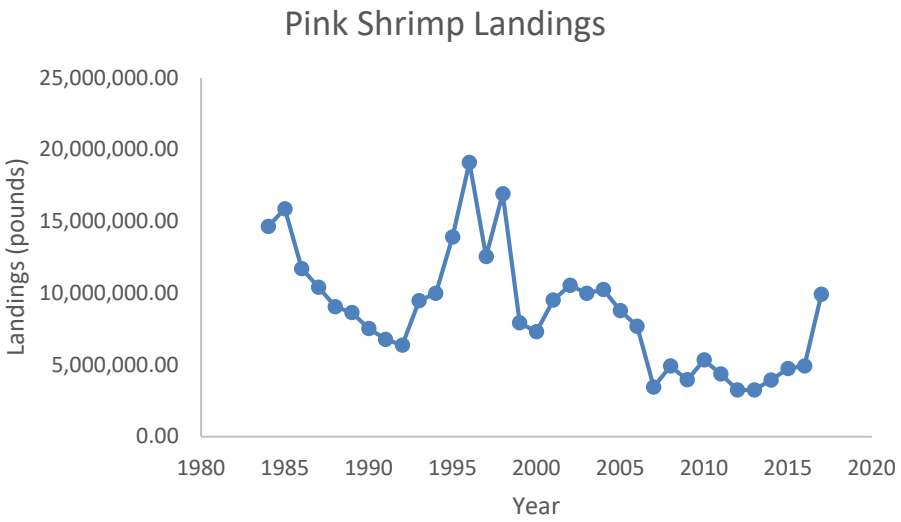
$Fmsy_{(annual)} = 1.35$

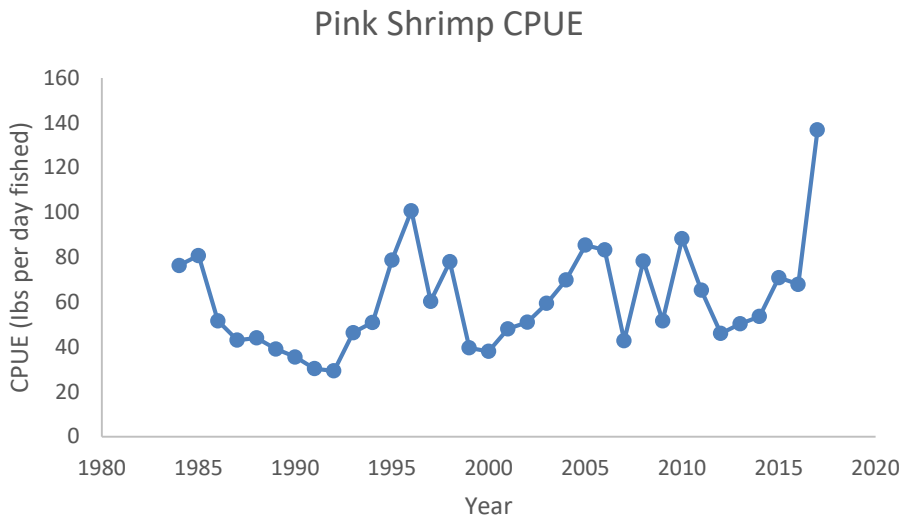


Pink shrimp stock synthesis SSB and SSBmsy estimate, biological year 2016 (July 2016 – June 2017).



Pink shrimp stock synthesis annual F estimate, biological year 2016 (July 2016 – June 2017).

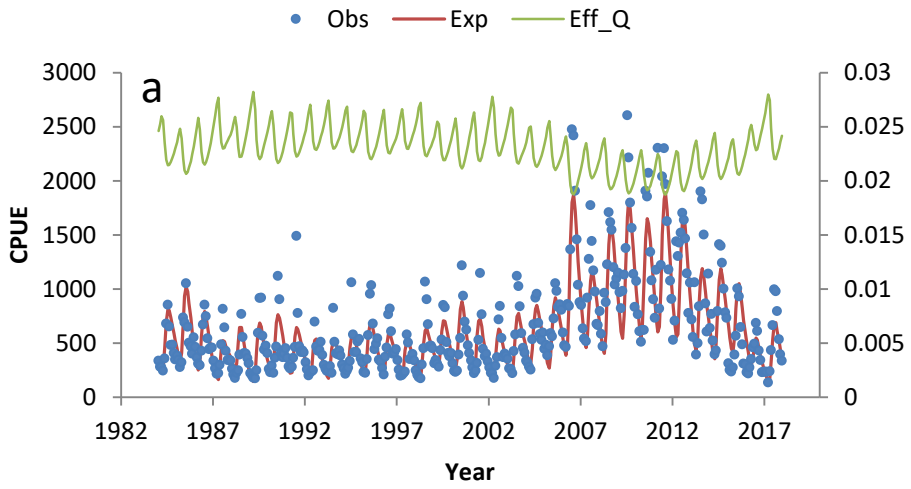


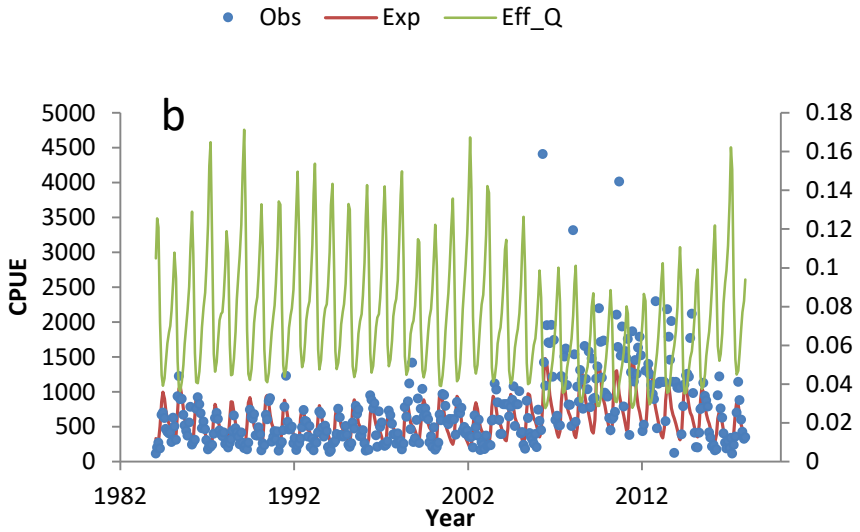


Pink shrimp landings and offshore CPUE 1984-2017.

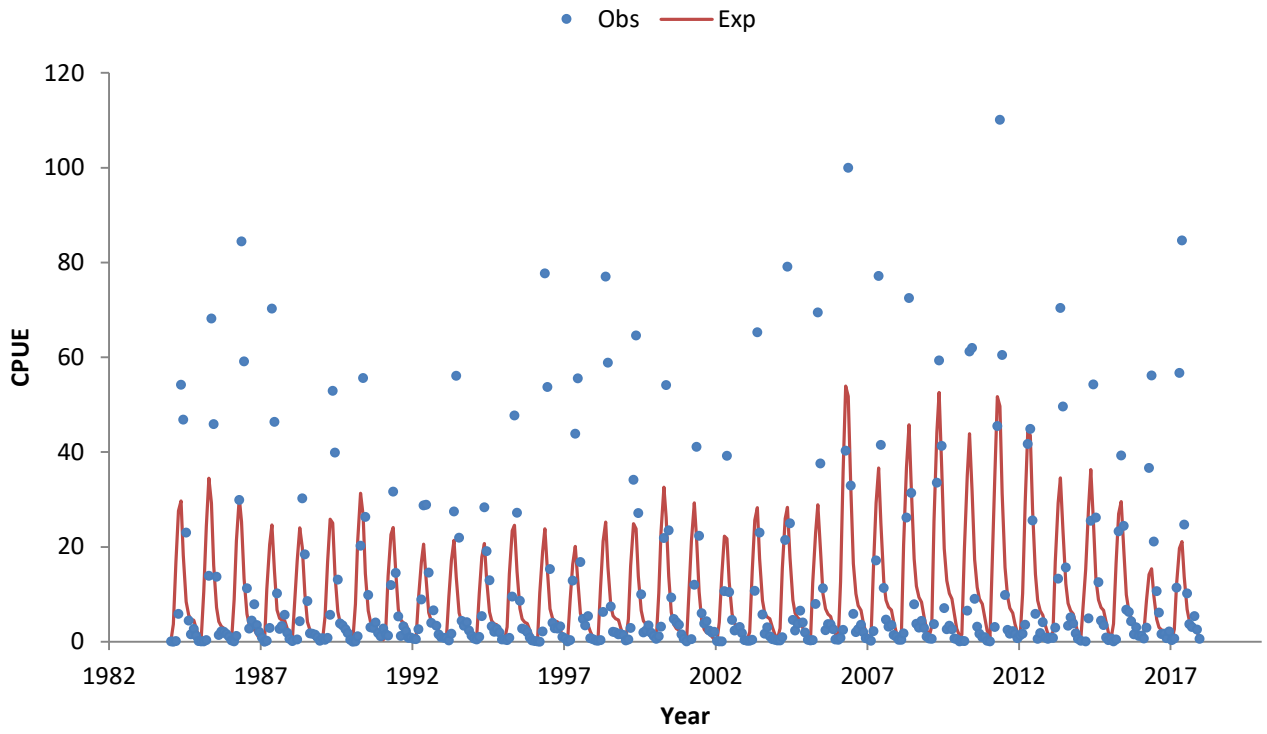
Brown Shrimp Model Output

- Fits to CPUE and size compositions as well as selectivity estimates were developed.
- Spawning biomass and fishing mortality estimated.

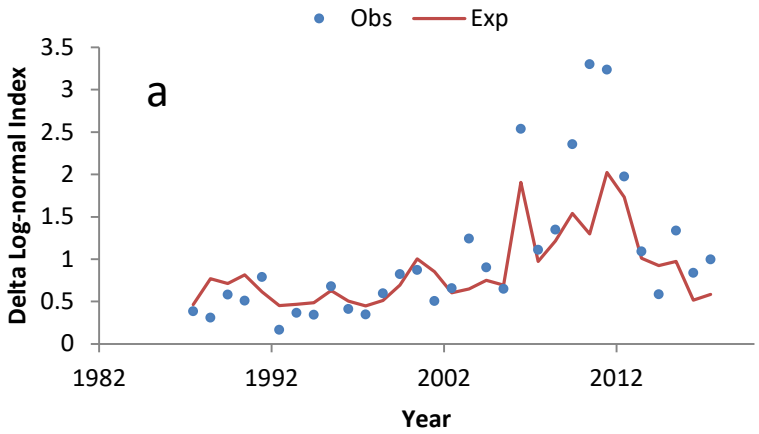


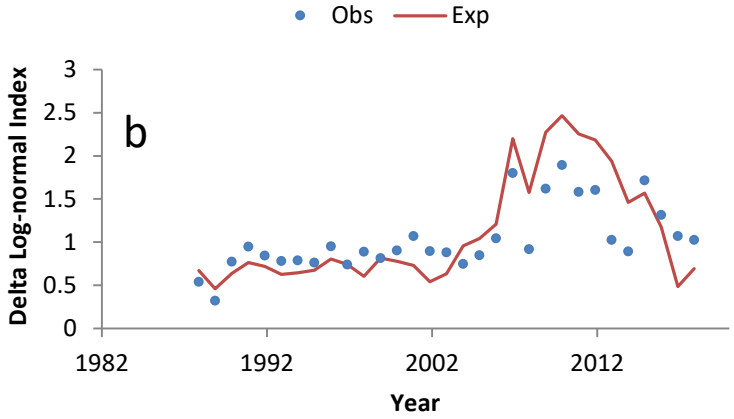


Brown shrimp CPUE and Q fits for Inshore and Offshore Fleets. Panel a is Inshore and panel b is Offshore 1984-2017.

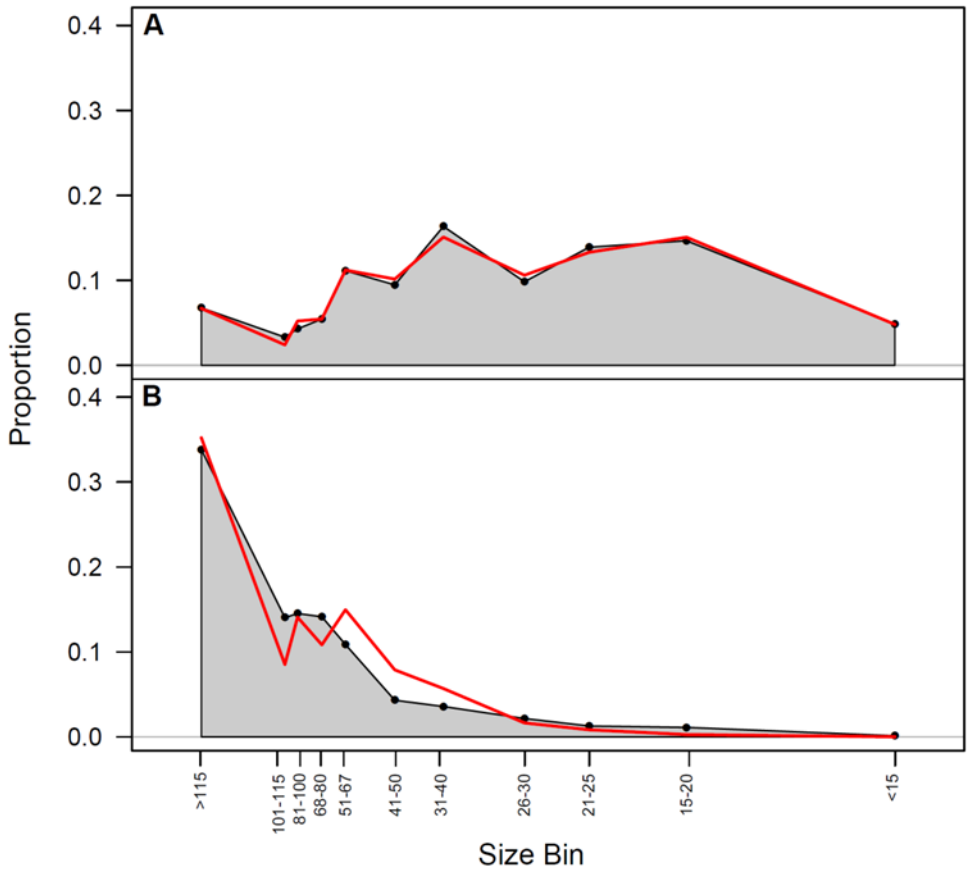


Brown shrimp Louisiana West Survey delta log normal CPUE fits, 1984-2017.

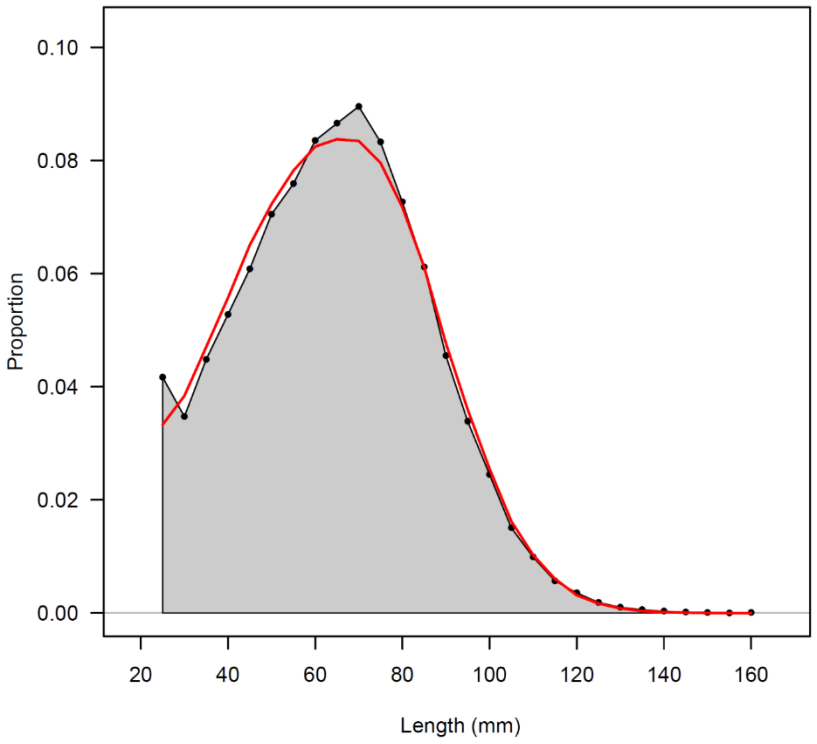




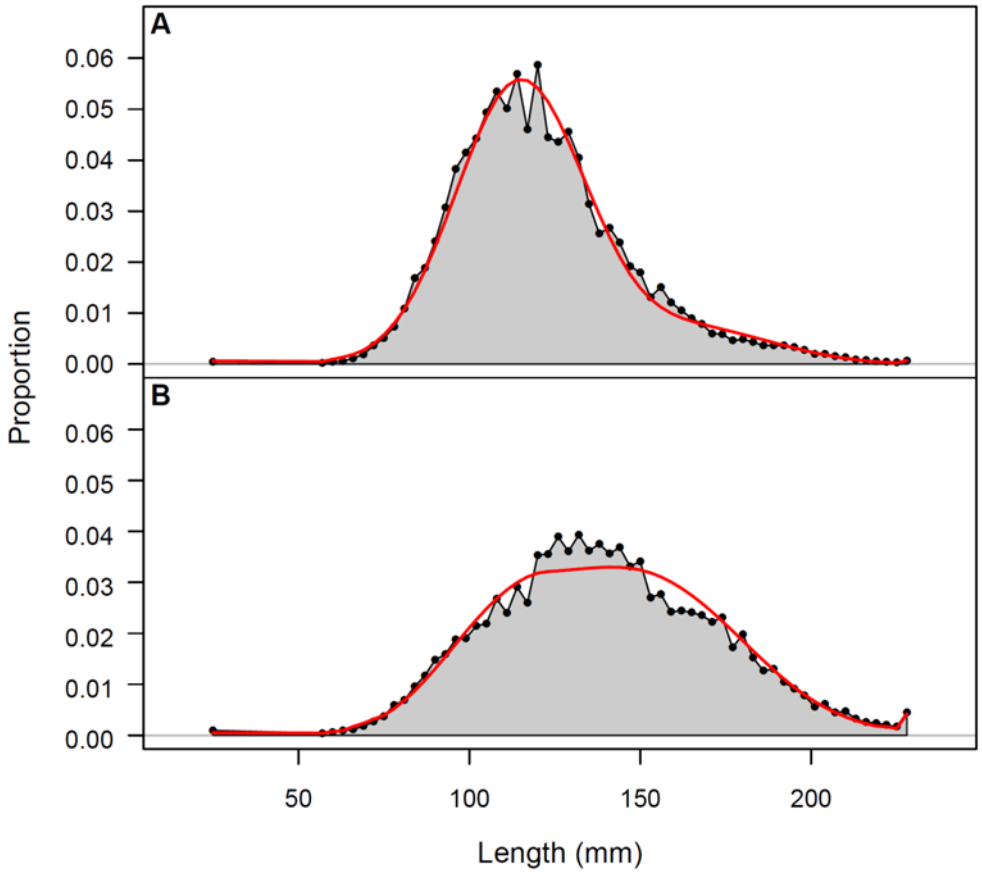
Brown shrimp SEAMAP Summer and Fall Survey Delta Lognormal fits. Panel a is Summer and panel b is Fall, 1987-2017.



Brown shrimp size composition fits for Offshore and Inshore Fleets. Panel A is Offshore and panel B is Inshore.



Brown shrimp size composition fits for Louisiana West Survey.



Brown shrimp size composition fits for the SEAMAP surveys. Panel a is summer and Panel b is fall survey fits.

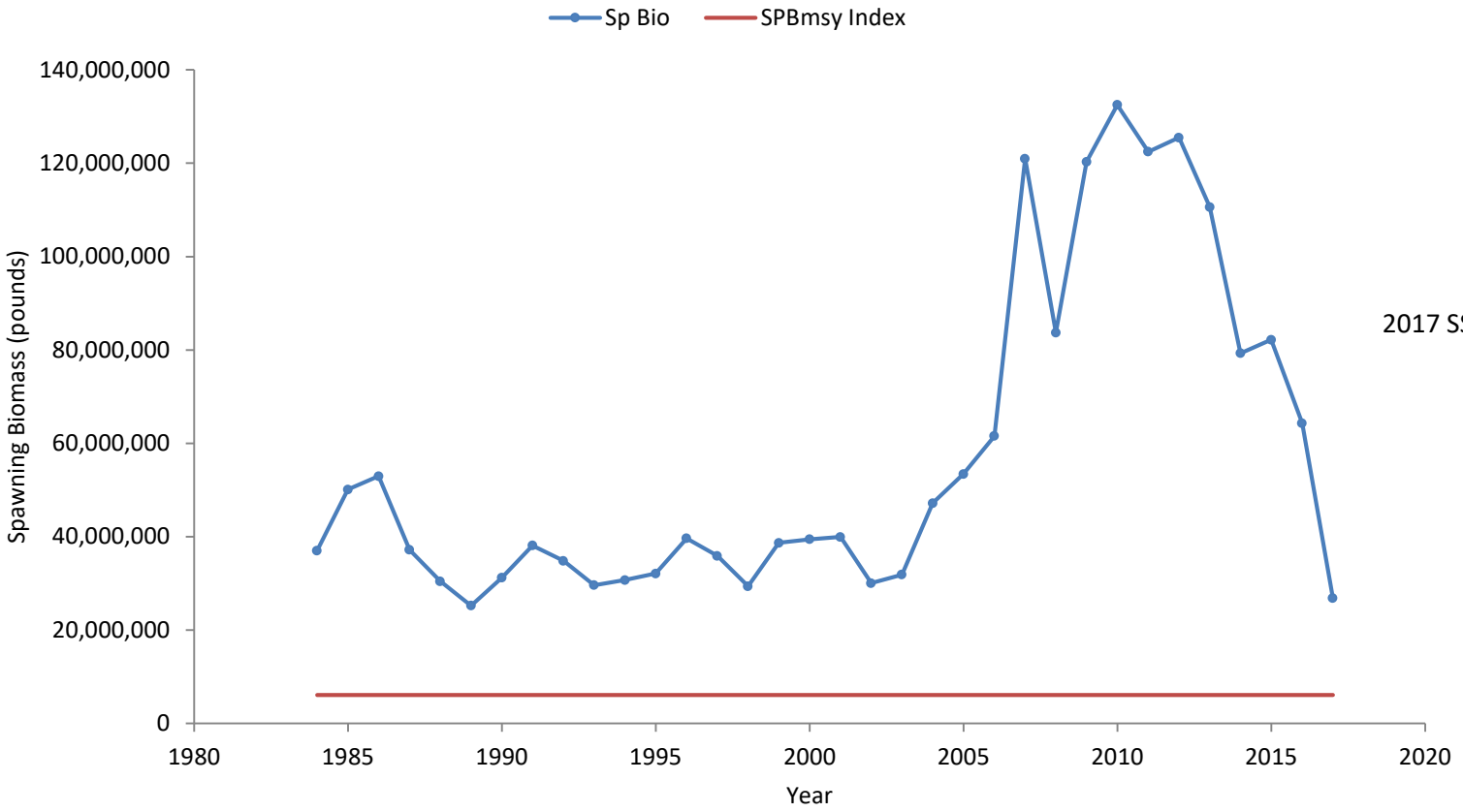
Brown Shrimp SSBmsy and Fmsy Estimates

SSBmsy - The brown shrimp stock assessment is parameterized as an annual model with seasons.

This results in an annual SSBmsy equal to 6,098,824 pounds of tails (2,766.4 metric tons).

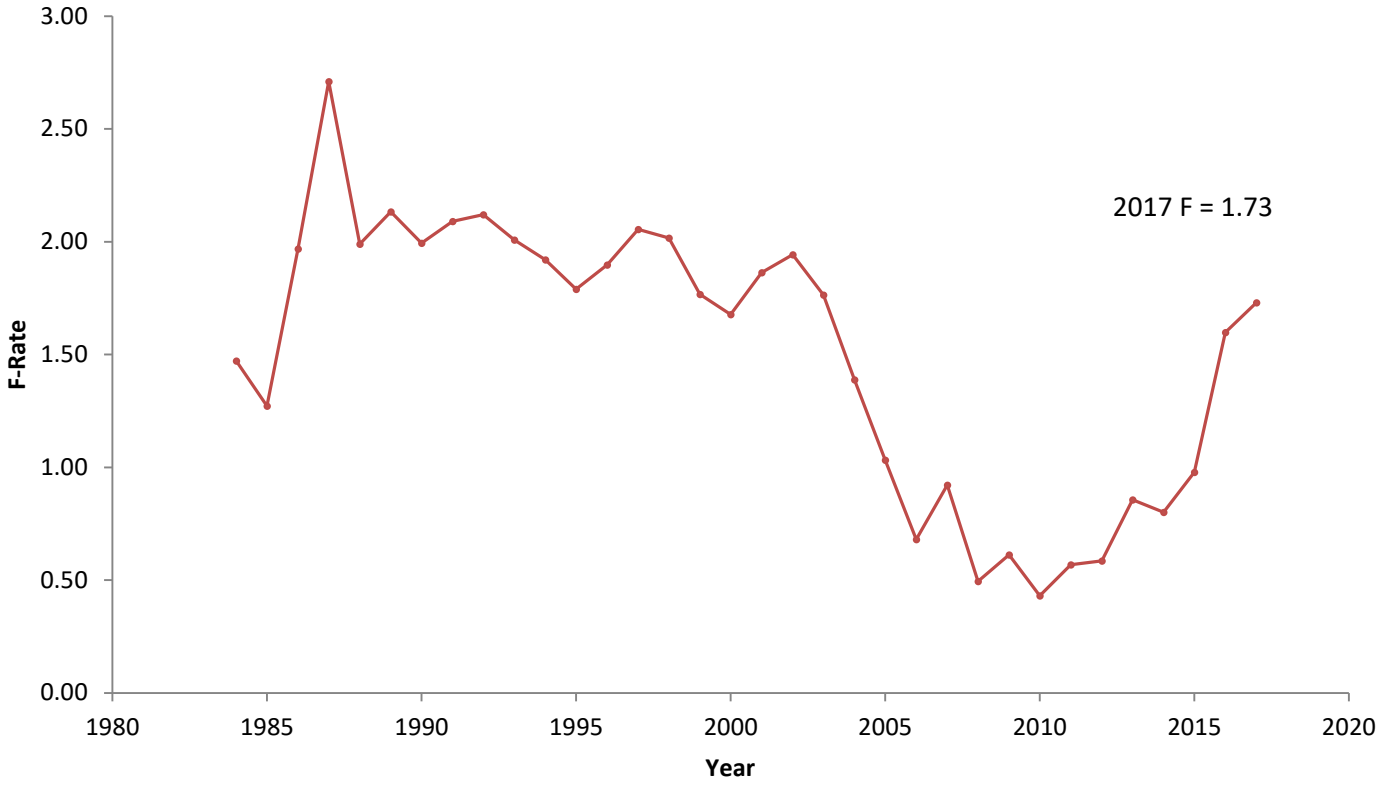
Fmsy - SS calculates an annual Fmsy. This is compared to the annual Fstd estimated in the annual assessment run.

$Fmsy_{(annual)} = 9.12$

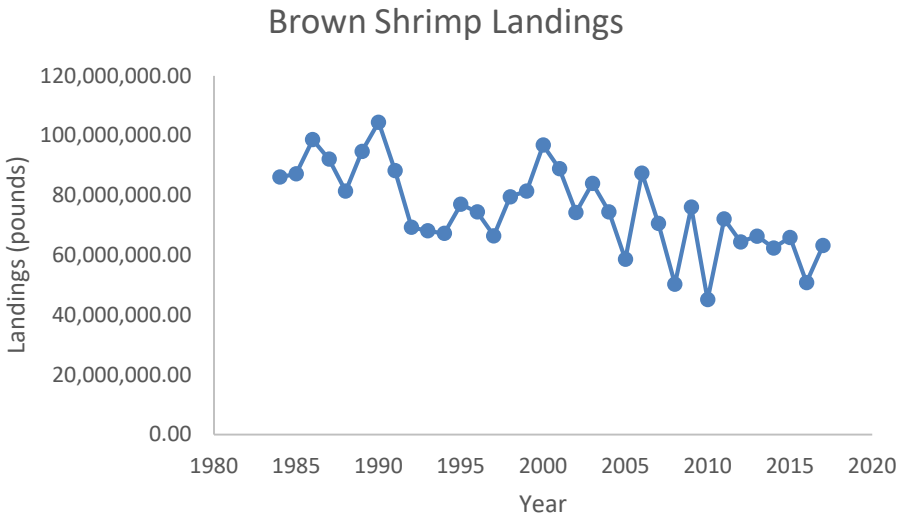


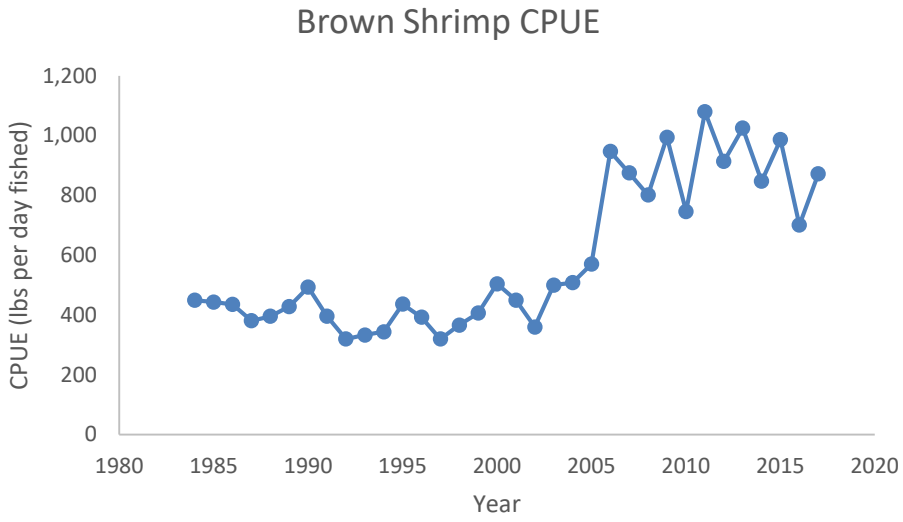
2017 SSB = 626.8 million lbs.

Brown shrimp 2017 stock synthesis annual SSB and SSBmsy estimates.



Brown shrimp 2017 stock synthesis annual F estimates.

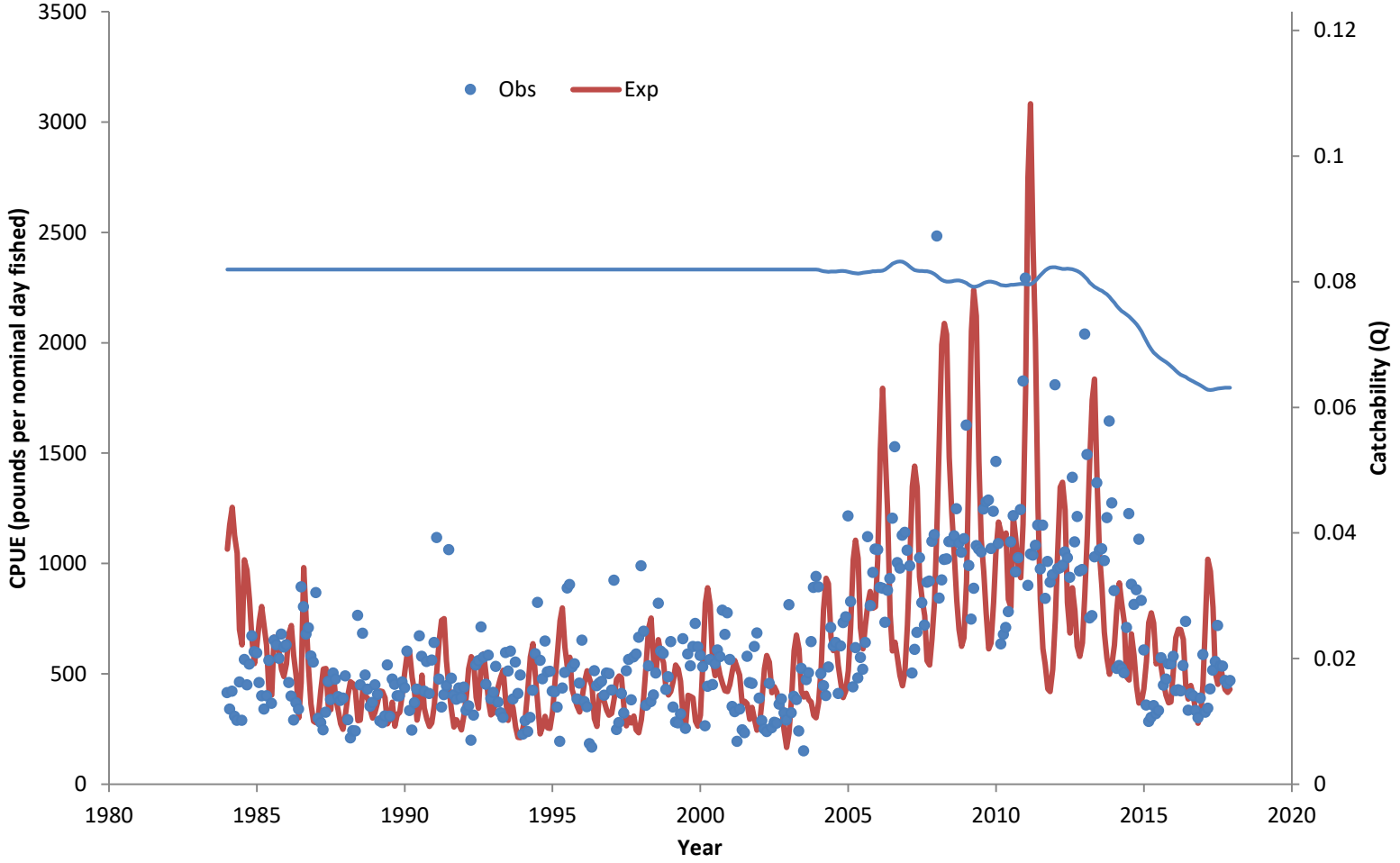




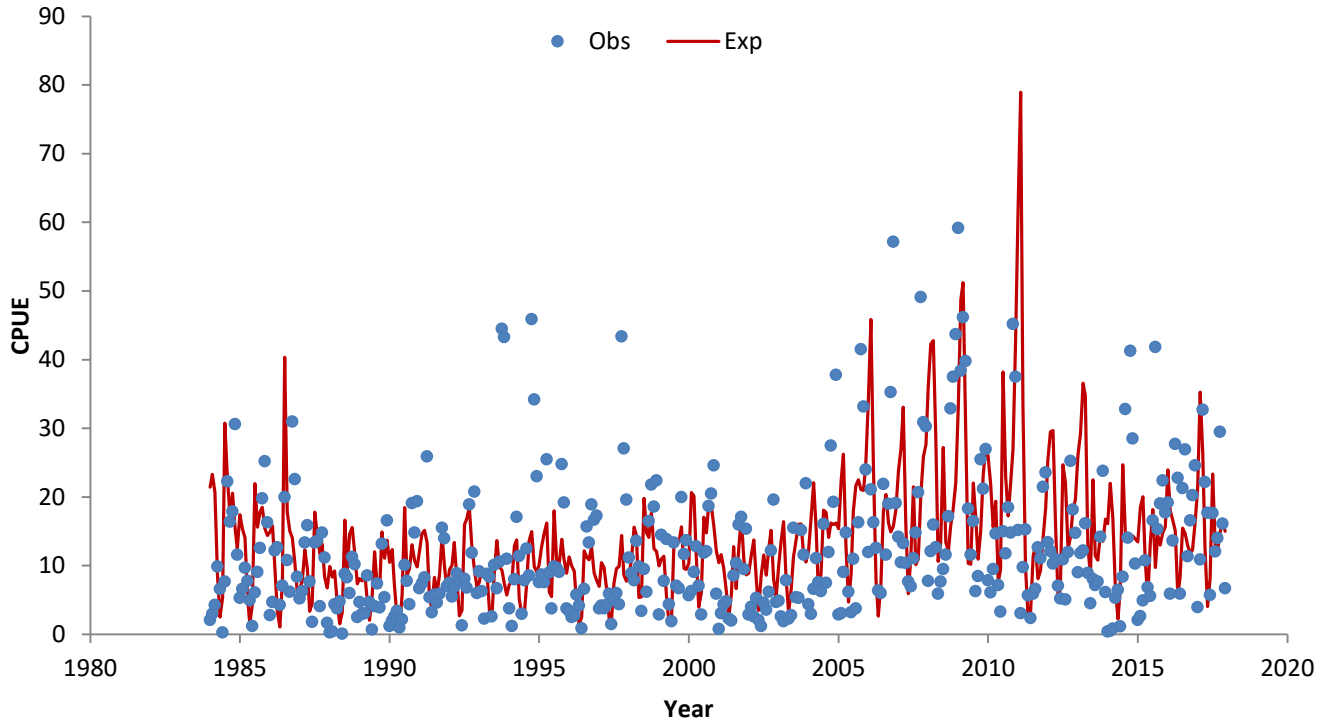
Brown shrimp landings and offshore CPUE 1984-2017.

White Shrimp Model Output

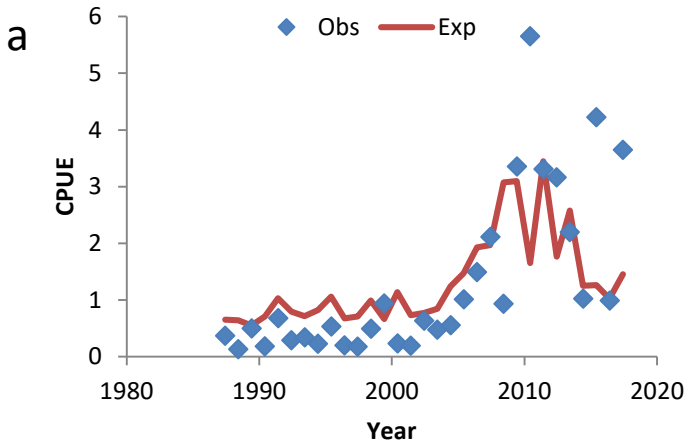
- Fits to CPUE and size compositions as well as selectivity estimates were developed.
- Spawning biomass and fishing mortality estimated.

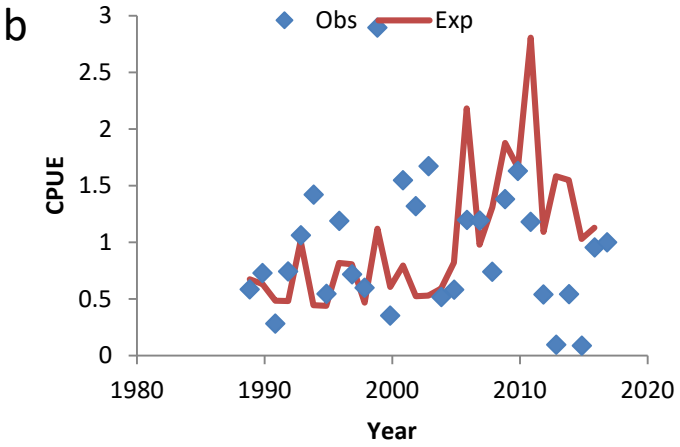


White shrimp commercial fishery CPUE and Q fits, 1984-2017.

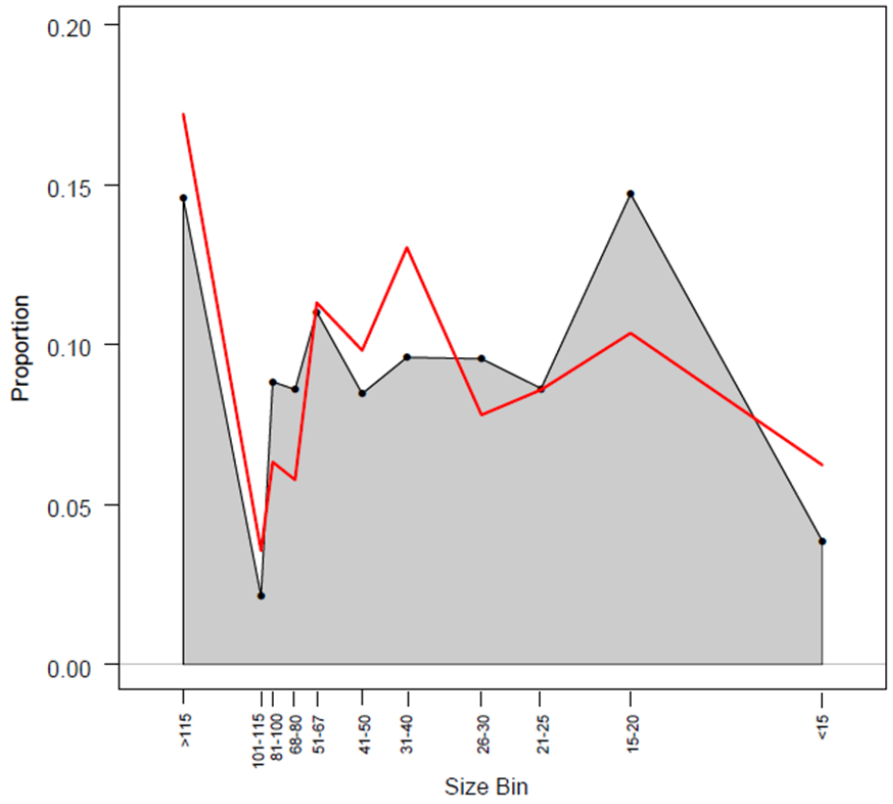


White shrimp Louisiana West Survey delta log normal CPUE fits, 1984-2017.

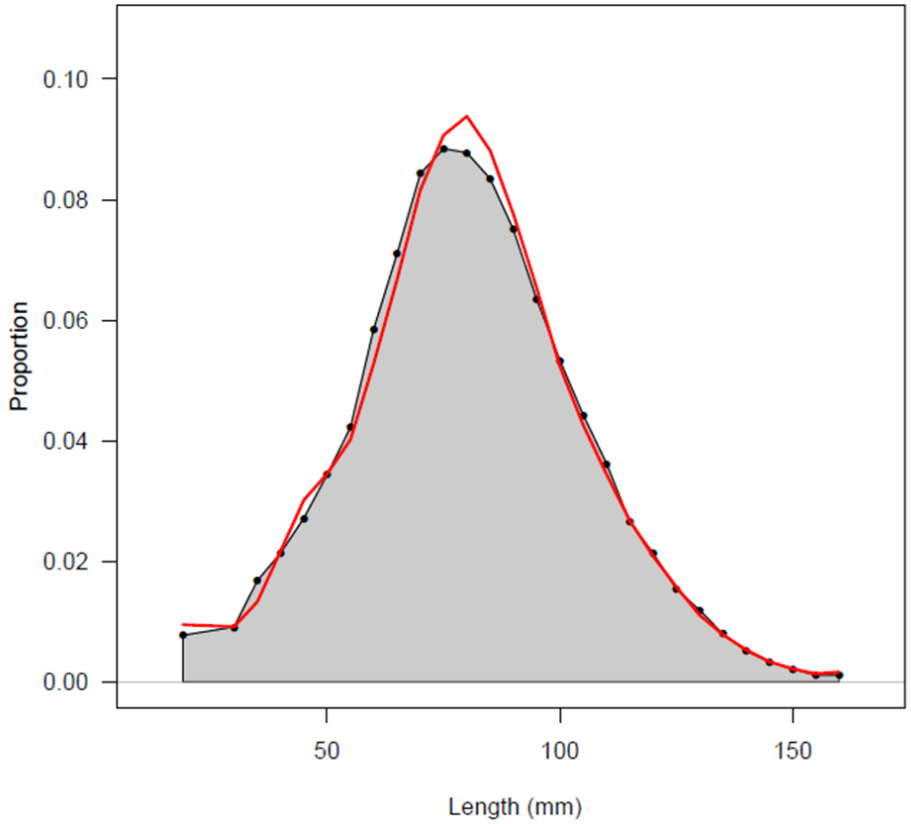




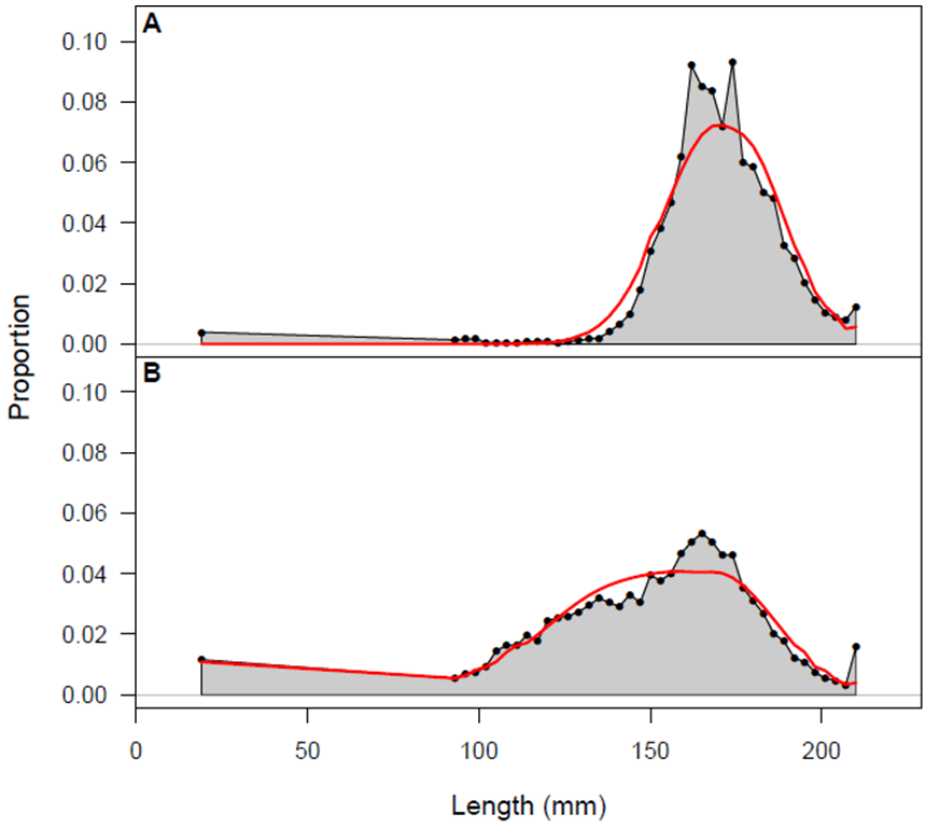
White shrimp SEAMAP survey CPUE. Panel a is Summer and panel b is Fall CPUE fits, 1987-2017.



White shrimp commercial fishery size composition fits.



White shrimp Louisiana survey size composition fits.



White shrimp SEAMAP survey size composition fits. Panel A is Summer and panel B is Fall CPUE fits.

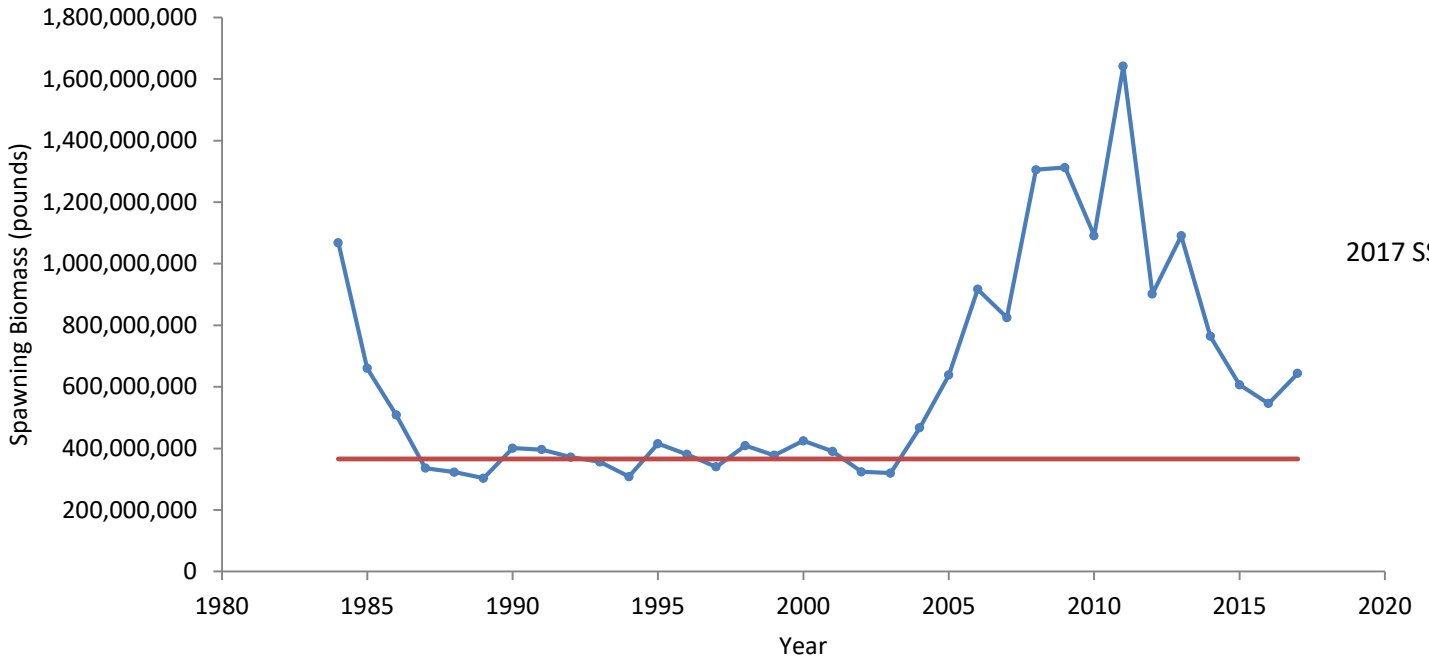
White Shrimp SSBmsy and Fmsy Estimates

SSBmsy - White shrimp spawn and recruit in cycles in throughout the year and similar to the pink shrimp model, this models these parameters on a continuous basis. An annual SSBmsy is estimated by multiplying the terminal benchmark "year" SSBmsy estimate by 12.

We derive an annual adjusted SSBmsy of 365,611,862 pounds of tails (165,885 metric tons).

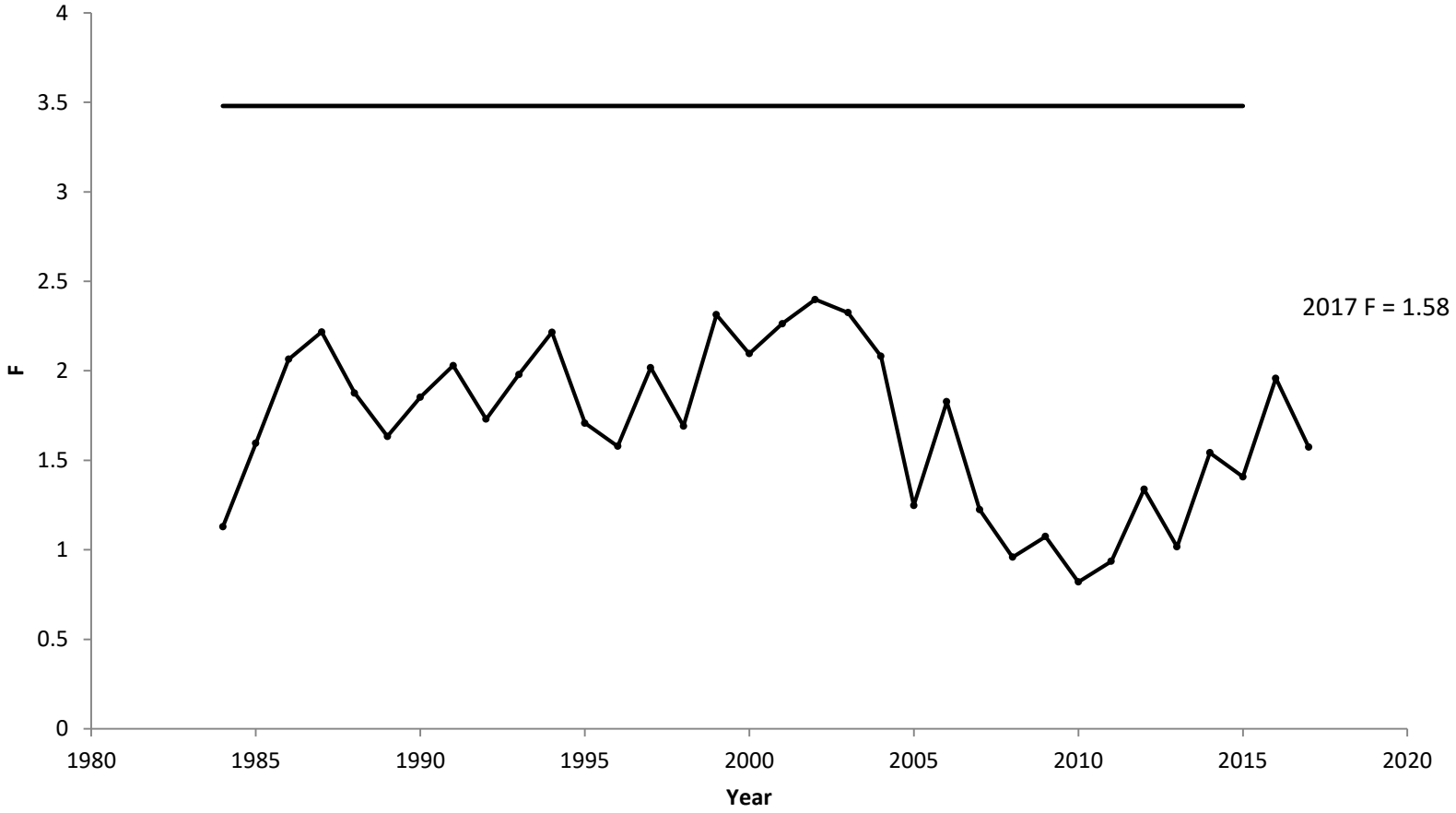
Fmsy - the SS model estimates an Fmsy value. This value is multiplied by 12 to estimate an annual Fmsy. The sum of the mean monthly Fstd estimates is compared to this Fmsy estimate.

$Fmsy_{(annual)} = 3.48$

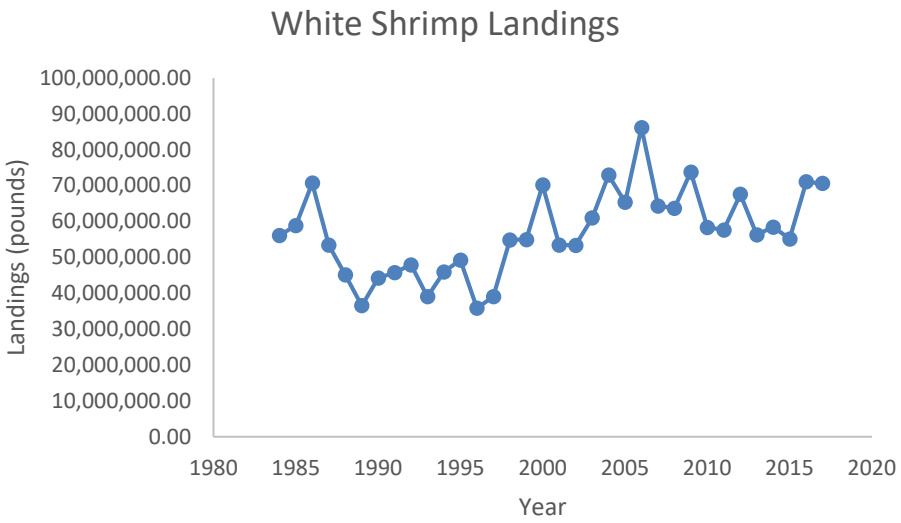


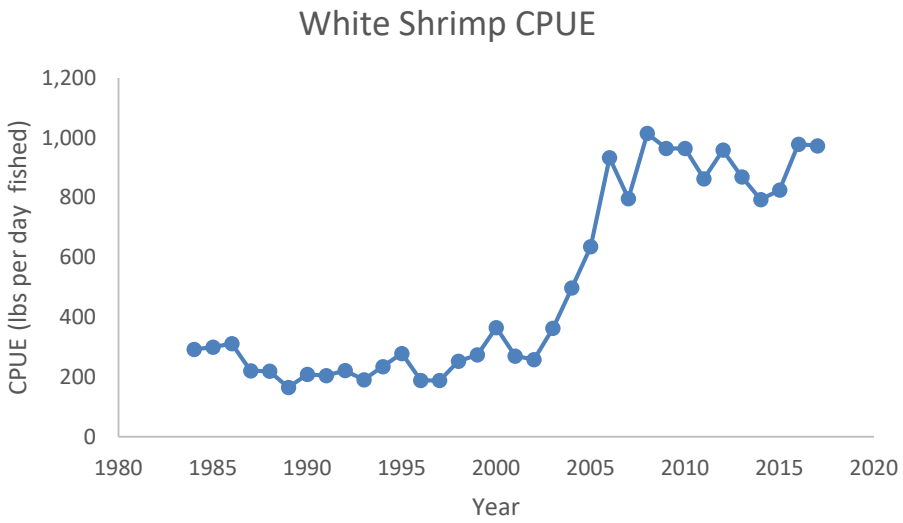
2017 SSB = 643.4 million lbs.

White shrimp stock synthesis annual SSB and SSBmsy Estimates, 1984-2017.



White shrimp stock synthesis annual F estimates, 1984-2017.





White shrimp landings and offshore CPUE 1984-2017.

Conclusions

- All three stocks are healthy and are not Overfished nor undergoing Overfishing

- Spawning stock biomass for all three stocks is greater than overfished reference points
  - Pink = 62.8 million lbs.
  - Brown = 26.8 million lbs.
  - White = 643.4 million lbs.

- Fishing mortality rates are less than the F-rate overfishing reference points
  - Pink = 0.34
  - Brown = 1.73
  - White = 1.58

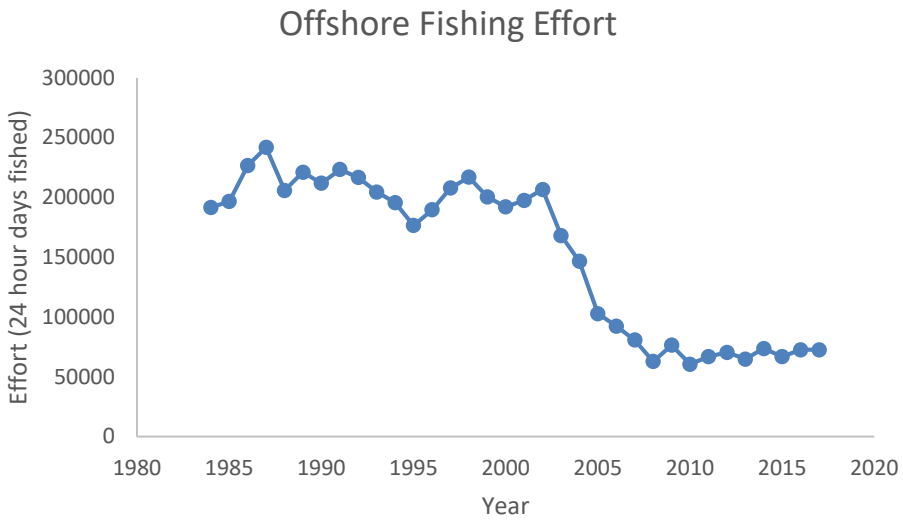
Acknowledgements

Drs. Richard Methot and James M. Nance
National Marine Fisheries Service
Assistance with Stock Synthesis modeling and SSBmsy and Fmsy estimation

James Primrose and Jo Williams
National Marine Fisheries Service
Assistance with data compilation and maps

Louisiana Wildlife and Fisheries – Joe West

GOM Commercial Shrimp Fishermen


Offshore Fishing Effort
Effort (24 hour days fished)
300000
250000
200000
150000
100000
50000
0
1980
1985
1990
1995
2000
2005
2010
2015
2020
Year

Gulf of Mexico Pink Shrimp Stock Assessment Forecast Output File						
Model Run, Rick A. Hart, NMFS SEFSC Galveston Laboratory						
#V3.24a						
SS-V3.24a-safe;_02/24/2012;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADMB_10						
Thu	Aug	14	14:43:10	2014		
Calculate_FMSY	Value			Annual Calculations		
SPR	0.23598					
Fmult	0.60304					
F_std	0.112206				1.346472	
Exploit(Y/Bsmry)	0.319483					
Recruits@MSY	382004	--	--	382004	0.874834	
SPBio	895.35	0.002344	--		10744.2	
SPBmsy/SPBzero(using_SPB_virgin)	0.206443	--	--			
SPBmsy/SPBzero(using_BenchmarkYr_biology)	0.206443	--	--			
MSY_for_optimize	655.635	0.001716	--			
MSY_encountered	655.635	0.001716	--			
MSY_dead	655.635	0.001716	--	77634.7		
MSY_retain	655.635	0.001716	--			
Biomass_Smry	2052.17	0.005372	--			

Pink shrimp stock synthesis annual SSBmsy and Fmsy estimates.

Gulf of Mexico Brown Shrimp Stock Assessment Forecast Output File						
Model Run, Rick A. Hart, NMFS SEFSC Galveston Laboratory						
#V3.24a						
SS-V3.24a-safe;_02/24/2012;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADMB_10						
Mon	Aug	25	11:17:07	2014		
calculate_FMSY	Value					
SPR	0.0565764					
Fmult	109.395					
F_std	9.11625					
Exploit(Y/Bsmry)	13.8838					
Recruits@MSY	3.98E+07	--	--	3.98E+07	0.999852	
SPBio	2766.38	6.95E-05	--	Spawning biomass at MSY		
SPBmsy/SPBzero(using_SPB_virgin)	0.0618594	--	--			
SPBmsy/SPBzero(using_BenchmarkYr_biology)	0.056568	--	--			
MSY_for_optimize	66643.2	0.00167366	--			
MSY_encountered	0	0	--			
MSY_dead	66643.2	0.00167366	--	1.58E+07		
MSY_retain	66643.2	0.00167366	--			
Biomass_Smry	4800.07	0.000120548	--			

Brown shrimp stock synthesis annual SSBmsy calculations.

#V3.24a									
SS-V3.24a-safe;_02/24/2012;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADMB_10									
Wed	Sep	17	11:15:17	2014					
Calculated_Max_Allowable_F	3.25438								
calculate_FMSY	Value			Annual Value					
SPR	0.169578								
Fmult	0.535717								
F_std	0.290407			3.484884					
Exploit(Y/Bsmry)	0.188141								
Recruits@MSY	2.22E+06	--	--	This would be annualized spawning biomass at MSY					
SPBio	13823.8	0.006224	--	165885.6					
SPBmsy/SPBzero(using_SPB_virgin)	0.167476	--	--						
SPBmsy/SPBzero(using_BenchmarkYr_biology)	0.167475	--	--						
MSY_for_optimize	3380.67	0.001522	--						
MSY_encountered	0	0	--						
MSY_dead	3380.67	0.001522	--	879826					
MSY_retain	3380.67	0.001522	--						
Biomass_Smry	17968.8	0.008091	--						

White shrimp Stock Synthesis SSBmsy and Fmsy calculations.