

Tab D, No. 4(a)

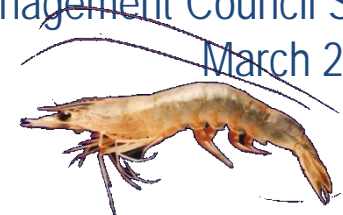
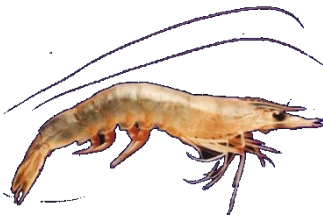


Gulf of Mexico Penaeid Shrimp Stock Assessment Update 2017 Fishing Year

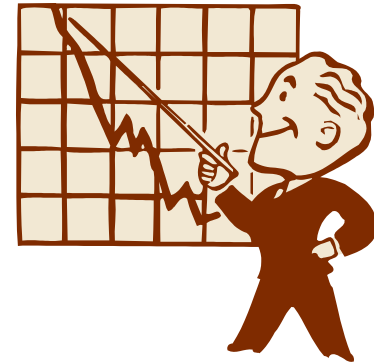
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Galveston, TX USA

Gulf of Mexico Fisheries Management Council SSC
March 2019

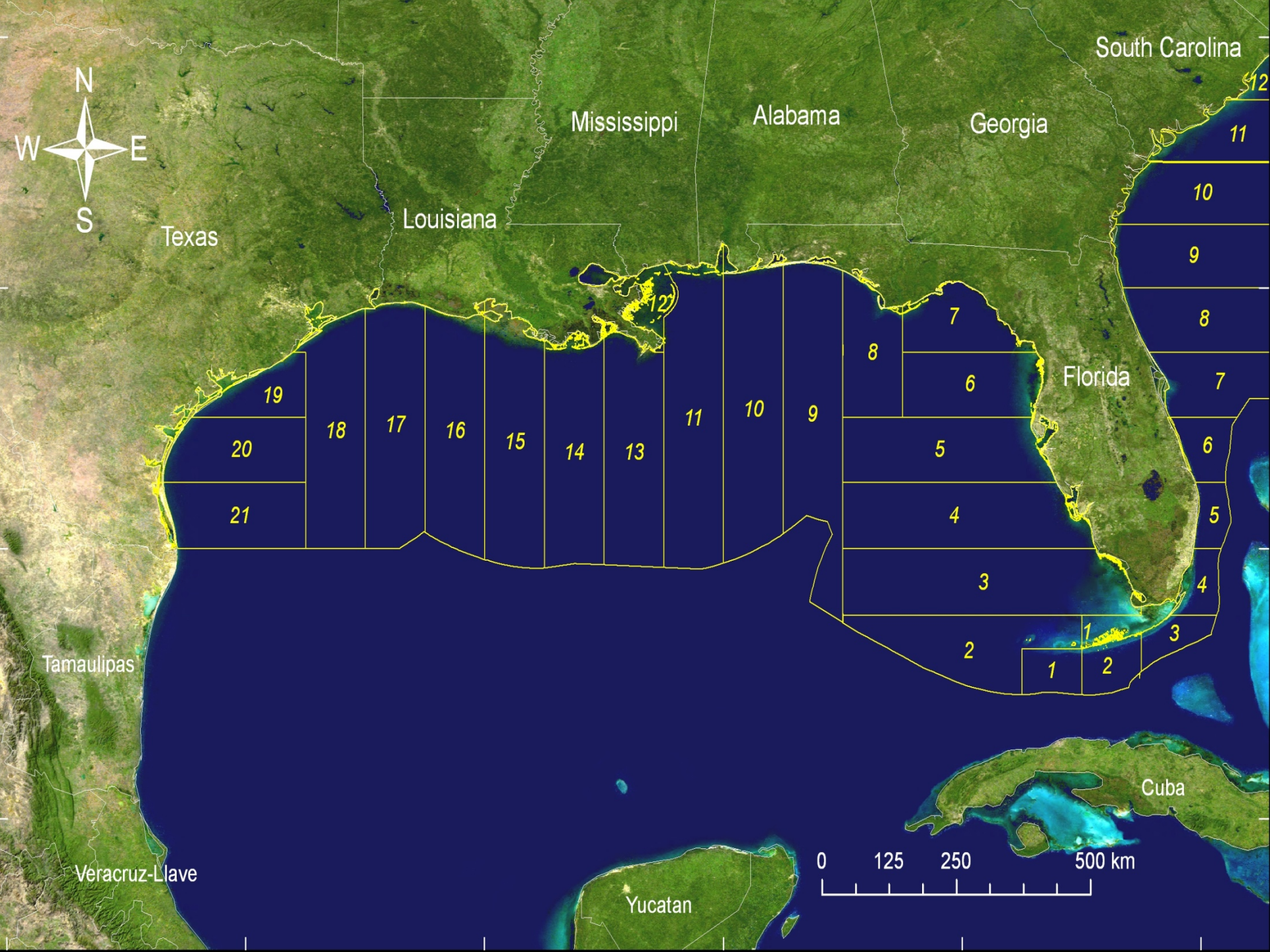


Assessment Updates



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



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.

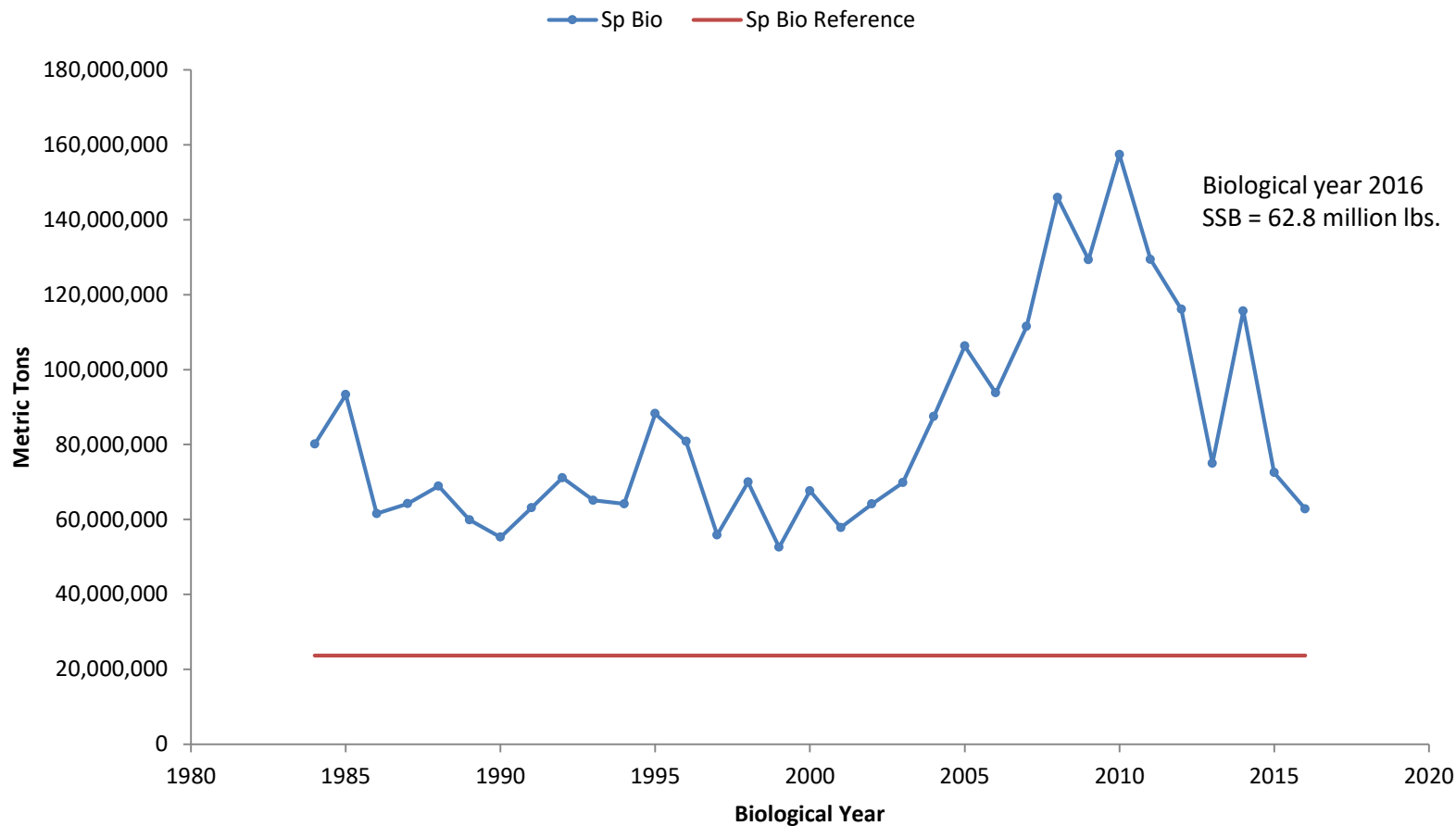
Pink Shrimp SSBmsy and Fmsy Estimates

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.

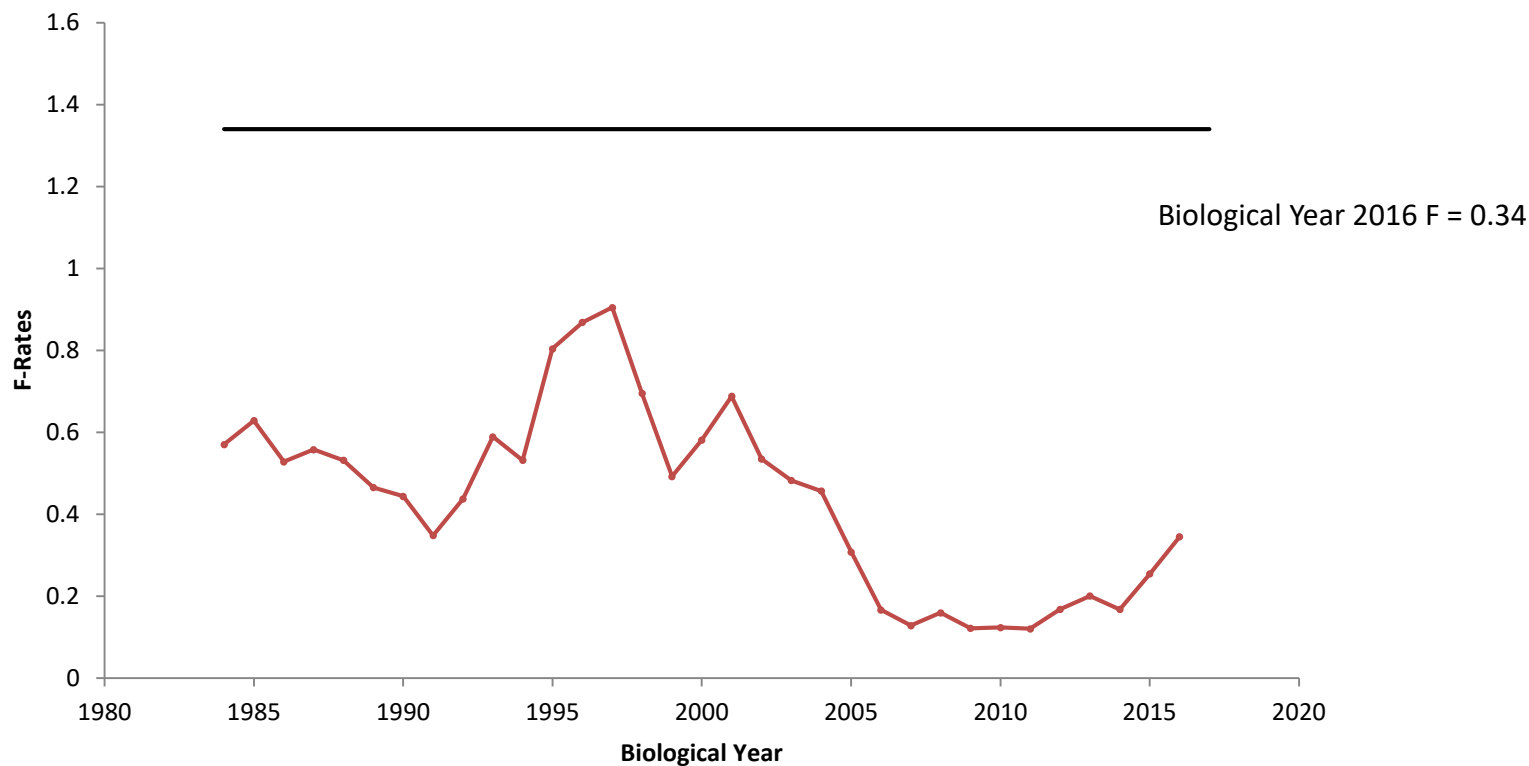
This results in an annual SSBmsy of 23,686,465 lbs. (10,744.2 metric tons) of tails.

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.

$$Fmsy_{(annual)} = 1.35$$

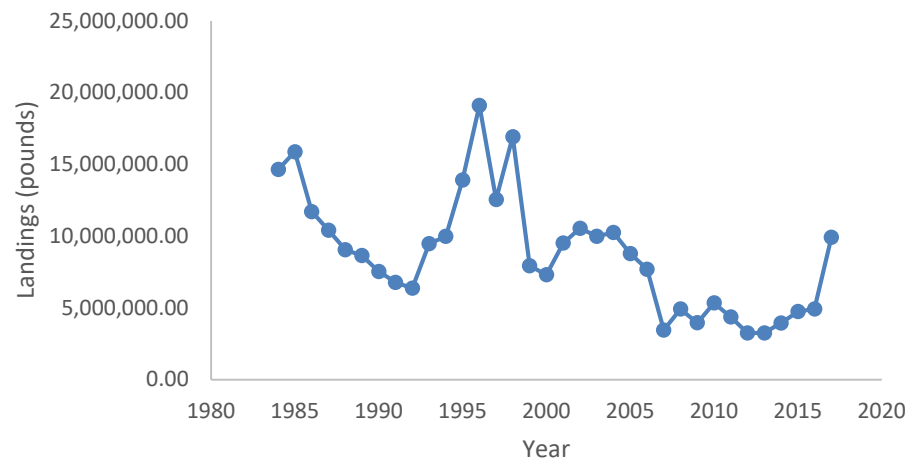


Pink shrimp stock synthesis SSB and SSBmsy estimate, biological year 2016 (July 2016 – June 2017).

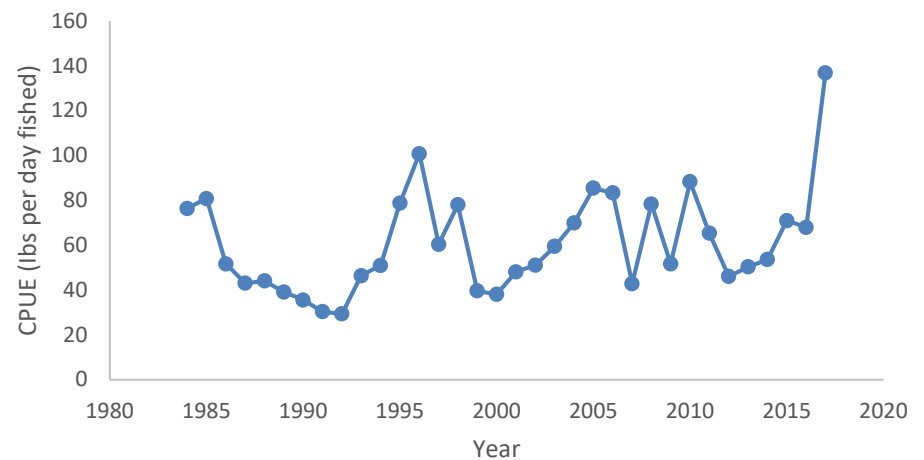


Pink shrimp stock synthesis annual F estimate, biological year 2016 (July 2016 – June 2017).

Pink Shrimp Landings



Pink Shrimp CPUE



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.

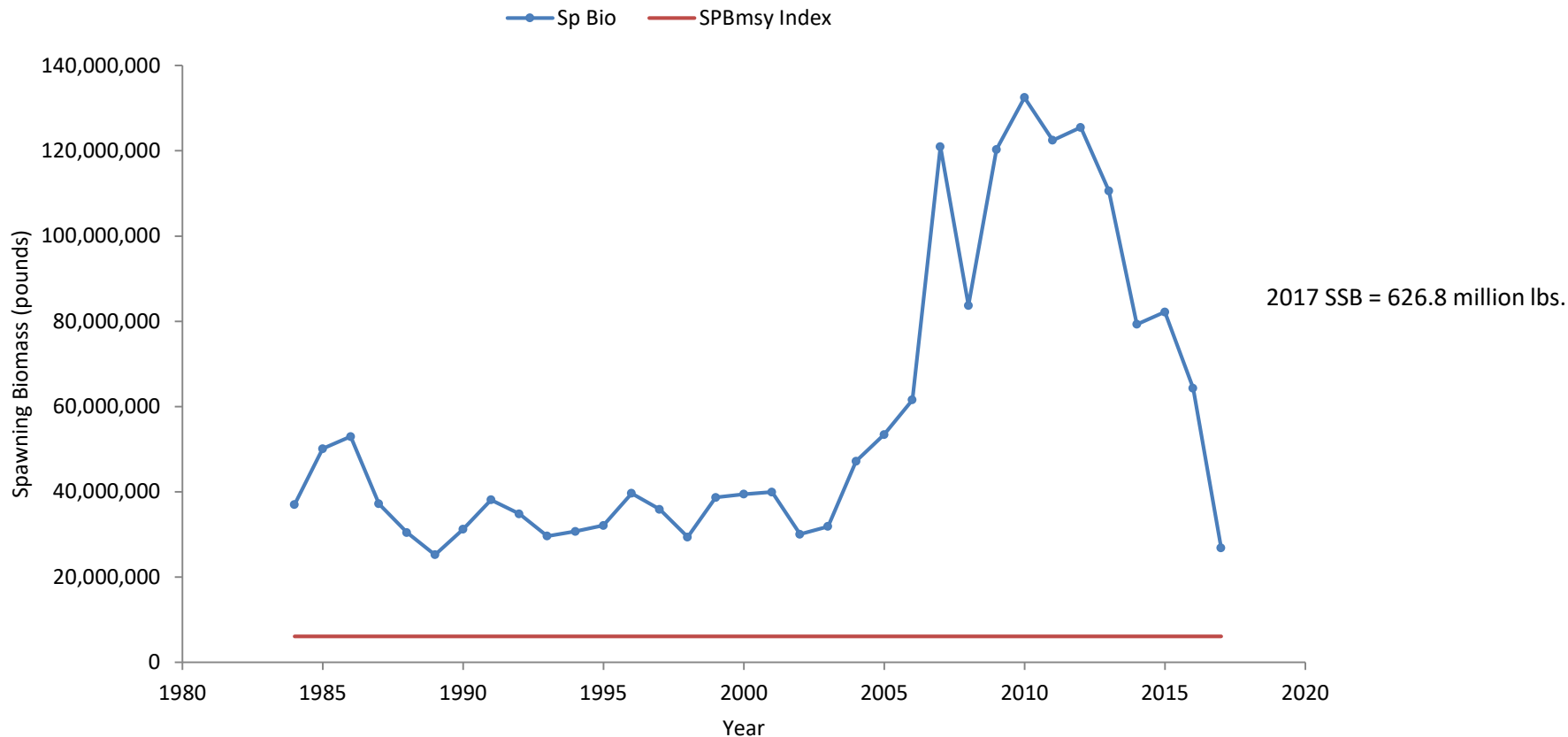
Brown Shrimp SSBmsy and Fmsy Estimates

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

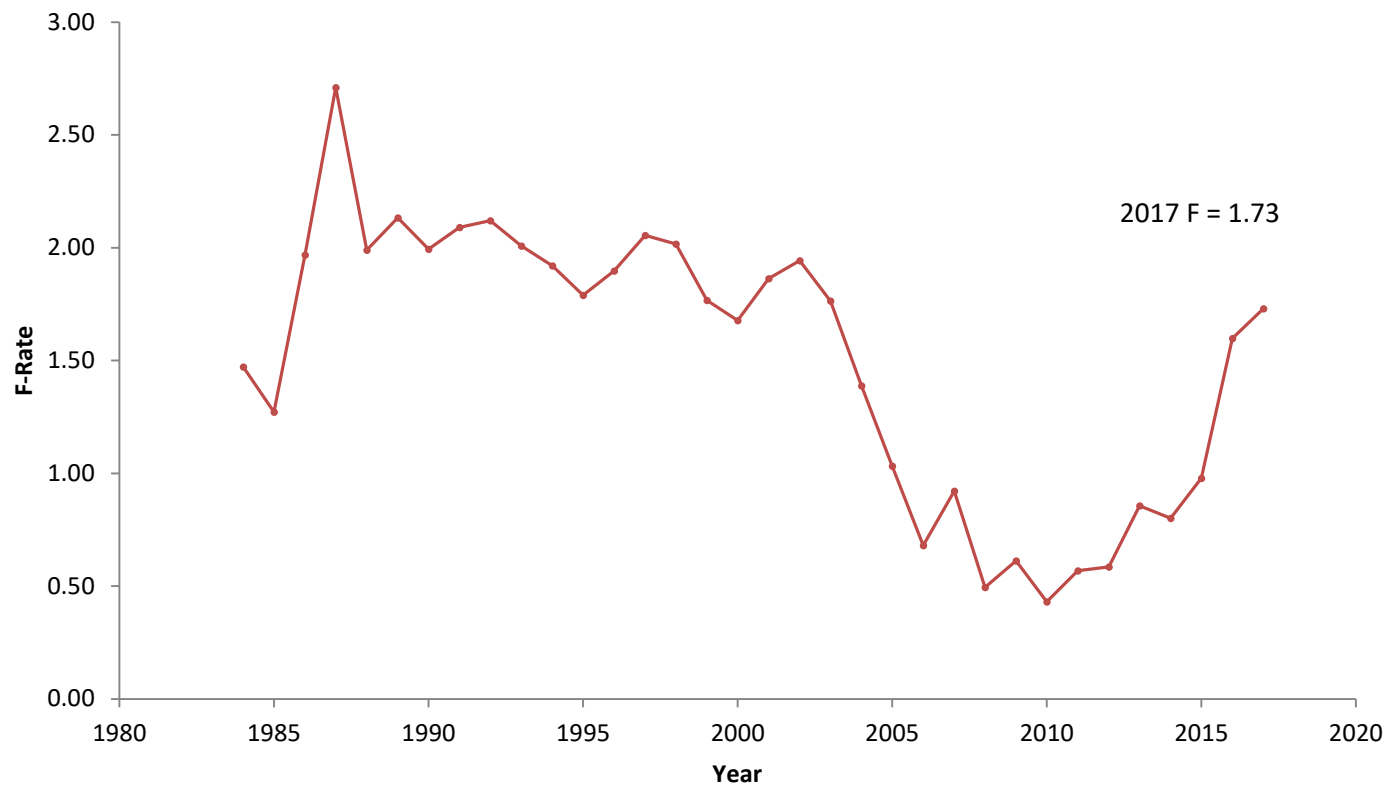
This results in an annual SSBmsy equal to 6,098,824 pounds of tails (2,766.4 metric tons).

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

$$Fmsy_{(annual)} = 9.12$$

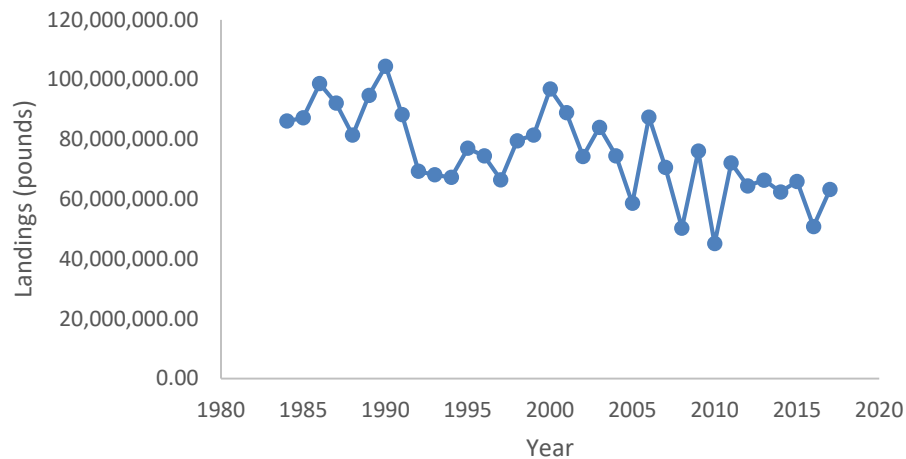


Brown shrimp 2017 stock synthesis annual SSB and SSBmsy estimates.

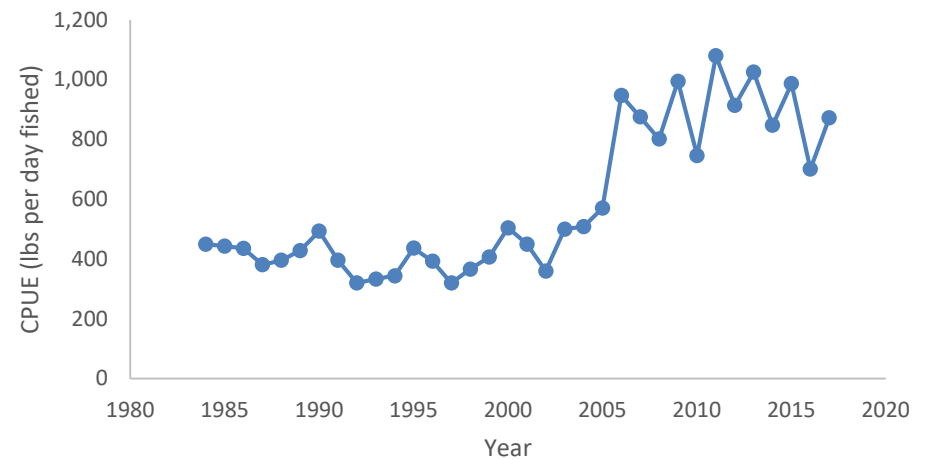


Brown shrimp 2017 stock synthesis annual F estimates.

Brown Shrimp Landings



Brown Shrimp CPUE



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.

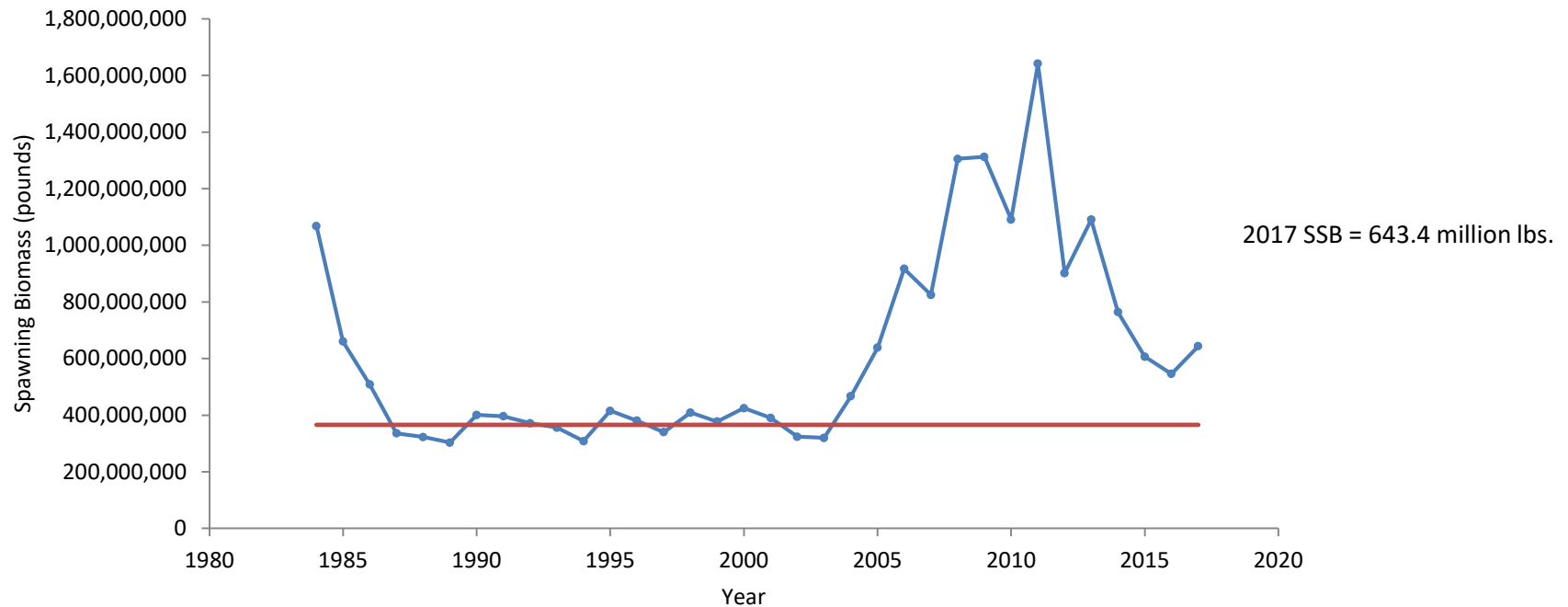
White Shrimp SSBmsy and Fmsy Estimates

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.

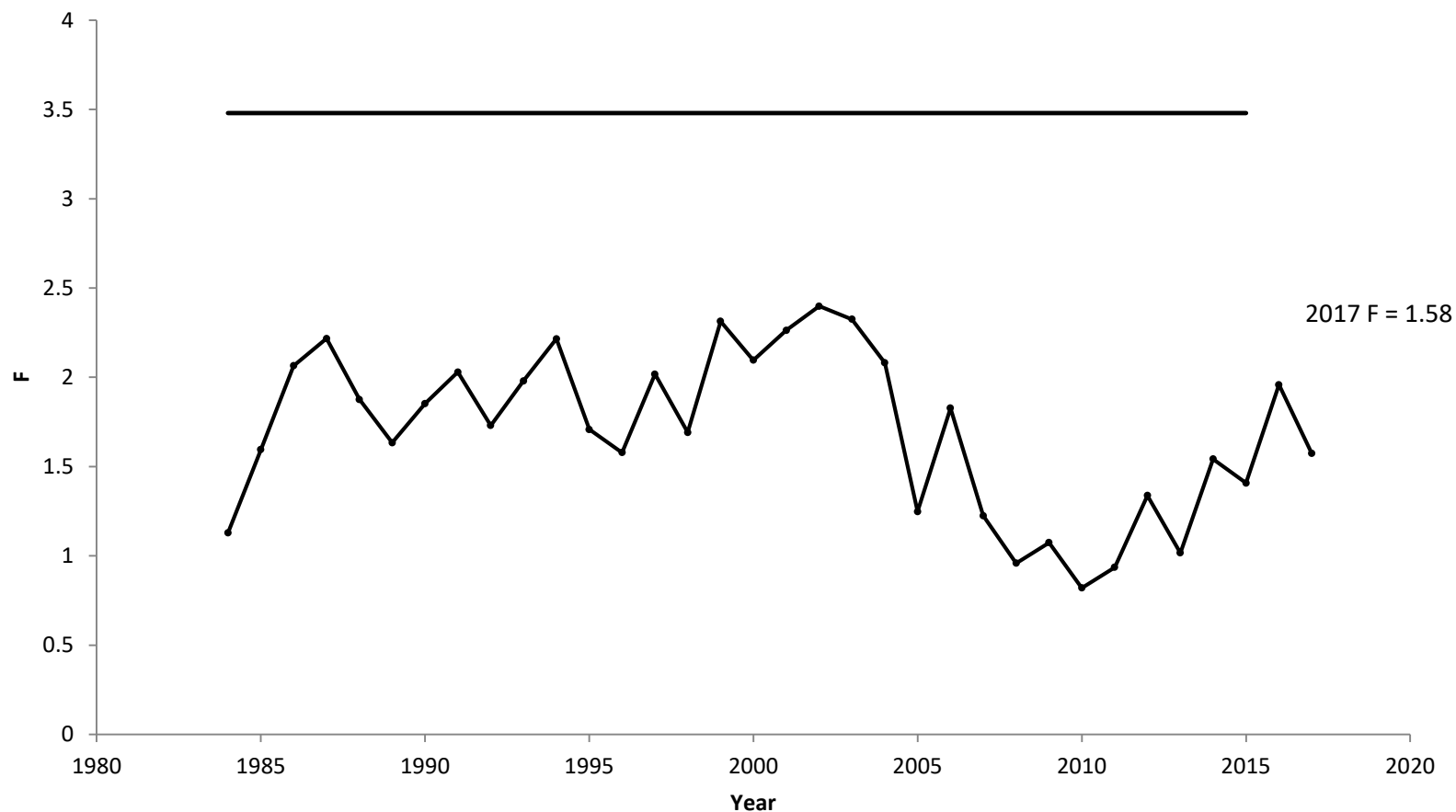
We derive an annual adjusted SSBmsy of 365,611,862 pounds of tails (165,885 metric tons).

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.

$$Fmsy_{(annual)} = 3.48$$

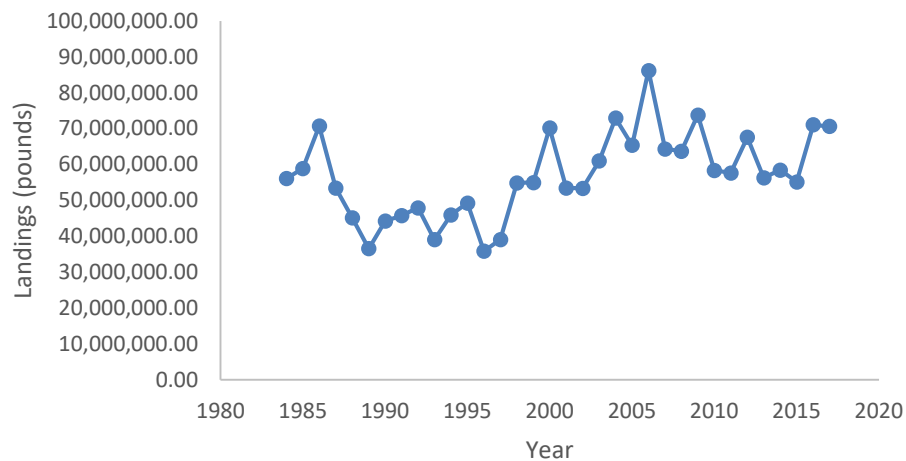


White shrimp stock synthesis annual SSB and SSBmsy
Estimates, 1984-2017.

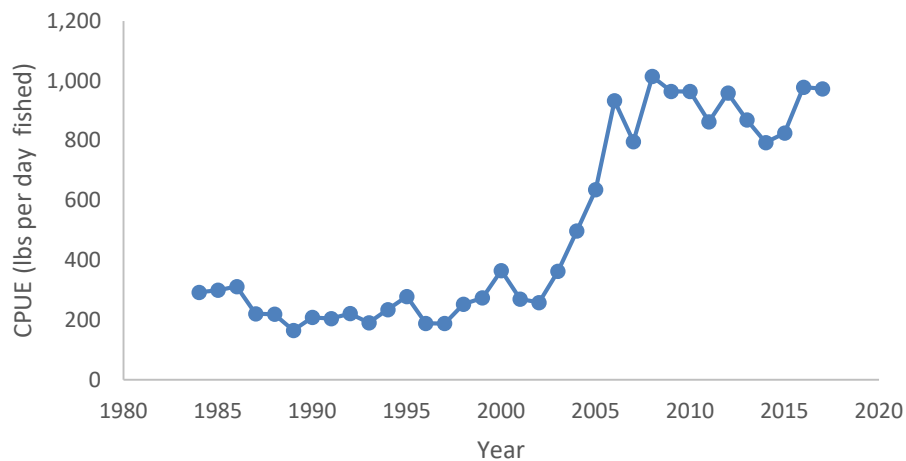


White shrimp stock synthesis annual F estimates, 1984-2017.

White Shrimp Landings



White Shrimp CPUE



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

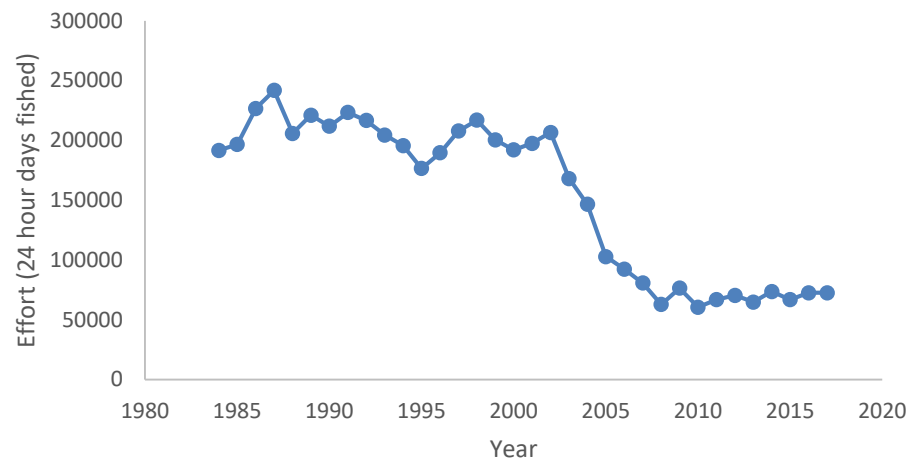
Drs. Richard Methot and James M. Nance
National Marine Fisheries Service
Assistance with Stock Synthesis modeling and SSBmsy and
Fmsy estimation

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









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.