SEDAR 9 Update Stock Assessment Report

Gulf of Mexico Vermilion Snapper

December 2011

Gulf of Mexico Fishery Management Council
2203 N Lois Ave
Suite 1100
Tampa, FL 33607

Table of Contents

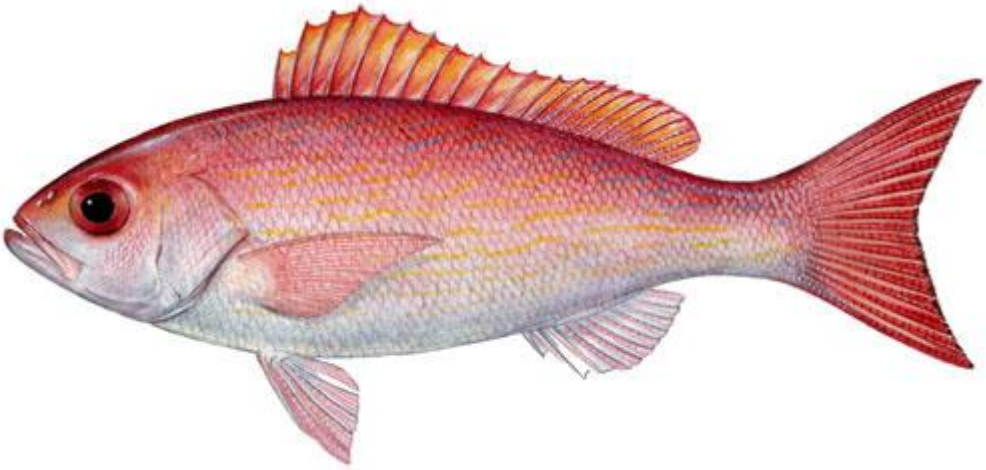
Section I	2011 SEDAR 9 Update Assessment for Vermilion Snapper
Section II	Addendum and Supplementary Information
Section III	Gulf of Mexico Fishery Management Council Scientific and Statistical Committee Review Report

SEDAR 9 Update Stock Assessment Report

Section I:

2011 SEDAR 9 Update Assessment Report for Vermilion Snapper

An Alternative SSASPM Stock Assessment of Gulf of Mexico Vermilion Snapper that Incorporates the Recent Decline in Shrimp Effort.



Brian Linton, Shannon L. Cass-Calay and Clay E. Porch
NOAA Fisheries
Southeast Fishery Science Center
Miami, Florida
October, 2011

Finalized December 19, 2011

Table of Contents

1 Executive Summary 3
2 Introduction 3
3 Life History 4
4 Commercial Fisheries 4
4.1 Commercial Landings 4
4.2 Shrimp Fishery Bycatch 4
5 Recreational Fisheries 5
5.1 Recreational Landings 5
6 Indices of Abundance 5
7 STOCK ASSESSMENT METHODS 5
7.1 Overview 5
7.2 Model Equations 5
7.3 Model Configurations 5
7.4 Parameters: Fixed and Estimated 6
7.5 Measures of Uncertainty 6
7.6 Management Benchmarks and Reference Points 6
8. SSAPM MODEL RESULTS 6
8.1. Measures of Overall Fit 6
8.2. Parameter Estimates 7
8.3 Selectivity 7
8.4 Fishing Mortality 7
8.5 Stock Biomass 7
8.6 Recruitment 8
8.7 Retrospective Analyses 8
8.8 Benchmarks / Reference Points 8
9. PROJECTIONS 8
9.1 Projection Methods 8
9.2 Projection Results 9
9.3 Calculation of ABC from the PDF of OFL. 10
10 Literature Cited 10
11 Tables 11

12 Figures..... 57

1 Executive Summary

The SEDAR 9 vermilion snapper base assessment and 2011 update continuity run were not fitted to the annual estimates of shrimp fishery bycatch for 1981-2010. Instead, the annual values were each replaced with the overall median value for all years combined. In the view of the SEDAR 9 participants, it was preferable to input a constant value for all years rather than introduce spurious trends by using the highly uncertain annual estimates. A large variance (low weight) was assigned to the bycatch inputs so that the model would not be constrained to match those constant trends. Nevertheless, fitting to a constant value for all years could have unintended consequences, particularly given the observation that shrimp fishery effort has declined sharply since 2004. This paper implements an alternative formulation that incorporates shrimp fishery effort and reads the constant shrimp bycatch inputs as representing an average value calculated across years (rather than a constant that is the same in every year). Two shrimp effort scenarios were explored in this alternative run: 1) using Gulfwide shrimp effort and 2) using shrimp effort from the eastern Gulf (i.e., statistical areas 1-12).

Fits to the input data (i.e., catch, indices of abundance and age composition data) were remarkably similar between the alternative and continuity runs, with the exception of fits to the shrimp fishery bycatch. The alternative run predicted a decline in shrimp fishery bycatch, due to recent declines in shrimp fishery effort. The continuity run simply predicted that shrimp bycatch varied around the average bycatch. Most predicted quantities (e.g., selectivity, spawning biomass, and age-1 recruitment) and relative SSB benchmarks (i.e., $SSB/SSB_{SPR30\%}$) were very similar between the alternative and continuity runs. Apical F and $F/F_{SPR30\%}$ differed between the alternative and continuity runs, due to the differences in shrimp fishery bycatch described above. In particular, predicted F_{2010} from the alternative run (0.24 for both Gulfwide and eastern Gulf shrimp effort scenarios) was roughly half the predicted F_{2010} from the continuity run (0.47). Predicted $F_{2010}/F_{SPR30\%}$ from the alternative run (0.31 for Gulfwide shrimp effort, 0.28 for eastern Gulf shrimp effort) was roughly half the predicted F_{2010} from the continuity run (0.62). The alternative and continuity runs both indicate that the Gulf of Mexico vermilion snapper stock is not overfished and is not experiencing overfishing.

2 Introduction

A SEDAR Update Assessment was conducted during June - October, 2011 by NOAA Fisheries - Southeast Fisheries Science Center personnel. The objective was to update the 2006 benchmark assessment of vermilion snapper (*Rhomboplites aurorubens*) within US waters of the Gulf of Mexico (SEDAR-9). The update continuity run, like the SEDAR 9 base assessment, replaced the annual estimates of shrimp fishery bycatch for 1981-2010 with the overall median value for all years combined. In the view of the SEDAR 9 participants, it was preferable to input a constant value for all years rather than introduce spurious trends by using the highly uncertain annual estimates. A large variance (low weight) was assigned to the bycatch inputs so that the model would not be constrained to match those constant trends. Nevertheless, fitting to a constant value

for all years could have unintended consequences, particularly given the observation that shrimp fishery effort has declined sharply since 2004. The objective of this report is to more realistically model shrimp fishery bycatch by treating the median shrimp bycatch as the central tendency, and by including shrimp fishery effort data in the model. The full results of the 2011 vermilion snapper continuity run are presented in a separate report (SEDAR 2011).

3 Life History

Life history data used in the alternative run were identical to data used in the continuity run for vermilion snapper (SEDAR 2011). These life history data include morphometric conversion factors, natural mortality, age, growth, and reproductive biology.

4 Commercial Fisheries

4.1 Commercial Landings

Commercial landings used in the alternative run (**Table 4.1**) were identical to landings used in the continuity run for vermilion snapper (SEDAR 2011).

4.2 Shrimp Fishery Bycatch

The alternative run inputs the same median bycatch of age-1 fish (i.e., 6.65 million fish) as the continuity run (SEDAR 2011). However, whereas the continuity run fits the predicted bycatch for each year to the same input value, the alternative formulation fits the central tendency of the predicted bycatch to the input value. The negative loglikelihood term for the bycatch therefore changes from

$$\sum_{y}^{Y} \frac{1}{2\sigma_y^2}\left(C_{input} - \hat{C}_y\right)^2 + log\sigma_y^2$$

to

$$\frac{1}{2\sigma^2}\left(C_{input} - \frac{1}{Y}\sum_{y}\hat{C}_y\right)^2 + log\sigma^2$$

where C_{input} is the observed average (median if a lognormal distribution is assumed) bycatch level input into the model, $\hat{C}_y$ is the value of bycatch predicted by the model for each year y, σ^2 represents the variance term, and Y is the total number of years over which C_{input} was computed.

In addition, shrimp fishery effort data were included in the model (**Table 4.2**). The shrimp fishery effort was restricted to effort from depths greater than 10 fm, as was done in the most recent Gulf of Mexico red snapper assessments (SEDAR 2005, 2009). Red snapper and vermilion snapper share similar spatial distributions; therefore the depth restriction used for red snapper was applied to vermilion snapper.

Two shrimp effort scenarios were explored in this alternative run: 1) using Gulfwide shrimp effort and 2) using shrimp effort from the eastern Gulf (i.e., statistical areas 1-12). The eastern Gulf shrimp effort scenario was included to explore the possibility that the majority of vermilion snapper bycatch in the shrimp fishery occurs in the eastern Gulf. For the eastern Gulf effort series, there were missing CVs for 1981-1997. A CV of 0.5, which is close to the series mean, was used to fill these missing years.

5 Recreational Fisheries

5.1 Recreational Landings

Recreational landings used in the alternative run (**Table 4.1**) were identical to landings used in the continuity run for vermilion snapper (SEDAR 2011).

6 Indices of Abundance

The indices of abundance used in the alternative run (**Table 6.1**) were identical to the indices used in the continuity run for vermilion snapper (SEDAR 2011).

7 STOCK ASSESSMENT METHODS

7.1 Overview

The alternative run used the same statistical catch at age model SSASPM (Porch 2002a) with the same parameter specifications and data sources as the continuity run, with two exceptions. First, while the continuity case simply allowed variations around the assumed constant shrimp bycatch (6.65 million Age-1), the alternative run treated the average shrimp bycatch as a time series mean, but allowed the predicted values to be informed by the shrimp effort time series, as well as other model inputs (see section 4.2 above).

7.2 Model Equations

The model equations are described in Porch (2002a) and in the previous vermilion snapper assessment report (SEDAR 2006).

7.3 Model Configurations

The model configuration for the alternative run was identical to the configuration of the continuity run (SEDAR 2011), with the exception of how shrimp fishery bycatch was estimated. In the continuity run, each year's estimate of shrimp bycatch was fit to the observed average shrimp bycatch in the likelihood function, assuming a lognormal error distribution. In the alternative run, the average of the annual shrimp bycatch estimates was fit to the observed average shrimp bycatch in the likelihood function, assuming a lognormal error distribution.

The alternative run also included shrimp fishery effort, which was fit by SSASPM assuming a lognormal error distribution. Two different shrimp fishery effort series were used in the alternative run: 1) Gulfwide shrimp fishery effort and 2) eastern Gulf shrimp fishery effort. The eastern Gulf shrimp effort series was included to explore the possibility that the majority of vermilion snapper bycatch in the shrimp fishery occurs in the eastern Gulf.

7.4 Parameters: Fixed and Estimated

The alternative run included the same process error parameters, observation error parameters, and annual process deviation parameters as the continuity run (SEDAR 2011).

7.5 Measures of Uncertainty

The variance of the parameter estimates were derived using an asymptotic variance-covariance matrix obtained from the inverse of the Hessian matrix.

7.6 Management Benchmarks and Reference Points

Reference points and benchmarks were calculated with regard to the F_{MSY} proxy, $F_{SPR30\%}$, which was recommended by the SEDAR 9 review panel and accepted by the GMFMC.

8. SSAPM MODEL RESULTS

The results of the alternative run were compared to the continuity run results in the following sections.

8.1. Measures of Overall Fit

Fits to the catch series are shown in **Figures 8.1** and **8.2**. In general, the predicted catches from the alternative run match the predicted catches from the continuity run, except for shrimp fishery bycatch. The continuity run predicts that shrimp bycatch varies around the average shrimp bycatch, while the alternative run predicts a decline in shrimp bycatch related to the decline in shrimp effort.

Fits to the shrimp fishery effort series are shown in **Figure 8.3** and **Table 8.1**. In general, the fits to the effort series were adequate with no extreme deviations from the observed values.

Fits to the indices of abundance are summarized in **Figures 8.4** and **8.5** and **Tables 8.2** and **8.3**. In general, the predicted indices from the alternative run match the predicted indices from the continuity run, with no major differences.

The fits to the observed age composition are summarized in **Figures 8.6** to **8.11**. In general, the predicted age compositions from the alternative run match the predicted age compositions from the continuity run, with no major differences.

8.2. Parameter Estimates

The SSAPSM parameter estimates and their corresponding standard deviations are summarized in **Tables 8.4** and **8.5**.

8.3 Selectivity

Predicted selectivity patterns are shown in **Figures 8.12** and **8.13**. Selectivity of the shrimp fleet was fixed at the values shown in **Figures 8.12** and **8.13**. The selectivity patterns estimated by the alternative run and the continuity run are quite similar.

8.4 Fishing Mortality

Annual trends in apical fishing mortality (F), and F relative to MSY and SPR30% levels are summarized in **Figures 8.14** and **8.15** and **Table 8.6**. The continuity run and alternative run with eastern Gulf shrimp effort show an increasing trend in F up until the late 1990s, followed by a general decrease in F. The alternative run with eastern Gulf shrimp shows greater magnitudes of increase and decrease than the continuity run. The alternative run with Gulfwide shrimp shows relative stable levels of F from 1986 to 2004. These differences in F are driven by the differences in how the shrimp fishery is modeled between the runs. In 2010, the terminal year of the 2011 update assessment, the values of apical F, F/F_{MSY} and $F/F_{SPR30\%}$ were as follows:

	Continuity Run	Alt Shrimp Eff GW	Alt Shrimp Eff E
F	0.469	0.235	0.235
F2010/FMSY	0.612	0.338	0.310
F2010/FSPR30%	0.615	0.307	0.277

Like the continuity run, the alternative run suggests that apical F has been less than F_{MSY} and $F_{SPR30\%}$ throughout the time series, indicating that the population is not currently undergoing overfishing.

8.5 Stock Biomass

Annual trends in spawning stock biomass (SSB) and SSB relative to MSY and SPR30% levels are summarized in **Figures 8.16** and **8.17** and **Table 8.7**. In general, the predicted SSB, SSB/SSB_{MSY} and $SSB/SSB_{SPR30\%}$ from the alternative run are similar to the predicted SSB, SSB/SSB_{MSY} and $SSB/SSB_{SPR30\%}$ from the continuity run, with no major differences.

In 2010, the terminal year of the 2011 update assessment, the values of SSB, SSB/SSB_{MSY} and $SSB/SSB_{SPR30\%}$ were as follows:

	Continuity Run	Alt Shrimp Eff GW	Alt Shrimp Eff E
SSB	1.09E+14	1.08E+14	1.09E+14
SSB2010/SSBMSY	1.556	1.477	1.459
SSB2010/SSBSPR30%	1.549	1.603	1.604

The alternative run is therefore consistent with the continuity run in estimating that the spawning biomass of vermilion snapper has never been below SSB_{MSY} or $SSB_{SPR30\%}$, except for the alternative run with eastern Gulf shrimp effort in which SSB dropped slightly below SSB_{MSY} ($SSB/ SSB_{MSY} = 0.996$) in 1999. These results indicate a population that is not currently overfished.

8.6 Recruitment

Annual estimates of recruitment (Age 1) are summarized in **Figure 8.18** and **Table 8.8**. In general, the predicted recruitment from the alternative run is similar to the predicted recruitment from the continuity run, with no major differences.

8.7 Retrospective Analyses

A retrospective analysis was conducted on the alternative run by sequentially increasing the terminal year of the assessment from 2004 to 2010. The model was refit as each new year of data was added to the assessment. Results of the retrospective analysis were examined for systematic bias in key parameter estimates and derived quantities.

Results of a retrospective analysis on F at age are summarized in **Figures 8.19** and **8.20**. There are no clear signs of a systematic bias in estimates of F at age as new years of data are added to the assessment.

Results of a retrospective analysis on SSB are summarized in **Figure 8.21**. There are no clear signs of systematic bias in estimates of SSB as new years of data are added to the assessment.

8.8 Benchmarks / Reference Points

The benchmarks and reference points are summarized in **Table 8.9**. The alternative run suggests that vermilion snapper are not overfished, nor are they undergoing overfishing. This result does not differ substantially from the continuity run.

The reference points and benchmarks were calculated using the same methods from the continuity run (SEDAR 2011).

9. PROJECTIONS

9.1 Projection Methods

Projections were made using PRO-2BOX (Porch, 2002b) in accordance with the terms of reference, as described in **Table 1**. As in the continuity run, the projections were made using recalculated S/R parameters that considered only the recent years of data (SEDAR 2011).

For all projection scenarios, in 2011 the projected catch was estimated with the assumption that $F_{2011}=F_{CURRENT}$. In subsequent years (2012-2017), the population was projected at constant F using the scenarios listed below.

The following scenarios were evaluated:

1) F 2012-2017 set equal to $F_{SPR30\%}$.
2) F 2012-2017 set equal to F_{OY}= 75% of $F_{SPR30\%}$.
3) Since no 2012 target was proposed, a similar scenario was projected that assumed F in 2012-2017 would equal F Current.
4) Constant catch set equal to average predicted yield for 2007-2009 (6.30 mp for Gulfwide shrimp effort, 6.18 mp for eastern Gulf shrimp effort).

Two sources of model uncertainty were carried into the projections:

1) The variance in numbers at age in the terminal year.
2) The variance in future recruitment (SD=0.4, no autocorrelation).

9.2 Projection Results

All projected yields presented in the following results represent total removals (i.e., directed landings + shrimp bycatch).

The results of the projection described in Scenario 1 (FSPR30; above) are summarized in **Figures 9.1** and **9.2** and **Tables 9.1-9.12**. Since the stock is currently estimated to be above the $SSB_{FSPR30\%}$ reference level, projections at F_{SPR30} allow annual yields during 2012-2017 that are above the equilibrium yield at F_{SPR30} and fish the stock biomass down toward the equilibrium SSB_{FSPR30}. The projected apical F and F/FSPR30% are constant at F_{SPR30} throughout the projection (2012-1017). Annual recruitment estimates are nearly constant during the projection interval, although the confidence intervals are wide.

The results of the projection described in Scenario 2 (75% of FSPR30; above) are summarized in **Figures 9.3** and **9.4** and **Tables 9.13-9.24**. Since the stock is currently estimated to be above the SSB_{OY} reference level, projections at F_{OY} allow annual yields during 2012-2017 that are above the equilibrium yield at F_{OY} and fish the stock biomass down toward the equilibrium SSB_{OY}. The projected apical F and F/FSPR30% are constant at F_{OY} throughout the projection (2012-1017). Annual recruitment estimates are nearly constant during the projection interval, although the confidence intervals are wide.

The results of the projection described in Scenario 3 ($F_{CURRENT}$; above) are summarized in **Figures 9.5** and **9.6** and **Tables 9.24-9.36**. Fishing at $F_{CURRENT}$ is intended to evaluate the trajectories in SSB, F, Yield, etc. if the fleets were allowed to fish at current levels throughout the projection (e.g. no new management effort). Since the estimated fishing mortality in 2010 ($F_{CURRENT}$) is the lowest of the series, and the stock is currently estimated to be above MSST while $F_{CURRENT}$ is below $F_{SPR30\%}$, the trajectories of SSB and yield slowly increase during the projection interval. Recruitment is constant during the projection interval, although the confidence intervals are wide.

The results of the projection described in Scenario 4 (Recent Yield; above) are summarized in **Figures 9.7** and **9.8** and **Tables 9.37-9.48**. This projection is similar to the projection at $F_{CURRENT}$ (Scenario 3; above) in that it explore the possibility that fishing effort is allowed to continue at

recent levels of catch (average 2007-2009). Since the stock is currently estimated to be above MSST and the Fs associated with recent yield are below FSPR30%, the trajectories of SSB, F, Yield, Recruitment etc. are nearly constant during the projection interval.

9.3 Calculation of ABC from the PDF of OFL.

Probability density functions for OFL were constructed by projecting at $F=F_{SPR30}$ during the projection interval. These PDFs can be used to produce ABC advice using the GFMSC control rule. Total removals ranging from 3.0 mp – 19 mp were considered. The results are summarized in **Tables 9.49** and **9.50** and **Figures 9.9** and **9.10**.

10 Literature Cited

Porch, C. E. 2002a. Preliminary assessment of Atlantic white marlin (*Tetrapturus albidus*) using a state-space implementation of an age-structured production model. Col. Vol. Sci. Pap. ICCAT 55(2): 559-577.

Porch, C. E. 2002b. PRO-2BOX user's guide (version 2.01). NOAA Fisheries, Southeast Fisheries Science Center, Sustainable Fisheries Division Contribution SFD-02/03-182.

SEDAR. 2005. Stock Assessment Report of SEDAR 7: Gulf of Mexico Red Snapper.

SEDAR. 2006. Stock Assessment Report of SEDAR 9: Gulf of Mexico Vermilion Snapper. Assessment Report 3.

SEDAR. 2009. Stock Assessment of Red Snapper in the Gulf of Mexico: SEDAR Update Assessment.

SEDAR. 2011. SEDAR Update Stock Assessment of Vermilion Snapper in the Gulf of Mexico: Continuity Run.

11 Tables

Table 4.1. Observed landings for Gulf of Mexico vermilion snapper. Commercial landings are reported in thousand pounds whole weight. Recreational landings are reported in thousand fish.

Year	Commercial		Recreational
	East	West	
1963	30.7	22.5	-
1964	33.6	23.5	-
1965	33.4	20.8	-
1966	17.4	6.7	-
1967	35.3	15.8	-
1968	70.2	50.3	-
1969	89.4	27.1	-
1970	83.4	44.4	-
1971	91.0	48.1	-
1972	80.4	46.5	-
1973	135.5	54.9	-
1974	128.6	66.8	-
1975	279.9	109.3	-
1976	246.0	60.5	-
1977	333.4	195.1	-
1978	286.6	163.3	-
1979	218.4	220.4	-
1980	160.1	148.5	-
1981	241.7	120.2	200.0
1982	246.6	151.2	852.0
1983	401.6	168.9	230.6
1984	547.9	889.7	355.0
1985	687.0	791.5	456.5
1986	690.8	1058.6	998.5
1987	539.3	1066.1	1035.3
1988	506.9	1046.1	1376.1
1989	596.4	1062.4	861.4
1990	1492.6	962.3	1174.2
1991	985.5	809.5	1165.1
1992	1298.0	1063.3	1360.3
1993	1671.0	1048.5	1203.3
1994	1585.6	1053.6	989.9
1995	1509.1	668.9	1229.9
1996	1169.9	657.4	586.2
1997	1045.1	1080.7	617.1

1998	831.1	901.5	313.8
1999	927.9	1108.2	421.6
2000	700.0	758.9	332.9
2001	798.5	916.6	619.9
2002	1008.4	996.7	512.4
2003	1154.3	1261.4	595.4
2004	933.1	1229.1	830.7
2005	982.3	886.6	635.9
2006	1122.6	637.6	609.8
2007	1174.0	1208.9	488.1
2008	1788.3	1011.9	530.2
2009	2814.4	950.8	630.3
2010	1323.1	770.7	477.6

Table 4.2. Relative shrimp fishery effort and associated CVs for Gulf of Mexico vermilion snapper.

	Gulfwide		Eastern Gulf	
Year	Rel. Effort	CV	Rel. Effort	CV
1981	0.917	0.59	0.932	0.50
1982	0.931	0.69	0.929	0.50
1983	0.821	0.61	1.017	0.50
1984	1.019	0.71	1.194	0.50
1985	0.988	0.57	1.152	0.50
1986	1.259	0.51	1.194	0.50
1987	1.223	0.52	0.967	0.50
1988	1.179	0.65	0.912	0.50
1989	1.135	0.53	1.106	0.50
1990	1.067	0.64	0.969	0.50
1991	1.250	0.58	0.997	0.50
1992	1.336	0.50	1.209	0.50
1993	1.269	0.54	0.998	0.50
1994	1.079	0.45	1.033	0.50
1995	1.020	0.57	1.221	0.50
1996	1.097	0.47	1.380	0.50
1997	1.277	0.61	1.455	0.50
1998	1.290	0.63	1.829	0.32
1999	1.061	0.65	1.127	0.48
2000	1.090	0.61	0.968	0.43
2001	1.181	0.78	1.088	0.40
2002	1.394	0.69	1.294	0.44
2003	1.134	0.48	1.078	0.34
2004	1.062	0.42	1.070	0.62
2005	0.801	0.65	0.901	0.50
2006	0.575	0.57	0.584	0.44
2007	0.455	0.57	0.439	0.50
2008	0.319	0.68	0.287	0.57
2009	0.406	0.65	0.442	0.67
2010	0.367	0.49	0.231	0.66

Table 6.1. Standardized CPUE indices and their associated CVs for Gulf of Mexico vermilion snapper.

	Commercial Handline				Recreational Headboat					
	East		West		East		West		MRFSS	
Year	Std CPUE	CV	Std CPUE	CV	Std CPUE	CV	Std CPUE	CV	Std CPUE	CV
1986	-	-	-	-	0.8998	0.2055	1.2790	0.1384	2.2906	0.1962
1987	-	-	-	-	1.0977	0.2028	1.0950	0.1149	1.0805	0.2792
1988	-	-	-	-	2.4114	0.1951	0.8643	0.1310	1.0994	0.2631
1989	-	-	-	-	1.4161	0.2000	1.2639	0.1285	0.7339	0.3755
1990	-	-	-	-	1.7836	0.1957	2.1301	0.1106	2.6112	0.3112
1991	-	-	-	-	1.5023	0.1950	1.0242	0.1271	1.7484	0.2072
1992	-	-	-	-	1.9680	0.1967	0.8777	0.1104	2.3177	0.1344
1993	0.8935	0.2208	0.8105	0.2142	1.3089	0.1940	0.9605	0.0996	2.1853	0.1960
1994	0.9349	0.2154	1.0640	0.2117	1.3981	0.1954	0.9916	0.0954	1.3002	0.2377
1995	0.8197	0.2160	0.8460	0.2078	1.3850	0.1985	1.1875	0.0937	2.1115	0.2738
1996	0.7932	0.2159	0.7446	0.2080	0.8490	0.1980	1.0232	0.1059	1.2603	0.3327
1997	0.6977	0.2179	0.8658	0.2045	0.7324	0.1984	1.2779	0.1158	0.6026	0.2023
1998	0.7069	0.2176	0.7599	0.2053	0.3032	0.1973	1.2154	0.1160	0.4369	0.1901
1999	0.7446	0.2161	0.7711	0.2049	0.5697	0.1966	0.7767	0.1275	0.5096	0.1373
2000	0.6203	0.2213	0.4950	0.2069	0.3965	0.1980	0.6893	0.1244	0.3762	0.1464
2001	0.6484	0.2185	0.5472	0.2059	0.3974	0.1954	0.9387	0.1191	0.4455	0.1443
2002	0.7961	0.2152	0.7455	0.2047	0.4498	0.1962	1.1272	0.1023	0.3628	0.1458
2003	0.7817	0.2146	0.9125	0.2043	0.5890	0.1959	0.7366	0.1142	0.4257	0.1406
2004	0.7801	0.2161	0.9406	0.2043	0.6499	0.1972	1.2109	0.1061	0.6062	0.1076
2005	1.0367	0.2145	0.7202	0.2068	0.7184	0.1971	1.2353	0.1052	0.6633	0.1205
2006	1.1007	0.2177	0.3856	0.2097	0.5838	0.2013	0.7946	0.1222	0.6113	0.1325
2007	1.2812	0.2239	1.5926	0.2176	0.5472	0.2032	1.1052	0.1188	0.4091	0.1526
2008	1.6315	0.2159	2.5368	0.2260	0.8771	0.1969	0.2108	0.2430	0.5128	0.1648
2009	2.0828	0.2153	1.7742	0.2282	1.0860	0.1972	0.3316	0.1791	0.1767	0.2233
2010	1.6500	0.2179	1.4877	0.2288	1.0797	0.1998	0.6528	0.1444	0.1225	0.1721

Table 8.1. Observed (scaled) and predicted shrimp fishery effort values for the alternative run with Gulfwide shrimp effort (GW) and eastern Gulf shrimp effort (EAST).

	GW		EAST	
YEAR	OBS	PRED	OBS	PRED
1950	-	0.0000	-	0.0000
1951	-	0.0227	-	0.0237
1952	-	0.0454	-	0.0473
1953	-	0.0681	-	0.0710
1954	-	0.0908	-	0.0947
1955	-	0.1135	-	0.1183
1956	-	0.1362	-	0.1420
1957	-	0.1589	-	0.1657
1958	-	0.1816	-	0.1893
1959	-	0.2043	-	0.2130
1960	-	0.2270	-	0.2367
1961	-	0.2497	-	0.2603
1962	-	0.2724	-	0.2840
1963	-	0.2951	-	0.3077
1964	-	0.3178	-	0.3313
1965	-	0.3404	-	0.3550
1966	-	0.3631	-	0.3787
1967	-	0.3858	-	0.4023
1968	-	0.4085	-	0.4260
1969	-	0.4312	-	0.4497
1970	-	0.4539	-	0.4733
1971	-	0.4766	-	0.4970
1972	-	0.4993	-	0.5207
1973	-	0.5220	-	0.5443
1974	-	0.5447	-	0.5680
1975	-	0.5674	-	0.5917
1976	-	0.5901	-	0.6153
1977	-	0.6128	-	0.6390
1978	-	0.6355	-	0.6627
1979	-	0.6582	-	0.6863
1980	-	0.6809	-	0.7100
1981	0.9176	0.7036	0.9322	0.7337
1982	0.9312	0.8665	0.9289	0.9090
1983	0.8209	0.8752	1.0175	1.0113
1984	1.0191	0.9803	1.1938	1.1322
1985	0.9884	1.0159	1.1521	1.1259
1986	1.2590	1.1539	1.1942	1.1083
1987	1.2237	1.1402	0.9677	0.9635
1988	1.1791	1.1228	0.9124	0.9419
1989	1.1353	1.0967	1.1059	1.0365
1990	1.0671	1.0806	0.9688	0.9840

1991	1.2501	1.1740	0.9971	1.0056
1992	1.3359	1.2535	1.2089	1.1245
1993	1.2692	1.2161	0.9985	1.0364
1994	1.0789	1.0976	1.0328	1.0664
1995	1.0203	1.0789	1.2217	1.2236
1996	1.0973	1.1178	1.3802	1.3425
1997	1.2772	1.2243	1.4556	1.4415
1998	1.2899	1.2458	1.8289	1.7010
1999	1.0610	1.1337	1.1270	1.2001
2000	1.0902	1.0663	0.9685	0.9984
2001	1.1817	1.0893	1.0879	1.0637
2002	1.3948	1.2020	1.2941	1.2027
2003	1.1343	1.1130	1.0787	1.0782
2004	1.0623	1.0263	1.0698	1.0154
2005	0.8009	0.8287	0.9010	0.8776
2006	0.5752	0.6353	0.5842	0.6249
2007	0.4557	0.5142	0.4388	0.4837
2008	0.3198	0.4343	0.2870	0.3851
2009	0.4064	0.4643	0.4418	0.4544
2010	0.3671	0.4499	0.2308	0.3830

Table 8.2. Observed (scaled) and predicted CPUE values for the alternative run with Gulfwide shrimp effort.

	COM HL EAST			COM HL WEST			HB EAST			HB WEST			MRFSS	
YEAR	OBS	PRED		OBS	PRED		OBS	PRED		OBS	PRED		OBS	PRED
1986							0.900	1.349		1.279	1.431		2.291	1.155
1987							1.098	1.262		1.095	1.336		1.081	1.078
1988							2.412	1.239		0.865	1.312		1.100	1.058
1989							1.416	1.376		1.264	1.460		0.734	1.178
1990							1.784	1.573		2.130	1.668		2.611	1.347
1991							1.503	1.574		1.024	1.667		1.749	1.345
1992							1.968	1.427		0.878	1.508		2.318	1.217
1993	0.894	1.521		0.811	1.530		1.309	1.268		0.961	1.341		2.185	1.083
1994	0.936	1.333		1.064	1.378		1.398	1.143		0.992	1.211		1.300	0.977
1995	0.820	1.137		0.846	1.195		1.385	1.011		1.188	1.070		2.112	0.864
1996	0.794	0.988		0.745	1.024		0.849	0.865		1.023	0.917		1.260	0.740
1997	0.698	0.855		0.866	0.875		0.733	0.729		1.278	0.772		0.603	0.623
1998	0.708	0.789		0.760	0.773		0.304	0.631		1.216	0.669		0.437	0.540
1999	0.745	0.746		0.771	0.725		0.570	0.578		0.777	0.613		0.510	0.495
2000	0.621	0.696		0.495	0.687		0.397	0.557		0.690	0.591		0.376	0.477
2001	0.649	0.704		0.548	0.663		0.398	0.547		0.939	0.580		0.446	0.468
2002	0.797	0.860		0.746	0.728		0.450	0.562		1.127	0.596		0.363	0.480
2003	0.782	0.936		0.913	0.848		0.589	0.640		0.737	0.679		0.426	0.548
2004	0.781	0.913		0.941	0.882		0.650	0.708		1.211	0.751		0.606	0.606
2005	1.037	0.897		0.721	0.862		0.719	0.715		1.236	0.757		0.663	0.611
2006	1.101	0.915		0.386	0.865		0.584	0.707		0.795	0.749		0.611	0.605
2007	1.282	0.912		1.593	0.871		0.548	0.708		1.105	0.750		0.409	0.606
2008	1.632	0.933		2.537	0.845		0.877	0.686		0.211	0.726		0.513	0.586
2009	2.083	1.033		1.775	0.858		1.086	0.655		0.332	0.692		0.177	0.559
2010	1.651	1.072		1.488	0.959		1.080	0.720		0.653	0.764		0.123	0.617

Table 8.3. Observed (scaled) and predicted CPUE values for the alternative run with eastern Gulf shrimp effort.

	COM HL EAST			COM HL WEST			HB EAST			HB WEST			MRFSS	
YEAR	OBS	PRED		OBS	PRED		OBS	PRED		OBS	PRED		OBS	PRED
1986							0.900	1.350		1.279	1.432		2.291	1.156
1987							1.098	1.258		1.095	1.333		1.081	1.075
1988							2.412	1.236		0.865	1.309		1.100	1.056
1989							1.416	1.376		1.264	1.461		0.734	1.179
1990							1.784	1.573		2.130	1.669		2.611	1.347
1991							1.503	1.574		1.024	1.666		1.749	1.345
1992							1.968	1.427		0.878	1.508		2.318	1.217
1993	0.894	1.520		0.811	1.529		1.309	1.268		0.961	1.341		2.185	1.083
1994	0.936	1.334		1.064	1.378		1.398	1.143		0.992	1.211		1.300	0.977
1995	0.820	1.138		0.846	1.196		1.385	1.012		1.188	1.070		2.112	0.864
1996	0.794	0.989		0.745	1.025		0.849	0.867		1.023	0.918		1.260	0.741
1997	0.698	0.856		0.866	0.876		0.733	0.731		1.278	0.773		0.603	0.624
1998	0.708	0.791		0.760	0.774		0.304	0.632		1.216	0.671		0.437	0.541
1999	0.745	0.745		0.771	0.724		0.570	0.578		0.777	0.613		0.510	0.495
2000	0.621	0.693		0.495	0.685		0.397	0.556		0.690	0.590		0.376	0.476
2001	0.649	0.703		0.548	0.661		0.398	0.546		0.939	0.579		0.446	0.467
2002	0.797	0.860		0.746	0.727		0.450	0.561		1.127	0.595		0.363	0.480
2003	0.782	0.936		0.913	0.848		0.589	0.640		0.737	0.679		0.426	0.548
2004	0.781	0.913		0.941	0.883		0.650	0.709		1.211	0.751		0.606	0.606
2005	1.037	0.897		0.721	0.863		0.719	0.715		1.236	0.758		0.663	0.612
2006	1.101	0.915		0.386	0.866		0.584	0.707		0.795	0.750		0.611	0.605
2007	1.282	0.912		1.593	0.871		0.548	0.708		1.105	0.751		0.409	0.606
2008	1.632	0.933		2.537	0.845		0.877	0.686		0.211	0.726		0.513	0.586
2009	2.083	1.033		1.775	0.858		1.086	0.655		0.332	0.692		0.177	0.559
2010	1.651	1.073		1.488	0.959		1.080	0.721		0.653	0.764		0.123	0.617

Table 8.4. SSASPM parameter estimates and standard deviation from the alternative run with Gulfwide shrimp effort.

Parameter	Description	Estimate	Std Dev
1	Beverton & Holt - Alpha	1.41E+07	1.06E+06
2	Beverton & Holt - Beta	1.76E+01	8.61E+00
3	Index -Q CMHL_E	4.13E-01	2.45E-02
4	Index -Q CMHL_W	6.15E-08	4.35E-09
5	Index -Q HB_E	7.43E-08	6.26E-09
6	Index -Q HB_W	1.05E-07	7.84E-09
7	Index -Q REC	1.11E-07	8.39E-09
8	Effort - CMHL_E	9.00E-08	6.78E-09
9	Effort - CMHL_W	4.00E-02	7.09E-03
10	Effort - REC	4.08E-02	7.40E-03
11	Effort - SHRIMP	6.63E-02	1.21E-02
12	Logistic Selectivity Par 1 - CMHL_E	9.02E-01	6.93E-02
13	Logistic Selectivity Par 2 - CMHL_E	2.57E-01	4.35E-02
14	Logistic Selectivity Par 1 - CMHL_W	2.35E+00	9.27E-02
15	Logistic Selectivity Par 2 - CMHL_W	3.99E-01	5.39E-02
16	Logistic Selectivity Par 1 - REC	3.11E+00	1.36E-01
17	Logistic Selectivity Par 2 - REC	5.68E-01	2.93E-02
19	Recruitment Deviation - 1981	-2.33E-02	3.53E-01
20	Recruitment Deviation - 1982	2.16E-01	3.36E-01
21	Recruitment Deviation - 1983	1.53E-01	3.27E-01
22	Recruitment Deviation - 1984	1.25E-01	3.13E-01
23	Recruitment Deviation - 1985	1.93E-01	3.28E-01
24	Recruitment Deviation - 1986	8.32E-01	3.03E-01
25	Recruitment Deviation - 1987	1.27E+00	2.14E-01
26	Recruitment Deviation - 1988	1.83E-01	2.55E-01
27	Recruitment Deviation - 1989	4.86E-01	1.83E-01
28	Recruitment Deviation - 1990	3.85E-01	1.64E-01
29	Recruitment Deviation - 1991	5.03E-01	1.45E-01
30	Recruitment Deviation - 1992	2.12E-01	1.53E-01
31	Recruitment Deviation - 1993	-1.89E-01	1.65E-01
32	Recruitment Deviation - 1994	-1.50E-01	1.50E-01
33	Recruitment Deviation - 1995	-3.42E-01	1.57E-01
34	Recruitment Deviation - 1996	-3.75E-02	1.37E-01
35	Recruitment Deviation - 1997	1.64E-02	1.39E-01
36	Recruitment Deviation - 1998	-1.61E-01	1.47E-01
37	Recruitment Deviation - 1999	-3.32E-01	1.57E-01
38	Recruitment Deviation - 2000	5.86E-01	1.23E-01
39	Recruitment Deviation - 2001	4.43E-01	1.31E-01
40	Recruitment Deviation - 2002	1.03E-01	1.42E-01
41	Recruitment Deviation - 2003	6.10E-02	1.34E-01
42	Recruitment Deviation - 2004	1.74E-01	1.32E-01
43	Recruitment Deviation - 2005	-3.73E-02	1.46E-01
44	Recruitment Deviation - 2006	-5.72E-02	1.48E-01
45	Recruitment Deviation - 2007	4.95E-01	1.25E-01
46	Recruitment Deviation - 2008	3.12E-01	1.78E-01
47	Recruitment Deviation - 2009	-3.28E-01	3.11E-01
48	Recruitment Deviation - 2010	-1.10E-01	3.63E-01
49	Effort Deviation - CMHL_E -1981	-2.18E+00	1.87E-01
50	Effort Deviation - CMHL_E -1982	-1.55E+00	2.24E-01

Parameter Number	Description	Estimate	Std Dev
51	Effort Deviation - CMHL_E -1983	-1.05E+00	2.23E-01
52	Effort Deviation - CMHL_E -1984	-7.21E-01	2.20E-01
53	Effort Deviation - CMHL_E -1985	-4.61E-01	2.17E-01
54	Effort Deviation - CMHL_E -1986	-3.89E-01	2.17E-01
55	Effort Deviation - CMHL_E -1987	-5.88E-01	2.18E-01
56	Effort Deviation - CMHL_E -1988	-7.59E-01	2.19E-01
57	Effort Deviation - CMHL_E -1989	-7.31E-01	2.17E-01
58	Effort Deviation - CMHL_E -1990	1.28E-01	2.16E-01
59	Effort Deviation - CMHL_E -1991	-1.15E-01	2.17E-01
60	Effort Deviation - CMHL_E -1992	2.09E-01	2.17E-01
61	Effort Deviation - CMHL_E -1993	5.11E-01	2.15E-01
62	Effort Deviation - CMHL_E -1994	5.32E-01	2.13E-01
63	Effort Deviation - CMHL_E -1995	6.53E-01	2.13E-01
64	Effort Deviation - CMHL_E -1996	6.21E-01	2.16E-01
65	Effort Deviation - CMHL_E -1997	6.66E-01	2.17E-01
66	Effort Deviation - CMHL_E -1998	5.14E-01	2.16E-01
67	Effort Deviation - CMHL_E -1999	6.38E-01	2.15E-01
68	Effort Deviation - CMHL_E -2000	4.31E-01	2.15E-01
69	Effort Deviation - CMHL_E -2001	4.77E-01	2.13E-01
70	Effort Deviation - CMHL_E -2002	5.10E-01	2.13E-01
71	Effort Deviation - CMHL_E -2003	5.42E-01	2.12E-01
72	Effort Deviation - CMHL_E -2004	4.01E-01	2.13E-01
73	Effort Deviation - CMHL_E -2005	5.18E-01	2.15E-01
74	Effort Deviation - CMHL_E -2006	6.18E-01	2.15E-01
75	Effort Deviation - CMHL_E -2007	6.83E-01	2.15E-01
76	Effort Deviation - CMHL_E -2008	1.21E+00	2.21E-01
77	Effort Deviation - CMHL_E -2009	1.63E+00	2.26E-01
78	Effort Deviation - CMHL_E -2010	7.07E-01	2.22E-01
79	Effort Deviation - CMHL_W-1981	-2.71E+00	1.87E-01
80	Effort Deviation - CMHL_W-1982	-1.94E+00	2.25E-01
81	Effort Deviation - CMHL_W-1983	-1.71E+00	2.24E-01
82	Effort Deviation - CMHL_W-1984	-1.92E-01	2.21E-01
83	Effort Deviation - CMHL_W-1985	-1.75E-01	2.18E-01
84	Effort Deviation - CMHL_W-1986	1.57E-01	2.17E-01
85	Effort Deviation - CMHL_W-1987	2.33E-01	2.18E-01
86	Effort Deviation - CMHL_W-1988	1.87E-01	2.18E-01
87	Effort Deviation - CMHL_W-1989	4.28E-02	2.17E-01
88	Effort Deviation - CMHL_W-1990	-1.08E-01	2.17E-01
89	Effort Deviation - CMHL_W-1991	-1.72E-01	2.18E-01
90	Effort Deviation - CMHL_W-1992	1.53E-01	2.18E-01
91	Effort Deviation - CMHL_W-1993	2.27E-01	2.16E-01
92	Effort Deviation - CMHL_W-1994	2.66E-01	2.14E-01
93	Effort Deviation - CMHL_W-1995	1.84E-02	2.15E-01
94	Effort Deviation - CMHL_W-1996	1.90E-01	2.17E-01
95	Effort Deviation - CMHL_W-1997	8.24E-01	2.18E-01
96	Effort Deviation - CMHL_W-1998	7.83E-01	2.16E-01
97	Effort Deviation - CMHL_W-1999	9.93E-01	2.15E-01
98	Effort Deviation - CMHL_W-2000	6.89E-01	2.15E-01
99	Effort Deviation - CMHL_W-2001	8.11E-01	2.13E-01
100	Effort Deviation - CMHL_W-2002	8.19E-01	2.14E-01

Table 8.4 continued... SSASPM parameter estimates and standard deviation from the alternative run with Gulfwide shrimp effort.

Parameter Number	Description	Estimate	Std Dev	Parameter	Description	Estimate	Std Dev
101	Effort Deviation - CMHL_W-2003	8.76E-01	2.13E-01	151	Effort Deviation - SHRIMP	2.99E-01	1.40E-01
102	Effort Deviation - CMHL_W-2004	8.25E-01	2.13E-01	152	Effort Deviation - SHRIMP	1.96E-01	1.30E-01
103	Effort Deviation - CMHL_W-2005	6.15E-01	2.16E-01	153	Effort Deviation - SHRIMP	1.79E-01	1.44E-01
104	Effort Deviation - CMHL_W-2006	3.22E-01	2.16E-01	154	Effort Deviation - SHRIMP	2.15E-01	1.33E-01
105	Effort Deviation - CMHL_W-2007	8.72E-01	2.16E-01	155	Effort Deviation - SHRIMP	3.06E-01	1.47E-01
106	Effort Deviation - CMHL_W-2008	8.73E-01	2.22E-01	156	Effort Deviation - SHRIMP	3.23E-01	1.50E-01
107	Effort Deviation - CMHL_W-2009	7.98E-01	2.24E-01	157	Effort Deviation - SHRIMP	2.29E-01	1.53E-01
108	Effort Deviation - CMHL_W-2010	4.25E-01	2.20E-01	158	Effort Deviation - SHRIMP	1.67E-01	1.46E-01
109	Effort Deviation - REC-1981	-1.33E+00	2.77E-01	159	Effort Deviation - SHRIMP	1.89E-01	1.58E-01
110	Effort Deviation - REC-1982	-4.38E-01	3.00E-01	160	Effort Deviation - SHRIMP	2.87E-01	1.53E-01
111	Effort Deviation - REC-1983	-1.16E+00	2.98E-01	161	Effort Deviation - SHRIMP	2.10E-01	1.33E-01
112	Effort Deviation - REC-1984	-8.92E-01	2.96E-01	162	Effort Deviation - SHRIMP	1.29E-01	1.25E-01
113	Effort Deviation - REC-1985	-5.71E-01	2.94E-01	163	Effort Deviation - SHRIMP	-8.48E-02	1.51E-01
114	Effort Deviation - REC-1986	7.80E-02	2.93E-01	164	Effort Deviation - SHRIMP	-3.50E-01	1.44E-01
115	Effort Deviation - REC-1987	2.46E-01	2.93E-01	165	Effort Deviation - SHRIMP	-5.62E-01	1.44E-01
116	Effort Deviation - REC-1988	4.18E-01	2.93E-01	166	Effort Deviation - SHRIMP	-7.31E-01	1.54E-01
117	Effort Deviation - REC-1989	1.48E-02	2.89E-01	167	Effort Deviation - SHRIMP	-6.64E-01	1.51E-01
118	Effort Deviation - REC-1990	1.31E-01	2.89E-01	168	Effort Deviation - SHRIMP	-6.96E-01	1.35E-01
119	Effort Deviation - REC-1991	3.62E-01	3.04E-01	169	Lifetime Reproductive Rate	1.76E+01	8.61E+00
120	Effort Deviation - REC-1992	6.24E-01	3.07E-01	170	r0	1.41E+07	1.06E+06
121	Effort Deviation - REC-1993	4.89E-01	2.95E-01	171	Bcurrent	1.08E+14	1.47E+13
122	Effort Deviation - REC-1994	2.10E-01	2.79E-01	172	Fcurrent	2.35E-01	3.57E-02
123	Effort Deviation - REC-1995	3.94E-01	2.78E-01	173	Bvirgin	2.15E+14	1.63E+13
124	Effort Deviation - REC-1996	1.95E-01	2.92E-01	174	B - 1950	2.15E+14	1.63E+13
125	Effort Deviation - REC-1997	3.61E-01	3.00E-01	175	B - 1951	2.15E+14	1.63E+13
126	Effort Deviation - REC-1998	-6.35E-02	2.94E-01	176	B - 1952	2.14E+14	1.62E+13
127	Effort Deviation - REC-1999	8.80E-02	2.90E-01	177	B - 1953	2.13E+14	1.61E+13
128	Effort Deviation - REC-2000	-3.89E-02	2.86E-01	178	B - 1954	2.12E+14	1.60E+13
129	Effort Deviation - REC-2001	2.22E-01	2.75E-01	179	B - 1955	2.10E+14	1.59E+13
130	Effort Deviation - REC-2002	1.55E-01	2.79E-01	180	B - 1956	2.08E+14	1.58E+13
131	Effort Deviation - REC-2003	1.65E-01	2.77E-01	181	B - 1957	2.06E+14	1.56E+13
132	Effort Deviation - REC-2004	3.09E-01	2.75E-01	182	B - 1958	2.04E+14	1.55E+13
133	Effort Deviation - REC-2005	3.10E-01	2.89E-01	183	B - 1959	2.02E+14	1.53E+13
134	Effort Deviation - REC-2006	2.36E-01	2.87E-01	184	B - 1960	2.00E+14	1.51E+13
135	Effort Deviation - REC-2007	1.12E-01	2.87E-01	185	B - 1961	1.97E+14	1.50E+13
136	Effort Deviation - REC-2008	5.24E-01	3.22E-01	186	B - 1962	1.95E+14	1.48E+13
137	Effort Deviation - REC-2009	8.74E-01	3.69E-01	187	B - 1963	1.93E+14	1.46E+13
138	Effort Deviation - REC-2010	3.13E-01	3.14E-01	188	B - 1964	1.90E+14	1.45E+13
139	Effort Deviation - SHRIMP	-2.48E-01	1.23E-01	189	B - 1965	1.88E+14	1.43E+13
140	Effort Deviation - SHRIMP	-4.01E-02	1.53E-01	190	B - 1966	1.85E+14	1.42E+13
141	Effort Deviation - SHRIMP	-3.02E-02	1.48E-01	191	B - 1967	1.83E+14	1.40E+13
142	Effort Deviation - SHRIMP	8.32E-02	1.56E-01	192	B - 1968	1.81E+14	1.39E+13
143	Effort Deviation - SHRIMP	1.19E-01	1.43E-01	193	B - 1969	1.78E+14	1.37E+13
144	Effort Deviation - SHRIMP	2.46E-01	1.36E-01	194	B - 1970	1.76E+14	1.36E+13
145	Effort Deviation - SHRIMP	2.34E-01	1.37E-01	195	B - 1971	1.74E+14	1.34E+13
146	Effort Deviation - SHRIMP	2.19E-01	1.50E-01	196	B - 1972	1.72E+14	1.33E+13
147	Effort Deviation - SHRIMP	1.95E-01	1.39E-01	197	B - 1973	1.69E+14	1.32E+13
148	Effort Deviation - SHRIMP	1.81E-01	1.49E-01	198	B - 1974	1.67E+14	1.31E+13
149	Effort Deviation - SHRIMP	2.64E-01	1.43E-01	199	B - 1975	1.65E+14	1.30E+13
150	Effort Deviation - SHRIMP	3.29E-01	1.35E-01	200	B - 1976	1.63E+14	1.29E+13

Table 8.4 continued... SSASPM parameter estimates and standard deviation from the alternative run with Gulfwide shrimp effort.

Parameter	Description	Estimate	Std Dev	Parameter	Description	Estimate	Std Dev
201	B - 1977	1.61E+14	1.27E+13	251	B1966 over B0	8.63E-01	1.47E-02
202	B - 1978	1.59E+14	1.26E+13	252	B1967 over B0	8.52E-01	1.58E-02
203	B - 1979	1.56E+14	1.25E+13	253	B1968 over B0	8.41E-01	1.69E-02
204	B - 1980	1.54E+14	1.24E+13	254	B1969 over B0	8.30E-01	1.79E-02
205	B - 1981	1.52E+14	1.49E+13	255	B1970 over B0	8.19E-01	1.89E-02
206	B - 1982	1.56E+14	1.41E+13	256	B1971 over B0	8.09E-01	1.99E-02
207	B - 1983	1.54E+14	1.23E+13	257	B1972 over B0	7.99E-01	2.09E-02
208	B - 1984	1.50E+14	1.21E+13	258	B1973 over B0	7.88E-01	2.18E-02
209	B - 1985	1.46E+14	1.34E+13	259	B1974 over B0	7.78E-01	2.27E-02
210	B - 1986	1.75E+14	2.05E+13	260	B1975 over B0	7.68E-01	2.36E-02
211	B - 1987	2.31E+14	1.80E+13	261	B1976 over B0	7.58E-01	2.45E-02
212	B - 1988	1.89E+14	1.25E+13	262	B1977 over B0	7.48E-01	2.53E-02
213	B - 1989	1.85E+14	1.16E+13	263	B1978 over B0	7.39E-01	2.61E-02
214	B - 1990	1.76E+14	1.06E+13	264	B1979 over B0	7.29E-01	2.69E-02
215	B - 1991	1.73E+14	9.93E+12	265	B1980 over B0	7.20E-01	2.76E-02
216	B - 1992	1.53E+14	8.51E+12	266	B1981 over B0	7.52E-01	6.04E-02
217	B - 1993	1.26E+14	7.06E+12	267	B1982 over B0	7.41E-01	6.01E-02
218	B - 1994	1.10E+14	6.20E+12	268	B1983 over B0	7.13E-01	5.85E-02
219	B - 1995	9.52E+13	5.36E+12	269	B1984 over B0	6.87E-01	5.86E-02
220	B - 1996	9.24E+13	5.16E+12	270	B1985 over B0	6.77E-01	6.08E-02
221	B - 1997	8.97E+13	5.09E+12	271	B1986 over B0	7.64E-01	7.53E-02
222	B - 1998	8.21E+13	4.76E+12	272	B1987 over B0	9.42E-01	8.28E-02
223	B - 1999	7.39E+13	4.53E+12	273	B1988 over B0	8.41E-01	6.78E-02
224	B - 2000	1.02E+14	6.31E+12	274	B1989 over B0	8.29E-01	6.56E-02
225	B - 2001	1.13E+14	6.65E+12	275	B1990 over B0	7.89E-01	6.15E-02
226	B - 2002	1.07E+14	6.11E+12	276	B1991 over B0	7.68E-01	5.92E-02
227	B - 2003	1.02E+14	5.90E+12	277	B1992 over B0	6.92E-01	5.28E-02
228	B - 2004	1.04E+14	6.14E+12	278	B1993 over B0	5.85E-01	4.46E-02
229	B - 2005	9.94E+13	5.74E+12	279	B1994 over B0	5.22E-01	4.03E-02
230	B - 2006	9.90E+13	5.80E+12	280	B1995 over B0	4.53E-01	3.49E-02
231	B - 2007	1.24E+14	7.44E+12	281	B1996 over B0	4.35E-01	3.38E-02
232	B - 2008	1.33E+14	9.44E+12	282	B1997 over B0	4.19E-01	3.26E-02
233	B - 2009	1.14E+14	1.07E+13	283	B1998 over B0	3.87E-01	3.03E-02
234	B - 2010	1.08E+14	1.47E+13	284	B1999 over B0	3.50E-01	2.77E-02
235	B1950 over B0	1.00E+00	8.08E-08	285	B2000 over B0	4.58E-01	3.68E-02
236	B1951 over B0	9.99E-01	1.26E-04	286	B2001 over B0	5.04E-01	3.95E-02
237	B1952 over B0	9.96E-01	4.99E-04	287	B2002 over B0	4.84E-01	3.74E-02
238	B1953 over B0	9.91E-01	1.07E-03	288	B2003 over B0	4.72E-01	3.67E-02
239	B1954 over B0	9.84E-01	1.80E-03	289	B2004 over B0	4.86E-01	3.87E-02
240	B1955 over B0	9.77E-01	2.65E-03	290	B2005 over B0	4.76E-01	3.78E-02
241	B1956 over B0	9.68E-01	3.60E-03	291	B2006 over B0	4.80E-01	3.86E-02
242	B1957 over B0	9.59E-01	4.62E-03	292	B2007 over B0	6.05E-01	5.02E-02
243	B1958 over B0	9.49E-01	5.69E-03	293	B2008 over B0	6.42E-01	5.76E-02
244	B1959 over B0	9.39E-01	6.79E-03	294	B2009 over B0	5.39E-01	5.47E-02
245	B1960 over B0	9.28E-01	7.92E-03	295	B2010 over B0	4.98E-01	6.30E-02
246	B1961 over B0	9.18E-01	9.06E-03	296	N2010 Age1	1.46E+07	3.94E+06
247	B1962 over B0	9.07E-01	1.02E-02	297	N2010 Age2	6.36E+06	1.85E+06
248	B1963 over B0	8.96E-01	1.14E-02	298	N2010 Age3	7.96E+06	1.32E+06
249	B1964 over B0	8.85E-01	1.25E-02	299	N2010 Age4	5.69E+06	6.39E+05
250	B1965 over B0	8.74E-01	1.36E-02	300	N2010 Age5	1.87E+06	2.64E+05

Table 8.4 continued... SSASPM parameter estimates and standard deviation from the alternative run with Gulfwide shrimp effort.

Parameter	Description	Estimate	Std Dev
301	N2010 Age6	1.02E+06	1.56E+05
302	N2010 Age7	6.80E+05	1.13E+05
303	N2010 Age8	3.61E+05	6.50E+04
304	N2010 Age9	2.24E+05	4.24E+04
305	N2010 Age10	1.92E+05	3.70E+04
306	N2010 Age11	1.31E+05	2.66E+04
307	N2010 Age12	3.33E+04	7.80E+03
308	N2010 Age13	2.28E+04	5.41E+03
309	N2010 Age14	4.44E+04	1.09E+04
310	F2010 Age1	4.69E-01	9.99E-02
311	F2010 Age2	1.62E-01	2.98E-02
312	F2010 Age3	1.32E-01	1.67E-02
313	F2010 Age4	1.85E-01	2.45E-02
314	F2010 Age5	2.21E-01	3.21E-02
315	F2010 Age6	2.32E-01	3.46E-02
316	F2010 Age7	2.34E-01	3.51E-02
317	F2010 Age8	2.35E-01	3.52E-02
318	F2010 Age9	2.35E-01	3.52E-02
319	F2010 Age10	2.35E-01	3.52E-02
320	F2010 Age11	2.35E-01	3.52E-02
321	F2010 Age12	2.35E-01	3.52E-02
322	F2010 Age13	2.35E-01	3.52E-02
323	F2010 Age14	2.35E-01	3.52E-02

Table 8.5. SSASPM parameter estimates and standard deviation from the alternative run with eastern Gulf shrimp effort.

Parameter	Description	Estimate	Std Dev	Parameter Number	Description	Estimate	Std Dev
1	Beverton & Holt - Alpha	14280000	1079400	51	Effort Deviation - CMHL_E -1983	-1.0475	0.22299
2	Beverton & Holt - Beta	18.822	9.131	52	Effort Deviation - CMHL_E -1984	-0.7233	0.21955
3	Index -Q CMHL_E	0.41979	0.023373	53	Effort Deviation - CMHL_E -1985	-0.46162	0.21721
4	Index -Q CMHL_W	6.1634E-08	4.3563E-09	54	Effort Deviation - CMHL_E -1986	-0.38692	0.21748
5	Index -Q HB_E	7.4442E-08	6.2684E-09	55	Effort Deviation - CMHL_E -1987	-0.58441	0.21796
6	Index -Q HB_W	1.0486E-07	7.8457E-09	56	Effort Deviation - CMHL_E -1988	-0.7575	0.21933
7	Index -Q REC	1.1173E-07	8.3929E-09	57	Effort Deviation - CMHL_E -1989	-0.72893	0.21679
8	Effort - CMHL_E	9.0232E-08	6.7782E-09	58	Effort Deviation - CMHL_E -1990	0.12823	0.21597
9	Effort - CMHL_W	0.040067	0.0070975	59	Effort Deviation - CMHL_E -1991	-0.11371	0.21734
10	Effort - REC	0.040819	0.0074097	60	Effort Deviation - CMHL_E -1992	0.21038	0.21699
11	Effort - SHRIMP	0.066466	0.012128	61	Effort Deviation - CMHL_E -1993	0.51329	0.21534
12	Logistic Selectivity Par 1 - CMHL_E	0.89663	0.0674	62	Effort Deviation - CMHL_E -1994	0.5337	0.21257
13	Logistic Selectivity Par 2 - CMHL_E	0.25678	0.043246	63	Effort Deviation - CMHL_E -1995	0.65391	0.21327
14	Logistic Selectivity Par 1 - CMHL_W	2.3481	0.092631	64	Effort Deviation - CMHL_E -1996	0.62067	0.21586
15	Logistic Selectivity Par 2 - CMHL_W	0.3979	0.053629	65	Effort Deviation - CMHL_E -1997	0.66452	0.21684
16	Logistic Selectivity Par 1 - REC	3.1065	0.13614	66	Effort Deviation - CMHL_E -1998	0.51032	0.21589
17	Logistic Selectivity Par 2 - REC	0.56854	0.029356	67	Effort Deviation - CMHL_E -1999	0.63616	0.21516
19	Recruitment Deviation - 1981	-0.000708	0.35567	68	Effort Deviation - CMHL_E -2000	0.4318	0.21481
20	Recruitment Deviation - 1982	0.25412	0.33925	69	Effort Deviation - CMHL_E -2001	0.47792	0.21321
21	Recruitment Deviation - 1983	0.21054	0.33375	70	Effort Deviation - CMHL_E -2002	0.51006	0.21298
22	Recruitment Deviation - 1984	0.17909	0.31913	71	Effort Deviation - CMHL_E -2003	0.54319	0.21219
23	Recruitment Deviation - 1985	0.21783	0.33144	72	Effort Deviation - CMHL_E -2004	0.40197	0.21319
24	Recruitment Deviation - 1986	0.79833	0.29548	73	Effort Deviation - CMHL_E -2005	0.51824	0.21541
25	Recruitment Deviation - 1987	1.1542	0.20904	74	Effort Deviation - CMHL_E -2006	0.61873	0.21498
26	Recruitment Deviation - 1988	0.11206	0.24863	75	Effort Deviation - CMHL_E -2007	0.68352	0.21504
27	Recruitment Deviation - 1989	0.43921	0.18086	76	Effort Deviation - CMHL_E -2008	1.2099	0.22134
28	Recruitment Deviation - 1990	0.31506	0.15869	77	Effort Deviation - CMHL_E -2009	1.6322	0.22594
29	Recruitment Deviation - 1991	0.40615	0.13969	78	Effort Deviation - CMHL_E -2010	0.70676	0.22162
30	Recruitment Deviation - 1992	0.1315	0.14984	79	Effort Deviation - CMHL_W-1981	-2.7133	0.18742
31	Recruitment Deviation - 1993	-0.2673	0.16034	80	Effort Deviation - CMHL_W-1982	-1.9416	0.22496
32	Recruitment Deviation - 1994	-0.14956	0.15084	81	Effort Deviation - CMHL_W-1983	-1.71	0.22367
33	Recruitment Deviation - 1995	-0.26218	0.15903	82	Effort Deviation - CMHL_W-1984	-0.19346	0.22139
34	Recruitment Deviation - 1996	0.080975	0.14268	83	Effort Deviation - CMHL_W-1985	-0.17628	0.21824
35	Recruitment Deviation - 1997	0.15537	0.14025	84	Effort Deviation - CMHL_W-1986	0.15706	0.21736
36	Recruitment Deviation - 1998	0.02333	0.14369	85	Effort Deviation - CMHL_W-1987	0.23576	0.21755
37	Recruitment Deviation - 1999	-0.32441	0.15343	86	Effort Deviation - CMHL_W-1988	0.18912	0.21781
38	Recruitment Deviation - 2000	0.54355	0.11502	87	Effort Deviation - CMHL_W-1989	0.043461	0.21724
39	Recruitment Deviation - 2001	0.42326	0.12055	88	Effort Deviation - CMHL_W-1990	-0.10637	0.21674
40	Recruitment Deviation - 2002	0.090701	0.13568	89	Effort Deviation - CMHL_W-1991	-0.17099	0.2178
41	Recruitment Deviation - 2003	0.036881	0.12992	90	Effort Deviation - CMHL_W-1992	0.15413	0.21755
42	Recruitment Deviation - 2004	0.16557	0.13581	91	Effort Deviation - CMHL_W-1993	0.22842	0.21638
43	Recruitment Deviation - 2005	-0.030462	0.14494	92	Effort Deviation - CMHL_W-1994	0.26721	0.2141
44	Recruitment Deviation - 2006	-0.078758	0.14675	93	Effort Deviation - CMHL_W-1995	0.019225	0.21531
45	Recruitment Deviation - 2007	0.46042	0.12442	94	Effort Deviation - CMHL_W-1996	0.19035	0.21668
46	Recruitment Deviation - 2008	0.27715	0.17673	95	Effort Deviation - CMHL_W-1997	0.82364	0.2177
47	Recruitment Deviation - 2009	-0.3397	0.30959	96	Effort Deviation - CMHL_W-1998	0.7803	0.21638
48	Recruitment Deviation - 2010	-0.1199	0.36127	97	Effort Deviation - CMHL_W-1999	0.9908	0.21495
49	Effort Deviation - CMHL_E -1981	-2.1861	0.18676	98	Effort Deviation - CMHL_W-2000	0.68922	0.21475
50	Effort Deviation - CMHL_E -1982	-1.5501	0.22393	99	Effort Deviation - CMHL_W-2001	0.81177	0.21259
				100	Effort Deviation - CMHL_W-2002	0.81971	0.21369

Parameter	Description	Estimate	Std Dev
1	Beverton & Holt - Alpha	1.43E+07	1.08E+06
2	Beverton & Holt - Beta	1.88E+01	9.13E+00
3	Index -Q CMHL_E	4.20E-01	2.34E-02
4	Index -Q CMHL_W	6.16E-08	4.36E-09
5	Index -Q HB_E	7.44E-08	6.27E-09
6	Index -Q HB_W	1.05E-07	7.85E-09
7	Index -Q REC	1.12E-07	8.39E-09
8	Effort - CMHL_E	9.02E-08	6.78E-09
9	Effort - CMHL_W	4.01E-02	7.10E-03
10	Effort - REC	4.08E-02	7.41E-03
11	Effort - SHRIMP	6.65E-02	1.21E-02
12	Logistic Selectivity Par 1 - CMHL_E	8.97E-01	6.74E-02
13	Logistic Selectivity Par 2 - CMHL_E	2.57E-01	4.32E-02
14	Logistic Selectivity Par 1 - CMHL_W	2.35E+00	9.26E-02
15	Logistic Selectivity Par 2 - CMHL_W	3.98E-01	5.36E-02
16	Logistic Selectivity Par 1 - REC	3.11E+00	1.36E-01
17	Logistic Selectivity Par 2 - REC	5.69E-01	2.94E-02
19	Recruitment Deviation - 1981	-7.08E-04	3.56E-01
20	Recruitment Deviation - 1982	2.54E-01	3.39E-01
21	Recruitment Deviation - 1983	2.11E-01	3.34E-01
22	Recruitment Deviation - 1984	1.79E-01	3.19E-01
23	Recruitment Deviation - 1985	2.18E-01	3.31E-01
24	Recruitment Deviation - 1986	7.98E-01	2.95E-01
25	Recruitment Deviation - 1987	1.15E+00	2.09E-01
26	Recruitment Deviation - 1988	1.12E-01	2.49E-01
27	Recruitment Deviation - 1989	4.39E-01	1.81E-01
28	Recruitment Deviation - 1990	3.15E-01	1.59E-01
29	Recruitment Deviation - 1991	4.06E-01	1.40E-01
30	Recruitment Deviation - 1992	1.32E-01	1.50E-01
31	Recruitment Deviation - 1993	-2.67E-01	1.60E-01
32	Recruitment Deviation - 1994	-1.50E-01	1.51E-01
33	Recruitment Deviation - 1995	-2.62E-01	1.59E-01
34	Recruitment Deviation - 1996	8.10E-02	1.43E-01
35	Recruitment Deviation - 1997	1.55E-01	1.40E-01
36	Recruitment Deviation - 1998	2.33E-02	1.44E-01
37	Recruitment Deviation - 1999	-3.24E-01	1.53E-01
38	Recruitment Deviation - 2000	5.44E-01	1.15E-01
39	Recruitment Deviation - 2001	4.23E-01	1.21E-01
40	Recruitment Deviation - 2002	9.07E-02	1.36E-01
41	Recruitment Deviation - 2003	3.69E-02	1.30E-01
42	Recruitment Deviation - 2004	1.66E-01	1.36E-01
43	Recruitment Deviation - 2005	-3.05E-02	1.45E-01
44	Recruitment Deviation - 2006	-7.88E-02	1.47E-01
45	Recruitment Deviation - 2007	4.60E-01	1.24E-01
46	Recruitment Deviation - 2008	2.77E-01	1.77E-01
47	Recruitment Deviation - 2009	-3.40E-01	3.10E-01
48	Recruitment Deviation - 2010	-1.20E-01	3.61E-01
49	Effort Deviation - CMHL_E -1981	-2.19E+00	1.87E-01
50	Effort Deviation - CMHL_E -1982	-1.55E+00	2.24E-01

Parameter Number	Description	Estimate	Std Dev
51	Effort Deviation - CMHL_E -1983	-1.05E+00	2.23E-01
52	Effort Deviation - CMHL_E -1984	-7.23E-01	2.20E-01
53	Effort Deviation - CMHL_E -1985	-4.62E-01	2.17E-01
54	Effort Deviation - CMHL_E -1986	-3.87E-01	2.17E-01
55	Effort Deviation - CMHL_E -1987	-5.84E-01	2.18E-01
56	Effort Deviation - CMHL_E -1988	-7.58E-01	2.19E-01
57	Effort Deviation - CMHL_E -1989	-7.29E-01	2.17E-01
58	Effort Deviation - CMHL_E -1990	1.28E-01	2.16E-01
59	Effort Deviation - CMHL_E -1991	-1.14E-01	2.17E-01
60	Effort Deviation - CMHL_E -1992	2.10E-01	2.17E-01
61	Effort Deviation - CMHL_E -1993	5.13E-01	2.15E-01
62	Effort Deviation - CMHL_E -1994	5.34E-01	2.13E-01
63	Effort Deviation - CMHL_E -1995	6.54E-01	2.13E-01
64	Effort Deviation - CMHL_E -1996	6.21E-01	2.16E-01
65	Effort Deviation - CMHL_E -1997	6.65E-01	2.17E-01
66	Effort Deviation - CMHL_E -1998	5.10E-01	2.16E-01
67	Effort Deviation - CMHL_E -1999	6.36E-01	2.15E-01
68	Effort Deviation - CMHL_E -2000	4.32E-01	2.15E-01
69	Effort Deviation - CMHL_E -2001	4.78E-01	2.13E-01
70	Effort Deviation - CMHL_E -2002	5.10E-01	2.13E-01
71	Effort Deviation - CMHL_E -2003	5.43E-01	2.12E-01
72	Effort Deviation - CMHL_E -2004	4.02E-01	2.13E-01
73	Effort Deviation - CMHL_E -2005	5.18E-01	2.15E-01
74	Effort Deviation - CMHL_E -2006	6.19E-01	2.15E-01
75	Effort Deviation - CMHL_E -2007	6.84E-01	2.15E-01
76	Effort Deviation - CMHL_E -2008	1.21E+00	2.21E-01
77	Effort Deviation - CMHL_E -2009	1.63E+00	2.26E-01
78	Effort Deviation - CMHL_E -2010	7.07E-01	2.22E-01
79	Effort Deviation - CMHL_W-1981	-2.71E+00	1.87E-01
80	Effort Deviation - CMHL_W-1982	-1.94E+00	2.25E-01
81	Effort Deviation - CMHL_W-1983	-1.71E+00	2.24E-01
82	Effort Deviation - CMHL_W-1984	-1.93E-01	2.21E-01
83	Effort Deviation - CMHL_W-1985	-1.76E-01	2.18E-01
84	Effort Deviation - CMHL_W-1986	1.57E-01	2.17E-01
85	Effort Deviation - CMHL_W-1987	2.36E-01	2.18E-01
86	Effort Deviation - CMHL_W-1988	1.89E-01	2.18E-01
87	Effort Deviation - CMHL_W-1989	4.35E-02	2.17E-01
88	Effort Deviation - CMHL_W-1990	-1.06E-01	2.17E-01
89	Effort Deviation - CMHL_W-1991	-1.71E-01	2.18E-01
90	Effort Deviation - CMHL_W-1992	1.54E-01	2.18E-01
91	Effort Deviation - CMHL_W-1993	2.28E-01	2.16E-01
92	Effort Deviation - CMHL_W-1994	2.67E-01	2.14E-01
93	Effort Deviation - CMHL_W-1995	1.92E-02	2.15E-01
94	Effort Deviation - CMHL_W-1996	1.90E-01	2.17E-01
95	Effort Deviation - CMHL_W-1997	8.24E-01	2.18E-01
96	Effort Deviation - CMHL_W-1998	7.80E-01	2.16E-01
97	Effort Deviation - CMHL_W-1999	9.91E-01	2.15E-01
98	Effort Deviation - CMHL_W-2000	6.89E-01	2.15E-01
99	Effort Deviation - CMHL_W-2001	8.12E-01	2.13E-01
100	Effort Deviation - CMHL_W-2002	8.20E-01	2.14E-01

Table 8.5 continued... SSASPM parameter estimates and standard deviation from the alternative run with eastern Gulf shrimp effort.

Parameter Number	Description	Estimate	Std Dev	Parameter	Description	Estimate	Std Dev
101	Effort Deviation - CMHL_W-2003	0.87718	0.2127	151	Effort Deviation - SHRIMP	0.14487	0.13503
102	Effort Deviation - CMHL_W-2004	0.82636	0.21255	152	Effort Deviation - SHRIMP	0.17341	0.13495
103	Effort Deviation - CMHL_W-2005	0.61591	0.21601	153	Effort Deviation - SHRIMP	0.31092	0.13567
104	Effort Deviation - CMHL_W-2006	0.32231	0.21588	154	Effort Deviation - SHRIMP	0.40364	0.13478
105	Effort Deviation - CMHL_W-2007	0.87207	0.21549	155	Effort Deviation - SHRIMP	0.47482	0.13418
106	Effort Deviation - CMHL_W-2008	0.87368	0.22158	156	Effort Deviation - SHRIMP	0.6403	0.11069
107	Effort Deviation - CMHL_W-2009	0.79995	0.22382	157	Effort Deviation - SHRIMP	0.29151	0.13307
108	Effort Deviation - CMHL_W-2010	0.42549	0.22051	158	Effort Deviation - SHRIMP	0.10751	0.12552
109	Effort Deviation - REC-1981	-1.3315	0.27685	159	Effort Deviation - SHRIMP	0.17084	0.12133
110	Effort Deviation - REC-1982	-0.43835	0.29946	160	Effort Deviation - SHRIMP	0.29365	0.12686
111	Effort Deviation - REC-1983	-1.1562	0.29804	161	Effort Deviation - SHRIMP	0.18439	0.11359
112	Effort Deviation - REC-1984	-0.89348	0.29598	162	Effort Deviation - SHRIMP	0.12441	0.14617
113	Effort Deviation - REC-1985	-0.574	0.29345	163	Effort Deviation - SHRIMP	-0.021512	0.13534
114	Effort Deviation - REC-1986	0.07413	0.29315	164	Effort Deviation - SHRIMP	-0.36099	0.12778
115	Effort Deviation - REC-1987	0.24458	0.29254	165	Effort Deviation - SHRIMP	-0.61722	0.13496
116	Effort Deviation - REC-1988	0.41952	0.2931	166	Effort Deviation - SHRIMP	-0.84507	0.14277
117	Effort Deviation - REC-1989	0.016071	0.28913	167	Effort Deviation - SHRIMP	-0.67967	0.15274
118	Effort Deviation - REC-1990	0.13329	0.28907	168	Effort Deviation - SHRIMP	-0.85064	0.15407
119	Effort Deviation - REC-1991	0.367	0.30462	169	Lifetime Reproductive Rate	18.822	9.131
120	Effort Deviation - REC-1992	0.63127	0.30778	170	r0	14280000	1079400
121	Effort Deviation - REC-1993	0.49497	0.29562	171	Bcurrent	1.0855E+14	1.4797E+13
122	Effort Deviation - REC-1994	0.21446	0.279	172	Fcurrent	0.23507	0.035724
123	Effort Deviation - REC-1995	0.3981	0.27832	173	Bvirgin	2.1875E+14	1.6535E+13
124	Effort Deviation - REC-1996	0.19678	0.29205	174	B - 1950	2.1875E+14	1.6534E+13
125	Effort Deviation - REC-1997	0.35805	0.30006	175	B - 1951	2.1849E+14	1.6515E+13
126	Effort Deviation - REC-1998	-0.069052	0.29338	176	B - 1952	2.1774E+14	1.6456E+13
127	Effort Deviation - REC-1999	0.08179	0.28907	177	B - 1953	2.1659E+14	1.6366E+13
128	Effort Deviation - REC-2000	-0.042845	0.28586	178	B - 1954	2.151E+14	1.6251E+13
129	Effort Deviation - REC-2001	0.21998	0.27435	179	B - 1955	2.1335E+14	1.6116E+13
130	Effort Deviation - REC-2002	0.15492	0.27846	180	B - 1956	2.1139E+14	1.5967E+13
131	Effort Deviation - REC-2003	0.16551	0.27735	181	B - 1957	2.0927E+14	1.5807E+13
132	Effort Deviation - REC-2004	0.31015	0.27512	182	B - 1958	2.0701E+14	1.564E+13
133	Effort Deviation - REC-2005	0.31114	0.28865	183	B - 1959	2.0466E+14	1.5467E+13
134	Effort Deviation - REC-2006	0.23608	0.28649	184	B - 1960	2.0224E+14	1.5292E+13
135	Effort Deviation - REC-2007	0.11234	0.28656	185	B - 1961	1.9977E+14	1.5117E+13
136	Effort Deviation - REC-2008	0.52448	0.32213	186	B - 1962	1.9727E+14	1.4941E+13
137	Effort Deviation - REC-2009	0.87578	0.36981	187	B - 1963	1.9475E+14	1.4768E+13
138	Effort Deviation - REC-2010	0.31396	0.31457	188	B - 1964	1.9221E+14	1.4597E+13
139	Effort Deviation - SHRIMP	-0.2006	0.11659	189	B - 1965	1.8968E+14	1.4429E+13
140	Effort Deviation - SHRIMP	0.013734	0.134	190	B - 1966	1.8716E+14	1.4265E+13
141	Effort Deviation - SHRIMP	0.12038	0.13479	191	B - 1967	1.8465E+14	1.4105E+13
142	Effort Deviation - SHRIMP	0.23324	0.13482	192	B - 1968	1.8217E+14	1.3949E+13
143	Effort Deviation - SHRIMP	0.22771	0.13477	193	B - 1969	1.797E+14	1.3798E+13
144	Effort Deviation - SHRIMP	0.21198	0.1342	194	B - 1970	1.7726E+14	1.3652E+13
145	Effort Deviation - SHRIMP	0.071902	0.13403	195	B - 1971	1.7485E+14	1.351E+13
146	Effort Deviation - SHRIMP	0.049287	0.13472	196	B - 1972	1.7246E+14	1.3373E+13
147	Effort Deviation - SHRIMP	0.14498	0.1343	197	B - 1973	1.7011E+14	1.324E+13
148	Effort Deviation - SHRIMP	0.092951	0.13467	198	B - 1974	1.6778E+14	1.3112E+13
149	Effort Deviation - SHRIMP	0.11466	0.13438	199	B - 1975	1.6549E+14	1.2988E+13
150	Effort Deviation - SHRIMP	0.22644	0.13457	200	B - 1976	1.6323E+14	1.2868E+13

Parameter Number	Description	Estimate	Std Dev	Parameter	Description	Estimate	Std Dev
101	Effort Deviation - CMHL_W-2003	8.77E-01	2.13E-01	151	Effort Deviation - SHRIMP	1.45E-01	1.35E-01
102	Effort Deviation - CMHL_W-2004	8.26E-01	2.13E-01	152	Effort Deviation - SHRIMP	1.73E-01	1.35E-01
103	Effort Deviation - CMHL_W-2005	6.16E-01	2.16E-01	153	Effort Deviation - SHRIMP	3.11E-01	1.36E-01
104	Effort Deviation - CMHL_W-2006	3.22E-01	2.16E-01	154	Effort Deviation - SHRIMP	4.04E-01	1.35E-01
105	Effort Deviation - CMHL_W-2007	8.72E-01	2.15E-01	155	Effort Deviation - SHRIMP	4.75E-01	1.34E-01
106	Effort Deviation - CMHL_W-2008	8.74E-01	2.22E-01	156	Effort Deviation - SHRIMP	6.40E-01	1.11E-01
107	Effort Deviation - CMHL_W-2009	8.00E-01	2.24E-01	157	Effort Deviation - SHRIMP	2.92E-01	1.33E-01
108	Effort Deviation - CMHL_W-2010	4.25E-01	2.21E-01	158	Effort Deviation - SHRIMP	1.08E-01	1.26E-01
109	Effort Deviation - REC-1981	-1.33E+00	2.77E-01	159	Effort Deviation - SHRIMP	1.71E-01	1.21E-01
110	Effort Deviation - REC-1982	-4.38E-01	2.99E-01	160	Effort Deviation - SHRIMP	2.94E-01	1.27E-01
111	Effort Deviation - REC-1983	-1.16E+00	2.98E-01	161	Effort Deviation - SHRIMP	1.84E-01	1.14E-01
112	Effort Deviation - REC-1984	-8.93E-01	2.96E-01	162	Effort Deviation - SHRIMP	1.24E-01	1.46E-01
113	Effort Deviation - REC-1985	-5.74E-01	2.93E-01	163	Effort Deviation - SHRIMP	-2.15E-02	1.35E-01
114	Effort Deviation - REC-1986	7.41E-02	2.93E-01	164	Effort Deviation - SHRIMP	-3.61E-01	1.28E-01
115	Effort Deviation - REC-1987	2.45E-01	2.93E-01	165	Effort Deviation - SHRIMP	-6.17E-01	1.35E-01
116	Effort Deviation - REC-1988	4.20E-01	2.93E-01	166	Effort Deviation - SHRIMP	-8.45E-01	1.43E-01
117	Effort Deviation - REC-1989	1.61E-02	2.89E-01	167	Effort Deviation - SHRIMP	-6.80E-01	1.53E-01
118	Effort Deviation - REC-1990	1.33E-01	2.89E-01	168	Effort Deviation - SHRIMP	-8.51E-01	1.54E-01
119	Effort Deviation - REC-1991	3.67E-01	3.05E-01	169	Lifetime Reproductive Rate	1.88E+01	9.13E+00
120	Effort Deviation - REC-1992	6.31E-01	3.08E-01	170	r0	1.43E+07	1.08E+06
121	Effort Deviation - REC-1993	4.95E-01	2.96E-01	171	Bcurrent	1.09E+14	1.48E+13
122	Effort Deviation - REC-1994	2.14E-01	2.79E-01	172	Fcurrent	2.35E-01	3.57E-02
123	Effort Deviation - REC-1995	3.98E-01	2.78E-01	173	Bvirgin	2.19E+14	1.65E+13
124	Effort Deviation - REC-1996	1.97E-01	2.92E-01	174	B - 1950	2.19E+14	1.65E+13
125	Effort Deviation - REC-1997	3.58E-01	3.00E-01	175	B - 1951	2.18E+14	1.65E+13
126	Effort Deviation - REC-1998	-6.91E-02	2.93E-01	176	B - 1952	2.18E+14	1.65E+13
127	Effort Deviation - REC-1999	8.18E-02	2.89E-01	177	B - 1953	2.17E+14	1.64E+13
128	Effort Deviation - REC-2000	-4.28E-02	2.86E-01	178	B - 1954	2.15E+14	1.63E+13
129	Effort Deviation - REC-2001	2.20E-01	2.74E-01	179	B - 1955	2.13E+14	1.61E+13
130	Effort Deviation - REC-2002	1.55E-01	2.78E-01	180	B - 1956	2.11E+14	1.60E+13
131	Effort Deviation - REC-2003	1.66E-01	2.77E-01	181	B - 1957	2.09E+14	1.58E+13
132	Effort Deviation - REC-2004	3.10E-01	2.75E-01	182	B - 1958	2.07E+14	1.56E+13
133	Effort Deviation - REC-2005	3.11E-01	2.89E-01	183	B - 1959	2.05E+14	1.55E+13
134	Effort Deviation - REC-2006	2.36E-01	2.86E-01	184	B - 1960	2.02E+14	1.53E+13
135	Effort Deviation - REC-2007	1.12E-01	2.87E-01	185	B - 1961	2.00E+14	1.51E+13
136	Effort Deviation - REC-2008	5.24E-01	3.22E-01	186	B - 1962	1.97E+14	1.49E+13
137	Effort Deviation - REC-2009	8.76E-01	3.70E-01	187	B - 1963	1.95E+14	1.48E+13
138	Effort Deviation - REC-2010	3.14E-01	3.15E-01	188	B - 1964	1.92E+14	1.46E+13
139	Effort Deviation - SHRIMP	-2.01E-01	1.17E-01	189	B - 1965	1.90E+14	1.44E+13
140	Effort Deviation - SHRIMP	1.37E-02	1.34E-01	190	B - 1966	1.87E+14	1.43E+13
141	Effort Deviation - SHRIMP	1.20E-01	1.35E-01	191	B - 1967	1.85E+14	1.41E+13
142	Effort Deviation - SHRIMP	2.33E-01	1.35E-01	192	B - 1968	1.82E+14	1.39E+13
143	Effort Deviation - SHRIMP	2.28E-01	1.35E-01	193	B - 1969	1.80E+14	1.38E+13
144	Effort Deviation - SHRIMP	2.12E-01	1.34E-01	194	B - 1970	1.77E+14	1.37E+13
145	Effort Deviation - SHRIMP	7.19E-02	1.34E-01	195	B - 1971	1.75E+14	1.35E+13
146	Effort Deviation - SHRIMP	4.93E-02	1.35E-01	196	B - 1972	1.72E+14	1.34E+13
147	Effort Deviation - SHRIMP	1.45E-01	1.34E-01	197	B - 1973	1.70E+14	1.32E+13
148	Effort Deviation - SHRIMP	9.30E-02	1.35E-01	198	B - 1974	1.68E+14	1.31E+13
149	Effort Deviation - SHRIMP	1.15E-01	1.34E-01	199	B - 1975	1.65E+14	1.30E+13
150	Effort Deviation - SHRIMP	2.26E-01	1.35E-01	200	B - 1976	1.63E+14	1.29E+13

Table 8.5 continued... SSASPM parameter estimates and standard deviation from the alternative run with eastern Gulf shrimp effort.

Parameter	Description	Estimate	Std Dev	Parameter	Description	Estimate	Std Dev
201	B - 1977	1.61E+14	1.28E+13	251	B1966 over B0	8.63E-01	1.47E-02
202	B - 1978	1.59E+14	1.26E+13	252	B1967 over B0	8.52E-01	1.58E-02
203	B - 1979	1.57E+14	1.25E+13	253	B1968 over B0	8.41E-01	1.69E-02
204	B - 1980	1.54E+14	1.24E+13	254	B1969 over B0	8.30E-01	1.79E-02
205	B - 1981	1.52E+14	1.52E+13	255	B1970 over B0	8.19E-01	1.89E-02
206	B - 1982	1.58E+14	1.45E+13	256	B1971 over B0	8.09E-01	1.99E-02
207	B - 1983	1.56E+14	1.29E+13	257	B1972 over B0	7.99E-01	2.09E-02
208	B - 1984	1.51E+14	1.26E+13	258	B1973 over B0	7.88E-01	2.18E-02
209	B - 1985	1.47E+14	1.36E+13	259	B1974 over B0	7.78E-01	2.27E-02
210	B - 1986	1.73E+14	1.97E+13	260	B1975 over B0	7.68E-01	2.36E-02
211	B - 1987	2.22E+14	1.67E+13	261	B1976 over B0	7.58E-01	2.45E-02
212	B - 1988	1.87E+14	1.22E+13	262	B1977 over B0	7.48E-01	2.53E-02
213	B - 1989	1.84E+14	1.14E+13	263	B1978 over B0	7.39E-01	2.61E-02
214	B - 1990	1.74E+14	1.03E+13	264	B1979 over B0	7.29E-01	2.69E-02
215	B - 1991	1.70E+14	9.63E+12	265	B1980 over B0	7.20E-01	2.76E-02
216	B - 1992	1.51E+14	8.34E+12	266	B1981 over B0	7.52E-01	6.04E-02
217	B - 1993	1.25E+14	6.96E+12	267	B1982 over B0	7.41E-01	6.01E-02
218	B - 1994	1.11E+14	6.23E+12	268	B1983 over B0	7.13E-01	5.85E-02
219	B - 1995	9.70E+13	5.48E+12	269	B1984 over B0	6.87E-01	5.86E-02
220	B - 1996	9.55E+13	5.40E+12	270	B1985 over B0	6.77E-01	6.08E-02
221	B - 1997	9.38E+13	5.34E+12	271	B1986 over B0	7.64E-01	7.53E-02
222	B - 1998	8.58E+13	4.95E+12	272	B1987 over B0	9.42E-01	8.28E-02
223	B - 1999	7.41E+13	4.51E+12	273	B1988 over B0	8.41E-01	6.78E-02
224	B - 2000	1.01E+14	6.05E+12	274	B1989 over B0	8.29E-01	6.56E-02
225	B - 2001	1.13E+14	6.37E+12	275	B1990 over B0	7.89E-01	6.15E-02
226	B - 2002	1.07E+14	5.99E+12	276	B1991 over B0	7.68E-01	5.92E-02
227	B - 2003	1.02E+14	5.84E+12	277	B1992 over B0	6.92E-01	5.28E-02
228	B - 2004	1.04E+14	6.19E+12	278	B1993 over B0	5.85E-01	4.46E-02
229	B - 2005	9.99E+13	5.73E+12	279	B1994 over B0	5.22E-01	4.03E-02
230	B - 2006	9.88E+13	5.76E+12	280	B1995 over B0	4.53E-01	3.49E-02
231	B - 2007	1.23E+14	7.35E+12	281	B1996 over B0	4.35E-01	3.38E-02
232	B - 2008	1.32E+14	9.34E+12	282	B1997 over B0	4.19E-01	3.26E-02
233	B - 2009	1.14E+14	1.07E+13	283	B1998 over B0	3.87E-01	3.03E-02
234	B - 2010	1.09E+14	1.48E+13	284	B1999 over B0	3.50E-01	2.77E-02
235	B1950 over B0	1.00E+00	8.08E-08	285	B2000 over B0	4.58E-01	3.68E-02
236	B1951 over B0	9.99E-01	1.26E-04	286	B2001 over B0	5.04E-01	3.95E-02
237	B1952 over B0	9.96E-01	4.99E-04	287	B2002 over B0	4.84E-01	3.74E-02
238	B1953 over B0	9.91E-01	1.07E-03	288	B2003 over B0	4.72E-01	3.67E-02
239	B1954 over B0	9.84E-01	1.80E-03	289	B2004 over B0	4.86E-01	3.87E-02
240	B1955 over B0	9.77E-01	2.65E-03	290	B2005 over B0	4.76E-01	3.78E-02
241	B1956 over B0	9.68E-01	3.60E-03	291	B2006 over B0	4.80E-01	3.86E-02
242	B1957 over B0	9.59E-01	4.62E-03	292	B2007 over B0	6.05E-01	5.02E-02
243	B1958 over B0	9.49E-01	5.69E-03	293	B2008 over B0	6.42E-01	5.76E-02
244	B1959 over B0	9.39E-01	6.79E-03	294	B2009 over B0	5.39E-01	5.47E-02
245	B1960 over B0	9.28E-01	7.92E-03	295	B2010 over B0	4.98E-01	6.30E-02
246	B1961 over B0	9.18E-01	9.06E-03	296	N2010 Age1	1.46E+07	3.94E+06
247	B1962 over B0	9.07E-01	1.02E-02	297	N2010 Age2	6.36E+06	1.85E+06
248	B1963 over B0	8.96E-01	1.14E-02	298	N2010 Age3	7.96E+06	1.32E+06
249	B1964 over B0	8.85E-01	1.25E-02	299	N2010 Age4	5.69E+06	6.39E+05
250	B1965 over B0	8.74E-01	1.36E-02	300	N2010 Age5	1.87E+06	2.64E+05

Table 8.5 continued... SSASPM parameter estimates and standard deviation from the alternative run with eastern Gulf shrimp effort.

Parameter	Description	Estimate	Std Dev
301	N2010 Age6	1.02E+06	1.56E+05
302	N2010 Age7	6.80E+05	1.13E+05
303	N2010 Age8	3.61E+05	6.50E+04
304	N2010 Age9	2.24E+05	4.24E+04
305	N2010 Age10	1.92E+05	3.70E+04
306	N2010 Age11	1.31E+05	2.66E+04
307	N2010 Age12	3.33E+04	7.80E+03
308	N2010 Age13	2.28E+04	5.41E+03
309	N2010 Age14	4.44E+04	1.09E+04
310	F2010 Age1	4.69E-01	9.99E-02
311	F2010 Age2	1.62E-01	2.98E-02
312	F2010 Age3	1.32E-01	1.67E-02
313	F2010 Age4	1.85E-01	2.45E-02
314	F2010 Age5	2.21E-01	3.21E-02
315	F2010 Age6	2.32E-01	3.46E-02
316	F2010 Age7	2.34E-01	3.51E-02
317	F2010 Age8	2.35E-01	3.52E-02
318	F2010 Age9	2.35E-01	3.52E-02
319	F2010 Age10	2.35E-01	3.52E-02
320	F2010 Age11	2.35E-01	3.52E-02
321	F2010 Age12	2.35E-01	3.52E-02
322	F2010 Age13	2.35E-01	3.52E-02
323	F2010 Age14	2.35E-01	3.52E-02

Table 8.6. Comparison of annual estimates of F, F/F_{MSY} and $F/F_{SPR30\%}$ for the continuity run, alternative run with Gulfwide shrimp effort (GW), and alternative run with eastern Gulf shrimp effort (E).

	Apical F			F/F_{MSY}			$F/F_{SPR30\%}$		
YEAR	Continuity	Alt Shrimp Eff GW	Alt Shrimp Eff E	Continuity	Alt Shrimp Eff GW	Alt Shrimp Eff E	Continuity	Alt Shrimp Eff GW	Alt Shrimp Eff E
1950	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1951	0.009	0.009	0.010	0.012	0.014	0.013	0.012	0.012	0.012
1952	0.019	0.019	0.020	0.024	0.027	0.026	0.025	0.025	0.023
1953	0.028	0.028	0.030	0.037	0.041	0.039	0.037	0.037	0.035
1954	0.037	0.038	0.040	0.049	0.054	0.053	0.049	0.049	0.047
1955	0.047	0.047	0.050	0.061	0.068	0.066	0.061	0.062	0.059
1956	0.056	0.056	0.060	0.073	0.081	0.079	0.074	0.074	0.070
1957	0.066	0.066	0.070	0.086	0.095	0.092	0.086	0.086	0.082
1958	0.075	0.075	0.080	0.098	0.108	0.105	0.098	0.099	0.094
1959	0.084	0.085	0.090	0.110	0.122	0.118	0.111	0.111	0.106
1960	0.094	0.094	0.100	0.122	0.136	0.132	0.123	0.123	0.117
1961	0.103	0.104	0.110	0.135	0.149	0.145	0.135	0.136	0.129
1962	0.113	0.113	0.120	0.147	0.163	0.158	0.147	0.148	0.141
1963	0.122	0.122	0.130	0.159	0.176	0.171	0.160	0.160	0.153
1964	0.131	0.132	0.140	0.171	0.190	0.185	0.172	0.173	0.165
1965	0.141	0.141	0.150	0.184	0.204	0.198	0.185	0.185	0.177
1966	0.150	0.151	0.160	0.196	0.217	0.211	0.197	0.198	0.188
1967	0.160	0.160	0.170	0.208	0.231	0.224	0.209	0.210	0.200
1968	0.169	0.170	0.180	0.221	0.245	0.238	0.222	0.223	0.212
1969	0.179	0.179	0.190	0.233	0.258	0.251	0.234	0.235	0.224
1970	0.188	0.189	0.200	0.245	0.272	0.264	0.246	0.247	0.236
1971	0.198	0.198	0.210	0.258	0.286	0.277	0.259	0.260	0.248
1972	0.207	0.208	0.220	0.270	0.300	0.291	0.271	0.272	0.260
1973	0.216	0.217	0.230	0.283	0.313	0.304	0.284	0.285	0.271
1974	0.226	0.227	0.241	0.295	0.327	0.317	0.296	0.297	0.283
1975	0.235	0.236	0.251	0.307	0.341	0.331	0.309	0.310	0.295
1976	0.245	0.246	0.261	0.320	0.354	0.344	0.321	0.322	0.307
1977	0.254	0.255	0.271	0.332	0.368	0.358	0.334	0.335	0.319
1978	0.264	0.265	0.281	0.345	0.382	0.371	0.346	0.347	0.331
1979	0.274	0.275	0.291	0.357	0.396	0.384	0.358	0.360	0.343
1980	0.283	0.284	0.301	0.369	0.409	0.398	0.371	0.372	0.355
1981	0.293	0.294	0.311	0.382	0.423	0.411	0.383	0.385	0.367
1982	0.393	0.363	0.387	0.513	0.523	0.511	0.515	0.475	0.456
1983	0.437	0.366	0.431	0.570	0.528	0.569	0.572	0.480	0.508
1984	0.440	0.411	0.484	0.575	0.592	0.638	0.577	0.539	0.569
1985	0.404	0.426	0.481	0.528	0.614	0.635	0.530	0.559	0.566
1986	0.330	0.485	0.474	0.431	0.699	0.625	0.433	0.636	0.558
1987	0.287	0.479	0.411	0.374	0.691	0.542	0.376	0.628	0.484
1988	0.342	0.472	0.402	0.446	0.680	0.530	0.448	0.619	0.473
1989	0.364	0.461	0.442	0.475	0.664	0.584	0.477	0.604	0.521
1990	0.386	0.454	0.420	0.503	0.654	0.554	0.505	0.595	0.494
1991	0.395	0.494	0.429	0.516	0.712	0.566	0.518	0.647	0.506
1992	0.448	0.528	0.481	0.585	0.761	0.635	0.587	0.692	0.566
1993	0.527	0.512	0.443	0.688	0.738	0.584	0.691	0.671	0.522
1994	0.562	0.462	0.456	0.734	0.665	0.601	0.737	0.605	0.537
1995	0.612	0.454	0.524	0.799	0.654	0.691	0.802	0.595	0.617
1996	0.575	0.470	0.576	0.751	0.678	0.760	0.754	0.616	0.678
1997	0.565	0.516	0.619	0.738	0.744	0.817	0.741	0.676	0.729
1998	0.598	0.525	0.732	0.781	0.756	0.967	0.784	0.688	0.863
1999	0.598	0.477	0.514	0.780	0.688	0.678	0.784	0.625	0.605
2000	0.432	0.448	0.426	0.564	0.646	0.563	0.566	0.587	0.502
2001	0.403	0.458	0.455	0.526	0.660	0.600	0.528	0.600	0.536
2002	0.453	0.506	0.515	0.591	0.730	0.680	0.594	0.663	0.606
2003	0.473	0.468	0.461	0.617	0.675	0.608	0.620	0.614	0.543
2004	0.458	0.431	0.434	0.597	0.622	0.573	0.600	0.565	0.511
2005	0.463	0.348	0.374	0.604	0.501	0.494	0.607	0.456	0.441
2006	0.433	0.266	0.266	0.566	0.383	0.351	0.568	0.349	0.313
2007	0.360	0.251	0.252	0.470	0.362	0.332	0.472	0.329	0.297
2008	0.363	0.344	0.345	0.473	0.496	0.456	0.475	0.451	0.407
2009	0.446	0.455	0.457	0.582	0.656	0.603	0.584	0.597	0.538
2010	0.469	0.235	0.235	0.612	0.338	0.310	0.615	0.307	0.277

Table 8.7. Comparison of annual estimates of SSB, SSB/SSB_{MSY} and $SSB/SSB_{SPR30\%}$ for the continuity run, alternative run with Gulfwide shrimp effort (GW), and alternative run with eastern Gulf shrimp effort (E).

	SSB			SSB/SSB_{MSY}			$SSB/SSB_{SPR30\%}$		
YEAR	Continuity	Alt Shrimp Eff GW	Alt Shrimp Eff E	Continuity	Alt Shrimp Eff GW	Alt Shrimp Eff E	Continuity	Alt Shrimp Eff GW	Alt Shrimp Eff E
1950	2.19E+14	2.15E+14	2.19E+14	3.126	2.947	2.941	3.113	3.199	3.232
1951	2.18E+14	2.15E+14	2.18E+14	3.123	2.944	2.938	3.109	3.195	3.228
1952	2.18E+14	2.14E+14	2.18E+14	3.113	2.934	2.928	3.099	3.184	3.217
1953	2.17E+14	2.13E+14	2.17E+14	3.097	2.919	2.912	3.083	3.168	3.200
1954	2.15E+14	2.12E+14	2.15E+14	3.077	2.900	2.892	3.063	3.148	3.178
1955	2.13E+14	2.10E+14	2.13E+14	3.053	2.878	2.869	3.040	3.123	3.152
1956	2.12E+14	2.08E+14	2.11E+14	3.027	2.853	2.842	3.013	3.096	3.123
1957	2.10E+14	2.06E+14	2.09E+14	2.998	2.825	2.814	2.985	3.066	3.092
1958	2.07E+14	2.04E+14	2.07E+14	2.967	2.796	2.783	2.954	3.035	3.058
1959	2.05E+14	2.02E+14	2.05E+14	2.935	2.766	2.752	2.922	3.002	3.024
1960	2.03E+14	2.00E+14	2.02E+14	2.902	2.735	2.719	2.890	2.968	2.988
1961	2.01E+14	1.97E+14	2.00E+14	2.869	2.703	2.686	2.856	2.933	2.951
1962	1.98E+14	1.95E+14	1.97E+14	2.835	2.670	2.652	2.822	2.898	2.914
1963	1.96E+14	1.93E+14	1.95E+14	2.800	2.638	2.618	2.788	2.863	2.877
1964	1.93E+14	1.90E+14	1.92E+14	2.766	2.605	2.584	2.754	2.827	2.840
1965	1.91E+14	1.88E+14	1.90E+14	2.732	2.572	2.550	2.719	2.792	2.802
1966	1.89E+14	1.85E+14	1.87E+14	2.697	2.540	2.516	2.685	2.756	2.765
1967	1.86E+14	1.83E+14	1.85E+14	2.663	2.507	2.483	2.651	2.721	2.728
1968	1.84E+14	1.81E+14	1.82E+14	2.629	2.475	2.449	2.617	2.686	2.691
1969	1.81E+14	1.78E+14	1.80E+14	2.596	2.443	2.416	2.584	2.651	2.655
1970	1.79E+14	1.76E+14	1.77E+14	2.562	2.411	2.383	2.551	2.617	2.619
1971	1.77E+14	1.74E+14	1.75E+14	2.529	2.380	2.351	2.518	2.582	2.583
1972	1.75E+14	1.72E+14	1.72E+14	2.497	2.349	2.319	2.485	2.549	2.548
1973	1.72E+14	1.69E+14	1.70E+14	2.464	2.318	2.287	2.453	2.515	2.513
1974	1.70E+14	1.67E+14	1.68E+14	2.432	2.288	2.256	2.422	2.483	2.479
1975	1.68E+14	1.65E+14	1.65E+14	2.401	2.258	2.225	2.390	2.450	2.445
1976	1.66E+14	1.63E+14	1.63E+14	2.370	2.228	2.195	2.359	2.418	2.412
1977	1.64E+14	1.61E+14	1.61E+14	2.339	2.199	2.165	2.329	2.387	2.378
1978	1.61E+14	1.59E+14	1.59E+14	2.309	2.170	2.135	2.299	2.355	2.346
1979	1.59E+14	1.56E+14	1.57E+14	2.279	2.142	2.106	2.269	2.325	2.314
1980	1.57E+14	1.54E+14	1.54E+14	2.250	2.114	2.077	2.240	2.294	2.282
1981	1.64E+14	1.52E+14	1.52E+14	2.351	2.075	2.048	2.341	2.252	2.251
1982	1.62E+14	1.56E+14	1.58E+14	2.317	2.135	2.124	2.307	2.317	2.333
1983	1.56E+14	1.54E+14	1.56E+14	2.229	2.106	2.102	2.219	2.286	2.310
1984	1.50E+14	1.50E+14	1.51E+14	2.149	2.048	2.035	2.140	2.223	2.236
1985	1.48E+14	1.46E+14	1.47E+14	2.118	2.004	1.975	2.109	2.175	2.170
1986	1.67E+14	1.75E+14	1.73E+14	2.388	2.395	2.332	2.378	2.599	2.562
1987	2.06E+14	2.31E+14	2.22E+14	2.946	3.158	2.986	2.933	3.427	3.281
1988	1.84E+14	1.89E+14	1.87E+14	2.628	2.591	2.510	2.617	2.812	2.758
1989	1.81E+14	1.85E+14	1.84E+14	2.591	2.538	2.473	2.579	2.755	2.718
1990	1.72E+14	1.76E+14	1.74E+14	2.466	2.411	2.337	2.455	2.616	2.568
1991	1.68E+14	1.73E+14	1.70E+14	2.401	2.367	2.280	2.390	2.569	2.506
1992	1.51E+14	1.53E+14	1.51E+14	2.165	2.098	2.030	2.155	2.276	2.231
1993	1.28E+14	1.26E+14	1.25E+14	1.828	1.724	1.676	1.820	1.871	1.842
1994	1.14E+14	1.10E+14	1.11E+14	1.633	1.512	1.492	1.626	1.641	1.639
1995	9.89E+13	9.52E+13	9.70E+13	1.415	1.304	1.304	1.409	1.415	1.433
1996	9.51E+13	9.24E+13	9.55E+13	1.359	1.265	1.284	1.353	1.373	1.411
1997	9.15E+13	8.97E+13	9.38E+13	1.309	1.229	1.261	1.303	1.333	1.386
1998	8.45E+13	8.21E+13	8.58E+13	1.209	1.124	1.154	1.204	1.219	1.268
1999	7.64E+13	7.39E+13	7.41E+13	1.093	1.012	0.996	1.089	1.099	1.095
2000	1.00E+14	1.02E+14	1.01E+14	1.431	1.393	1.356	1.424	1.512	1.491
2001	1.10E+14	1.13E+14	1.13E+14	1.575	1.547	1.517	1.568	1.679	1.667
2002	1.06E+14	1.07E+14	1.07E+14	1.512	1.461	1.434	1.505	1.585	1.576
2003	1.03E+14	1.02E+14	1.02E+14	1.475	1.399	1.371	1.468	1.518	1.506
2004	1.06E+14	1.04E+14	1.04E+14	1.519	1.422	1.400	1.513	1.543	1.538
2005	1.04E+14	9.94E+13	9.99E+13	1.488	1.361	1.343	1.482	1.477	1.476
2006	1.05E+14	9.90E+13	9.88E+13	1.500	1.355	1.328	1.493	1.471	1.460
2007	1.32E+14	1.24E+14	1.23E+14	1.890	1.699	1.658	1.882	1.844	1.822
2008	1.40E+14	1.33E+14	1.32E+14	2.008	1.818	1.775	1.999	1.973	1.951
2009	1.18E+14	1.14E+14	1.14E+14	1.685	1.555	1.528	1.677	1.688	1.679
2010	1.09E+14	1.08E+14	1.09E+14	1.556	1.477	1.459	1.549	1.603	1.604

Table 8.8. Comparison of annual estimates of recruitment (Age 1) for the continuity run, alternative run with Gulfwide shrimp effort (GW), and alternative run with eastern Gulf shrimp effort (E).

	Recruits (numbers)		
YEAR	Continuity	Alt Shrimp Eff GW	Alt Shrimp Eff E
1950	1.43E+07	1.41E+07	1.43E+07
1951	1.43E+07	1.41E+07	1.43E+07
1952	1.43E+07	1.41E+07	1.43E+07
1953	1.43E+07	1.40E+07	1.43E+07
1954	1.43E+07	1.40E+07	1.43E+07
1955	1.43E+07	1.40E+07	1.43E+07
1956	1.43E+07	1.40E+07	1.43E+07
1957	1.42E+07	1.40E+07	1.43E+07
1958	1.42E+07	1.40E+07	1.42E+07
1959	1.42E+07	1.40E+07	1.42E+07
1960	1.42E+07	1.40E+07	1.42E+07
1961	1.42E+07	1.40E+07	1.42E+07
1962	1.42E+07	1.40E+07	1.42E+07
1963	1.42E+07	1.40E+07	1.42E+07
1964	1.42E+07	1.40E+07	1.42E+07
1965	1.42E+07	1.39E+07	1.42E+07
1966	1.42E+07	1.39E+07	1.42E+07
1967	1.42E+07	1.39E+07	1.42E+07
1968	1.41E+07	1.39E+07	1.41E+07
1969	1.41E+07	1.39E+07	1.41E+07
1970	1.41E+07	1.39E+07	1.41E+07
1971	1.41E+07	1.39E+07	1.41E+07
1972	1.41E+07	1.39E+07	1.41E+07
1973	1.41E+07	1.39E+07	1.41E+07
1974	1.41E+07	1.38E+07	1.41E+07
1975	1.41E+07	1.38E+07	1.41E+07
1976	1.41E+07	1.38E+07	1.40E+07
1977	1.40E+07	1.38E+07	1.40E+07
1978	1.40E+07	1.38E+07	1.40E+07
1979	1.40E+07	1.38E+07	1.40E+07
1980	1.40E+07	1.38E+07	1.40E+07
1981	1.76E+07	1.34E+07	1.40E+07
1982	1.62E+07	1.70E+07	1.80E+07
1983	1.56E+07	1.60E+07	1.73E+07
1984	1.57E+07	1.56E+07	1.67E+07
1985	1.71E+07	1.66E+07	1.73E+07
1986	2.55E+07	3.14E+07	3.09E+07
1987	3.56E+07	4.95E+07	4.47E+07
1988	1.61E+07	1.69E+07	1.60E+07
1989	2.03E+07	2.27E+07	2.20E+07
1990	1.85E+07	2.05E+07	1.94E+07
1991	2.01E+07	2.29E+07	2.11E+07
1992	1.60E+07	1.71E+07	1.60E+07
1993	1.22E+07	1.14E+07	1.07E+07
1994	1.35E+07	1.16E+07	1.18E+07
1995	1.15E+07	9.47E+06	1.04E+07
1996	1.42E+07	1.26E+07	1.45E+07
1997	1.43E+07	1.33E+07	1.56E+07
1998	1.24E+07	1.11E+07	1.37E+07
1999	1.07E+07	9.23E+06	9.54E+06
2000	2.17E+07	2.28E+07	2.23E+07
2001	1.91E+07	2.06E+07	2.05E+07
2002	1.42E+07	1.48E+07	1.49E+07
2003	1.45E+07	1.41E+07	1.40E+07
2004	1.67E+07	1.57E+07	1.59E+07
2005	1.51E+07	1.28E+07	1.31E+07
2006	1.55E+07	1.24E+07	1.24E+07
2007	2.59E+07	2.16E+07	2.13E+07
2008	2.27E+07	1.84E+07	1.81E+07
2009	1.28E+07	9.78E+06	9.82E+06
2010	1.46E+07	1.20E+07	1.21E+07

Table 8.9. Required SFA and MSRA evaluations for the continuity run, alternative run with Gulfwide shrimp effort (GW), and alternative run with eastern Gulf shrimp effort (E). SSB measures are in eggs.

Criteria	Definition	Continuity Run	Alt Shrimp Eff GW	Alt Shrimp Eff E
Mortality Rate Criteria				
F_{MSY}	SEDAR 9 used $F_{SPR30\%}$ as proxy	0.76	0.76	0.85
MFMT (Amend 23)	$F_{SPR30\%}$	0.76	0.76	0.85
F_{OY} (Amend 23)	75% of $F_{SPR30\%}$	0.57	0.57	0.64
$F_{CURRENT}$	F_{2010}	0.47	0.24	0.24
$F_{CURRENT}$/MFMT	$F_{2010}/F_{SPR30\%}$	0.61	0.32	0.28
Base M	M = 0.25 all ages	0.25	0.25	0.25
Biomass Criteria				
SSB_{MSY}	Equil. egg production @ $F_{SPR30\%}$	7.02E+13	6.73E+13	6.77E+13
MSST	(I-M)*$SSB_{SPR30\%}$ where M=0.25	5.27E+13	5.05E+13	5.08E+13
$SSB_{CURRENT}$	SSB_{2010}	1.09E+14	1.08E+14	1.09E+14
$SSB_{CURRENT}/SSB_{MSY}$	$SSB_{2010}/SSB_{SPR30\%}$	1.55	1.60	1.61
$SSB_{CURRENT}$/MSST		2.07	2.14	2.15
Equilibrium MSY	Equilibrium Yield @ $F_{SPR30\%}$	7.37 mp (WW)	7.35 mp (WW)	7.42 mp (WW)
Equilibrium OY	Equilibrium Yield @ 75% of $F_{SPR30\%}$	7.19 mp (WW)	7.31 mp (WW)	7.40 mp (WW)
OFL (Total Removals)	Annual Yield @ MFMT			
	2012	10.43 mp	13.55 mp	14.21 mp
	2013	9.47 mp	10.84 mp	11.08 mp
	2014	8.82 mp	9.32 mp	9.39 mp
	2015	8.34 mp	8.40 mp	8.44 mp
	2016	8.00 mp	7.91 mp	7.94 mp
	2017	7.77 mp	7.65 mp	7.70 mp
Annual OY (Total Removals)	Annual Yield @ F_{OY}			
	2012	8.28 mp	10.84 mp	11.40 mp
	2013	7.95 mp	9.46 mp	9.75 mp
	2014	7.73 mp	8.63 mp	8.79 mp
	2015	7.57 mp	8.08 mp	8.19 mp
	2016	7.45 mp	7.75 mp	7.84 mp
	2017	7.37 mp	7.57 mp	7.65 mp

Table 9.1. Projected SSB (eggs) for alternative run with Gulfwide shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	8.60E+13	1.08E+14	1.40E+14	1.07E+14	2.11E+13
2013	7.08E+13	9.00E+13	1.20E+14	8.87E+13	2.06E+13
2014	6.18E+13	8.23E+13	1.09E+14	7.88E+13	1.86E+13
2015	5.84E+13	7.61E+13	1.05E+14	7.35E+13	2.03E+13
2016	5.55E+13	7.52E+13	1.05E+14	7.07E+13	1.98E+13
2017	5.28E+13	7.23E+13	9.99E+13	6.92E+13	1.92E+13

Table 9.2. Projected $SSB/SSB_{FSPR30\%}$ for alternative run with Gulfwide shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.277	1.607	2.076	1.587	0.313
2013	1.052	1.337	1.789	1.317	0.306
2014	0.918	1.223	1.623	1.171	0.276
2015	0.867	1.131	1.563	1.092	0.302
2016	0.825	1.117	1.566	1.050	0.294
2017	0.785	1.074	1.484	1.028	0.285

Table 9.3. Projected fishing mortality for alternative run with Gulfwide shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.763	0.763	0.763	0.763	0.000
2013	0.763	0.763	0.763	0.763	0.000
2014	0.763	0.763	0.763	0.763	0.000
2015	0.763	0.763	0.763	0.763	0.000
2016	0.763	0.763	0.763	0.763	0.000
2017	0.763	0.763	0.763	0.763	0.000

Table 9.4. Projected F/FSPR30% for alternative run with Gulfwide shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.000	1.000	1.000	1.000	0.000
2013	1.000	1.000	1.000	1.000	0.000
2014	1.000	1.000	1.000	1.000	0.000
2015	1.000	1.000	1.000	1.000	0.000
2016	1.000	1.000	1.000	1.000	0.000
2017	1.000	1.000	1.000	1.000	0.000

Table 9.5. Projected yield (total removals) in lbs for alternative run with Gulfwide shrimp effort.
PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.15E+07	1.37E+07	1.67E+07	1.36E+07	2.08E+06
2013	8.91E+06	1.10E+07	1.42E+07	1.08E+07	2.18E+06
2014	7.50E+06	9.72E+06	1.25E+07	9.32E+06	1.95E+06
2015	6.79E+06	8.67E+06	1.17E+07	8.40E+06	2.17E+06
2016	6.35E+06	8.44E+06	1.17E+07	7.91E+06	2.05E+06
2017	5.97E+06	7.94E+06	1.09E+07	7.65E+06	2.04E+06

Table 9.6. Projected recruitment (at age 1) in numbers for alternative run with Gulfwide shrimp effort.
PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	9.68E+06	1.61E+07	2.58E+07	1.60E+07	6.98E+06
2013	9.18E+06	1.56E+07	2.63E+07	1.58E+07	7.19E+06
2014	8.91E+06	1.58E+07	2.51E+07	1.54E+07	6.50E+06
2015	9.00E+06	1.52E+07	2.61E+07	1.51E+07	7.35E+06
2016	9.25E+06	1.51E+07	2.65E+07	1.49E+07	6.65E+06
2017	8.72E+06	1.44E+07	2.41E+07	1.47E+07	6.89E+06

Table 9.7. Projected SSB (eggs) for alternative run with eastern Gulf shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	8.64E+13	1.09E+14	1.42E+14	1.08E+14	2.15E+13
2013	7.06E+13	8.98E+13	1.21E+14	8.86E+13	2.09E+13
2014	6.09E+13	8.21E+13	1.09E+14	7.85E+13	1.89E+13
2015	5.80E+13	7.59E+13	1.06E+14	7.34E+13	2.07E+13
2016	5.52E+13	7.52E+13	1.06E+14	7.07E+13	2.01E+13
2017	5.27E+13	7.26E+13	1.00E+14	6.94E+13	1.95E+13

Table 9.8. Projected $SSB/SSB_{FSPR30\%}$ for alternative run with eastern Gulf shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.277	1.613	2.092	1.591	0.318
2013	1.043	1.327	1.791	1.308	0.309
2014	0.900	1.213	1.615	1.160	0.280
2015	0.857	1.121	1.560	1.084	0.305
2016	0.815	1.111	1.566	1.045	0.297
2017	0.779	1.072	1.482	1.025	0.287

Table 9.9. Projected fishing mortality for alternative run with eastern Gulf shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.849	0.849	0.849	0.849	0.000
2013	0.849	0.849	0.849	0.849	0.000
2014	0.849	0.849	0.849	0.849	0.000
2015	0.849	0.849	0.849	0.849	0.000
2016	0.849	0.849	0.849	0.849	0.000
2017	0.849	0.849	0.849	0.849	0.000

Table 9.10. Projected F/FSPR30% for alternative run with eastern Gulf shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.000	1.000	1.000	1.000	0.000
2013	1.000	1.000	1.000	1.000	0.000
2014	1.000	1.000	1.000	1.000	0.000
2015	1.000	1.000	1.000	1.000	0.000
2016	1.000	1.000	1.000	1.000	0.000
2017	1.000	1.000	1.000	1.000	0.000

Table 9.11. Projected yield (total removals) in lbs for alternative run with eastern Gulf shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.21E+07	1.44E+07	1.74E+07	1.42E+07	2.09E+06
2013	9.13E+06	1.12E+07	1.45E+07	1.11E+07	2.20E+06
2014	7.56E+06	9.81E+06	1.26E+07	9.39E+06	1.96E+06
2015	6.83E+06	8.70E+06	1.18E+07	8.44E+06	2.16E+06
2016	6.31E+06	8.43E+06	1.17E+07	7.94E+06	2.05E+06
2017	6.07E+06	8.00E+06	1.10E+07	7.70E+06	2.04E+06

Table 9.12. Projected recruitment (at age 1) in numbers for alternative run with eastern Gulf shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	9.74E+06	1.62E+07	2.59E+07	1.61E+07	7.02E+06
2013	9.23E+06	1.56E+07	2.65E+07	1.59E+07	7.23E+06
2014	8.94E+06	1.59E+07	2.52E+07	1.54E+07	6.52E+06
2015	9.02E+06	1.52E+07	2.62E+07	1.51E+07	7.38E+06
2016	9.27E+06	1.52E+07	2.65E+07	1.49E+07	6.68E+06
2017	8.72E+06	1.44E+07	2.42E+07	1.48E+07	6.92E+06

Table 9.13. Projected SSB (eggs) for alternative run with Gulfwide shrimp effort.

PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.13E+14	0.00E+00
2013	N/A	N/A	N/A	1.01E+14	0.00E+00
2014	N/A	N/A	N/A	9.45E+13	0.00E+00
2015	N/A	N/A	N/A	9.05E+13	0.00E+00
2016	N/A	N/A	N/A	8.82E+13	0.00E+00
2017	N/A	N/A	N/A	8.69E+13	0.00E+00

Table 9.14. Projected $SSB/SSB_{FSPR30\%}$ for alternative run with Gulfwide shrimp effort.

PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.675	0.000
2013	N/A	N/A	N/A	1.505	0.000
2014	N/A	N/A	N/A	1.404	0.000
2015	N/A	N/A	N/A	1.345	0.000
2016	N/A	N/A	N/A	1.310	0.000
2017	N/A	N/A	N/A	1.291	0.000

Table 9.15. Projected fishing mortality for alternative run with Gulfwide shrimp effort.

PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	0.572	0.000
2013	N/A	N/A	N/A	0.572	0.000
2014	N/A	N/A	N/A	0.572	0.000
2015	N/A	N/A	N/A	0.572	0.000
2016	N/A	N/A	N/A	0.572	0.000
2017	N/A	N/A	N/A	0.572	0.000

Table 9.16. Projected F/FSPR30% for alternative run with Gulfwide shrimp effort.

PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	0.750	0.000
2013	N/A	N/A	N/A	0.750	0.000
2014	N/A	N/A	N/A	0.750	0.000
2015	N/A	N/A	N/A	0.750	0.000
2016	N/A	N/A	N/A	0.750	0.000
2017	N/A	N/A	N/A	0.750	0.000

Table 9.17. Projected yield (total removals) in lbs for alternative run with Gulfwide shrimp effort.
PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.08E+07	0.00E+00
2013	N/A	N/A	N/A	9.46E+06	0.00E+00
2014	N/A	N/A	N/A	8.63E+06	0.00E+00
2015	N/A	N/A	N/A	8.08E+06	0.00E+00
2016	N/A	N/A	N/A	7.75E+06	0.00E+00
2017	N/A	N/A	N/A	7.57E+06	0.00E+00

Table 9.18. Projected recruitment (at age 1) in numbers for alternative run with Gulfwide shrimp effort.
PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.60E+07	0.00E+00
2013	N/A	N/A	N/A	1.59E+07	0.00E+00
2014	N/A	N/A	N/A	1.57E+07	0.00E+00
2015	N/A	N/A	N/A	1.55E+07	0.00E+00
2016	N/A	N/A	N/A	1.54E+07	0.00E+00
2017	N/A	N/A	N/A	1.54E+07	0.00E+00

Table 9.19. Projected SSB (eggs) for alternative run with eastern Gulf shrimp effort.
PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.14E+14	0.00E+00
2013	N/A	N/A	N/A	1.01E+14	0.00E+00
2014	N/A	N/A	N/A	9.42E+13	0.00E+00
2015	N/A	N/A	N/A	9.01E+13	0.00E+00
2016	N/A	N/A	N/A	8.78E+13	0.00E+00
2017	N/A	N/A	N/A	8.66E+13	0.00E+00

Table 9.20. Projected $SSB/SSB_{FSPR30\%}$ for alternative run with eastern Gulf shrimp effort
PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.681	0.000
2013	N/A	N/A	N/A	1.498	0.000
2014	N/A	N/A	N/A	1.391	0.000
2015	N/A	N/A	N/A	1.331	0.000
2016	N/A	N/A	N/A	1.297	0.000
2017	N/A	N/A	N/A	1.279	0.000

Table 9.21. Projected fishing mortality for alternative run with eastern Gulf shrimp effort.
PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	0.637	0.000
2013	N/A	N/A	N/A	0.637	0.000
2014	N/A	N/A	N/A	0.637	0.000
2015	N/A	N/A	N/A	0.637	0.000
2016	N/A	N/A	N/A	0.637	0.000
2017	N/A	N/A	N/A	0.637	0.000

Table 9.22. Projected F/FSPR30% for alternative run with eastern Gulf shrimp effort.
PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	0.750	0.000
2013	N/A	N/A	N/A	0.750	0.000
2014	N/A	N/A	N/A	0.750	0.000
2015	N/A	N/A	N/A	0.750	0.000
2016	N/A	N/A	N/A	0.750	0.000
2017	N/A	N/A	N/A	0.750	0.000

Table 9.23. Projected yield (total removals) in lbs for alternative run with eastern Gulf shrimp effort.
PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.14E+07	0.00E+00
2013	N/A	N/A	N/A	9.75E+06	0.00E+00
2014	N/A	N/A	N/A	8.79E+06	0.00E+00
2015	N/A	N/A	N/A	8.19E+06	0.00E+00
2016	N/A	N/A	N/A	7.84E+06	0.00E+00
2017	N/A	N/A	N/A	7.65E+06	0.00E+00

Table 9.24. Projected recruitment (at age 1) in numbers for alternative run with eastern Gulf shrimp effort.
PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.61E+07	0.00E+00
2013	N/A	N/A	N/A	1.60E+07	0.00E+00
2014	N/A	N/A	N/A	1.58E+07	0.00E+00
2015	N/A	N/A	N/A	1.56E+07	0.00E+00
2016	N/A	N/A	N/A	1.55E+07	0.00E+00
2017	N/A	N/A	N/A	1.54E+07	0.00E+00

Table 9.25. Projected SSB (eggs) for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.00E+14	1.25E+14	1.61E+14	1.24E+14	2.42E+13
2013	1.06E+14	1.31E+14	1.72E+14	1.30E+14	2.72E+13
2014	1.08E+14	1.40E+14	1.77E+14	1.34E+14	2.71E+13
2015	1.13E+14	1.42E+14	1.85E+14	1.37E+14	3.00E+13
2016	1.16E+14	1.47E+14	1.93E+14	1.39E+14	3.04E+13
2017	1.17E+14	1.48E+14	1.91E+14	1.40E+14	2.99E+13

Table 9.26. Projected $SSB/SSB_{FSPR30\%}$ for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.490	1.863	2.393	1.842	0.359
2013	1.573	1.952	2.557	1.924	0.405
2014	1.609	2.079	2.627	1.987	0.403
2015	1.685	2.114	2.743	2.031	0.445
2016	1.716	2.182	2.863	2.062	0.451
2017	1.734	2.194	2.844	2.083	0.445

Table 9.27. Projected fishing mortality for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.235	0.235	0.235	0.235	0.000
2013	0.235	0.235	0.235	0.235	0.000
2014	0.235	0.235	0.235	0.235	0.000
2015	0.235	0.235	0.235	0.235	0.000
2016	0.235	0.235	0.235	0.235	0.000
2017	0.235	0.235	0.235	0.235	0.000

Table 9.28. Projected F/FSPR30% for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.307	0.307	0.307	0.307	0.012
2013	0.307	0.307	0.307	0.307	0.012
2014	0.307	0.307	0.307	0.307	0.012
2015	0.307	0.307	0.307	0.307	0.012
2016	0.307	0.307	0.307	0.307	0.012
2017	0.307	0.307	0.307	0.307	0.012

Table 9.29. Projected yield (total removals) in lbs for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	4.24E+06	5.06E+06	6.15E+06	5.00E+06	7.59E+05
2013	4.35E+06	5.23E+06	6.49E+06	5.15E+06	8.76E+05
2014	4.49E+06	5.57E+06	6.74E+06	5.35E+06	8.90E+05
2015	4.66E+06	5.73E+06	7.21E+06	5.53E+06	1.04E+06
2016	4.82E+06	5.97E+06	7.54E+06	5.67E+06	1.05E+06
2017	4.88E+06	6.04E+06	7.60E+06	5.77E+06	1.09E+06

Table 9.30. Projected recruitment (at age 1) in numbers for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	9.68E+06	1.61E+07	2.58E+07	1.60E+07	6.98E+06
2013	9.37E+06	1.59E+07	2.68E+07	1.61E+07	7.32E+06
2014	9.47E+06	1.66E+07	2.63E+07	1.62E+07	6.84E+06
2015	9.69E+06	1.66E+07	2.80E+07	1.63E+07	7.84E+06
2016	1.02E+07	1.66E+07	2.85E+07	1.63E+07	7.21E+06
2017	9.62E+06	1.58E+07	2.65E+07	1.63E+07	7.60E+06

Table 9.31. Projected SSB (eggs) for alternative run with eastern Gulf shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.02E+14	1.28E+14	1.65E+14	1.27E+14	2.47E+13
2013	1.08E+14	1.35E+14	1.77E+14	1.33E+14	2.79E+13
2014	1.11E+14	1.44E+14	1.82E+14	1.37E+14	2.79E+13
2015	1.17E+14	1.47E+14	1.90E+14	1.41E+14	3.08E+13
2016	1.19E+14	1.51E+14	1.98E+14	1.43E+14	3.12E+13
2017	1.21E+14	1.52E+14	1.98E+14	1.45E+14	3.08E+13

Table 9.32. Projected $SSB/SSB_{FSPR30\%}$ for alternative run with eastern Gulf shrimp effort

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.511	1.892	2.432	1.869	0.365
2013	1.601	1.990	2.608	1.960	0.413
2014	1.646	2.125	2.681	2.030	0.412
2015	1.729	2.167	2.810	2.080	0.454
2016	1.762	2.237	2.931	2.114	0.462
2017	1.782	2.250	2.918	2.138	0.455

Table 9.33. Projected fishing mortality for alternative run with eastern Gulf shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.235	0.235	0.235	0.235	0.000
2013	0.235	0.235	0.235	0.235	0.000
2014	0.235	0.235	0.235	0.235	0.000
2015	0.235	0.235	0.235	0.235	0.000
2016	0.235	0.235	0.235	0.235	0.000
2017	0.235	0.235	0.235	0.235	0.000

Table 9.34. Projected F/FSPR30% for alternative run with eastern Gulf shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.277	0.277	0.277	0.277	0.011
2013	0.277	0.277	0.277	0.277	0.011
2014	0.277	0.277	0.277	0.277	0.011
2015	0.277	0.277	0.277	0.277	0.011
2016	0.277	0.277	0.277	0.277	0.011
2017	0.277	0.277	0.277	0.277	0.011

Table 9.35. Projected yield (total removals) in lbs for alternative run with eastern Gulf shrimp effort.
PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	4.11E+06	4.87E+06	5.89E+06	4.82E+06	6.90E+05
2013	4.26E+06	5.06E+06	6.26E+06	5.00E+06	8.15E+05
2014	4.41E+06	5.42E+06	6.57E+06	5.22E+06	8.46E+05
2015	4.59E+06	5.67E+06	7.02E+06	5.43E+06	9.94E+05
2016	4.75E+06	5.85E+06	7.40E+06	5.58E+06	1.01E+06
2017	4.84E+06	5.94E+06	7.53E+06	5.70E+06	1.05E+06

Table 9.36. Projected recruitment (at age 1) in numbers for alternative run with eastern Gulf shrimp effort.
PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	9.74E+06	1.62E+07	2.59E+07	1.61E+07	7.02E+06
2013	9.43E+06	1.60E+07	2.70E+07	1.62E+07	7.37E+06
2014	9.54E+06	1.67E+07	2.65E+07	1.63E+07	6.89E+06
2015	9.77E+06	1.67E+07	2.82E+07	1.64E+07	7.89E+06
2016	1.03E+07	1.68E+07	2.87E+07	1.64E+07	7.26E+06
2017	9.69E+06	1.60E+07	2.67E+07	1.65E+07	7.65E+06

Table 9.37. Projected SSB (eggs) for alternative run with Gulfwide shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	8.97E+13	1.18E+14	1.59E+14	1.17E+14	2.70E+13
2013	9.18E+13	1.21E+14	1.68E+14	1.19E+14	3.16E+13
2014	8.90E+13	1.28E+14	1.70E+14	1.20E+14	3.27E+13
2015	9.15E+13	1.31E+14	1.80E+14	1.22E+14	3.67E+13
2016	9.33E+13	1.34E+14	1.89E+14	1.23E+14	3.85E+13
2017	9.30E+13	1.34E+14	1.94E+14	1.24E+14	3.93E+13

Table 9.38. Projected $SSB/SSB_{FSPR30\%}$ for alternative run with Gulfwide shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.333	1.760	2.364	1.735	0.402
2013	1.364	1.796	2.494	1.764	0.469
2014	1.323	1.899	2.523	1.787	0.486
2015	1.360	1.941	2.680	1.808	0.545
2016	1.387	1.993	2.802	1.826	0.572
2017	1.382	1.995	2.881	1.844	0.583

Table 9.39. Projected fishing mortality for alternative run with Gulfwide shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.245	0.312	0.392	0.317	0.057
2013	0.235	0.312	0.404	0.319	0.069
2014	0.225	0.300	0.419	0.316	0.079
2015	0.210	0.292	0.420	0.311	0.090
2016	0.196	0.281	0.414	0.306	0.092
2017	0.193	0.274	0.412	0.302	0.100

Table 9.40. Projected F/FSPR30% for alternative run with Gulfwide shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.321	0.409	0.475	0.415	0.074
2013	0.308	0.409	0.529	0.418	0.090
2014	0.295	0.393	0.548	0.413	0.103
2015	0.275	0.383	0.548	0.407	0.118
2016	0.258	0.368	0.541	0.401	0.120
2017	0.254	0.360	0.538	0.396	0.132

Table 9.41. Projected yield (total removals) in lbs for alternative run with Gulfwide shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	6.30E+06	6.30E+06	6.30E+06	6.30E+06	0.00E+00
2013	6.30E+06	6.30E+06	6.30E+06	6.30E+06	0.00E+00
2014	6.30E+06	6.30E+06	6.30E+06	6.30E+06	0.00E+00
2015	6.30E+06	6.30E+06	6.30E+06	6.30E+06	0.00E+00
2016	6.30E+06	6.30E+06	6.30E+06	6.30E+06	0.00E+00
2017	6.30E+06	6.30E+06	6.30E+06	6.30E+06	0.00E+00

Table 9.42. Projected recruitment (at age 1) in numbers for alternative run with Gulfwide shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	9.64E+06	1.61E+07	2.58E+07	1.60E+07	6.96E+06
2013	9.31E+06	1.57E+07	2.65E+07	1.60E+07	7.28E+06
2014	9.36E+06	1.64E+07	2.61E+07	1.60E+07	6.76E+06
2015	9.60E+06	1.63E+07	2.78E+07	1.61E+07	7.76E+06
2016	9.99E+06	1.64E+07	2.82E+07	1.61E+07	7.13E+06
2017	9.45E+06	1.56E+07	2.61E+07	1.61E+07	7.52E+06

Table 9.43. Projected SSB (eggs) for alternative run with eastern Gulf shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	9.18E+13	1.21E+14	1.61E+14	1.19E+14	2.73E+13
2013	9.45E+13	1.24E+14	1.71E+14	1.22E+14	3.18E+13
2014	9.22E+13	1.31E+14	1.74E+14	1.24E+14	3.29E+13
2015	9.51E+13	1.35E+14	1.84E+14	1.26E+14	3.69E+13
2016	9.75E+13	1.38E+14	1.93E+14	1.27E+14	3.87E+13
2017	9.75E+13	1.39E+14	1.99E+14	1.29E+14	3.94E+13

Table 9.44. Projected $SSB/SSB_{FSPR30\%}$ for alternative run with eastern Gulf shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.357	1.783	2.384	1.760	0.403
2013	1.396	1.830	2.528	1.796	0.470
2014	1.362	1.937	2.568	1.828	0.487
2015	1.405	1.987	2.724	1.856	0.545
2016	1.441	2.045	2.856	1.881	0.571
2017	1.440	2.055	2.940	1.903	0.582

Table 9.45. Projected fishing mortality for alternative run with eastern Gulf shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.254	0.321	0.400	0.325	0.056
2013	0.241	0.318	0.412	0.326	0.069
2014	0.227	0.304	0.423	0.320	0.078
2015	0.210	0.294	0.425	0.313	0.088
2016	0.200	0.283	0.410	0.307	0.090
2017	0.193	0.273	0.409	0.302	0.097

Table 9.46. Projected F/FSPR30% for alternative run with eastern Gulf shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.299	0.378	0.433	0.383	0.066
2013	0.284	0.375	0.484	0.383	0.081
2014	0.268	0.358	0.498	0.377	0.092
2015	0.250	0.346	0.489	0.369	0.104
2016	0.236	0.333	0.483	0.361	0.106
2017	0.228	0.322	0.480	0.355	0.114

Table 9.47. Projected yield (total removals) in lbs for alternative run with eastern Gulf shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	6.18E+06	6.18E+06	6.18E+06	6.18E+06	0.00E+00
2013	6.18E+06	6.18E+06	6.18E+06	6.18E+06	0.00E+00
2014	6.18E+06	6.18E+06	6.18E+06	6.18E+06	0.00E+00
2015	6.18E+06	6.18E+06	6.18E+06	6.18E+06	0.00E+00
2016	6.18E+06	6.18E+06	6.18E+06	6.18E+06	0.00E+00
2017	6.18E+06	6.18E+06	6.18E+06	6.18E+06	0.00E+00

Table 9.48. Projected recruitment (at age 1) in numbers for alternative run with eastern Gulf shrimp effort.

PROJECT RECENT YIELD

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	9.70E+06	1.62E+07	2.59E+07	1.61E+07	7.00E+06
2013	9.37E+06	1.59E+07	2.67E+07	1.61E+07	7.33E+06
2014	9.44E+06	1.66E+07	2.63E+07	1.62E+07	6.81E+06
2015	9.67E+06	1.64E+07	2.80E+07	1.62E+07	7.82E+06
2016	1.01E+07	1.65E+07	2.84E+07	1.62E+07	7.19E+06
2017	9.54E+06	1.57E+07	2.63E+07	1.63E+07	7.58E+06

Table 9.49. Probability density functions for OFL in 2012-2017 for alternative run with Gulfwide shrimp effort.

	Probability of Exceeding OFL					
YIELD (mp)	2012	2013	2014	2015	2016	2017
3,000,000	0.0%	0.0%	0.1%	0.6%	0.8%	1.1%
3,100,000	0.0%	0.0%	0.1%	0.7%	0.9%	1.3%
3,200,000	0.0%	0.0%	0.1%	0.8%	1.1%	1.5%
3,300,000	0.0%	0.0%	0.1%	0.9%	1.2%	1.7%
3,400,000	0.0%	0.0%	0.1%	1.1%	1.4%	1.9%
3,500,000	0.0%	0.0%	0.1%	1.2%	1.6%	2.1%
3,600,000	0.0%	0.0%	0.2%	1.3%	1.8%	2.4%
3,700,000	0.0%	0.1%	0.2%	1.5%	2.0%	2.7%
3,800,000	0.0%	0.1%	0.2%	1.7%	2.2%	3.0%
3,900,000	0.0%	0.1%	0.3%	1.9%	2.5%	3.3%
4,000,000	0.0%	0.1%	0.3%	2.1%	2.8%	3.7%
4,100,000	0.0%	0.1%	0.4%	2.4%	3.2%	4.1%
4,200,000	0.0%	0.1%	0.4%	2.6%	3.5%	4.6%
4,300,000	0.0%	0.1%	0.5%	2.9%	3.9%	5.0%
4,400,000	0.0%	0.2%	0.6%	3.2%	4.3%	5.6%
4,500,000	0.0%	0.2%	0.7%	3.6%	4.8%	6.1%
4,600,000	0.0%	0.2%	0.8%	4.0%	5.3%	6.8%
4,700,000	0.0%	0.2%	0.9%	4.4%	5.9%	7.4%
4,800,000	0.0%	0.3%	1.0%	4.8%	6.5%	8.1%
4,900,000	0.0%	0.3%	1.2%	5.3%	7.1%	8.9%
5,000,000	0.0%	0.4%	1.4%	5.8%	7.8%	9.7%
5,100,000	0.0%	0.4%	1.5%	6.4%	8.5%	10.6%
5,200,000	0.0%	0.5%	1.8%	7.0%	9.3%	11.5%
5,300,000	0.0%	0.6%	2.0%	7.6%	10.2%	12.5%
5,400,000	0.0%	0.6%	2.3%	8.3%	11.0%	13.5%
5,500,000	0.0%	0.7%	2.5%	9.0%	12.0%	14.6%
5,600,000	0.0%	0.8%	2.9%	9.8%	13.0%	15.8%
5,700,000	0.0%	0.9%	3.2%	10.6%	14.1%	17.0%
5,800,000	0.0%	1.0%	3.6%	11.5%	15.2%	18.2%
5,900,000	0.0%	1.2%	4.0%	12.4%	16.4%	19.6%
6,000,000	0.0%	1.3%	4.5%	13.4%	17.6%	20.9%
6,100,000	0.0%	1.5%	5.0%	14.4%	18.9%	22.4%
6,200,000	0.0%	1.7%	5.5%	15.5%	20.2%	23.9%
6,300,000	0.0%	1.9%	6.1%	16.6%	21.6%	25.4%
6,400,000	0.0%	2.1%	6.8%	17.8%	23.1%	27.0%
6,500,000	0.0%	2.3%	7.5%	19.0%	24.6%	28.6%
6,600,000	0.0%	2.6%	8.2%	20.3%	26.2%	30.3%
6,700,000	0.0%	2.9%	9.0%	21.6%	27.8%	32.1%
6,800,000	0.1%	3.2%	9.9%	23.0%	29.4%	33.8%
6,900,000	0.1%	3.5%	10.8%	24.4%	31.1%	35.6%
7,000,000	0.1%	3.9%	11.8%	25.9%	32.9%	37.5%

Table 9.49 continued... Probability density functions for OFL in 2012-2017 for alternative run with Gulfwide shrimp effort.

	Probability of Exceeding OFL					
YIELD (mp)	2012	2013	2014	2015	2016	2017
7,100,000	0.1%	4.3%	12.8%	27.4%	34.7%	39.3%
7,200,000	0.1%	4.7%	13.9%	29.0%	36.5%	41.2%
7,300,000	0.1%	5.2%	15.1%	30.6%	38.3%	43.1%
7,400,000	0.2%	5.7%	16.3%	32.2%	40.2%	45.1%
7,500,000	0.2%	6.3%	17.6%	33.9%	42.1%	47.0%
7,600,000	0.2%	6.9%	19.0%	35.6%	44.0%	49.0%
7,700,000	0.2%	7.5%	20.4%	37.3%	46.0%	50.9%
7,800,000	0.3%	8.2%	21.9%	39.1%	47.9%	52.9%
7,900,000	0.3%	8.9%	23.4%	40.8%	49.8%	54.8%
8,000,000	0.4%	9.6%	25.0%	42.6%	51.8%	56.7%
8,100,000	0.4%	10.4%	26.7%	44.4%	53.7%	58.7%
8,200,000	0.5%	11.3%	28.4%	46.3%	55.7%	60.6%
8,300,000	0.6%	12.2%	30.2%	48.1%	57.6%	62.4%
8,400,000	0.7%	13.1%	32.0%	49.9%	59.5%	64.3%
8,500,000	0.7%	14.2%	33.8%	51.8%	61.4%	66.1%
8,600,000	0.9%	15.2%	35.7%	53.6%	63.2%	67.8%
8,700,000	1.0%	16.3%	37.6%	55.4%	65.0%	69.6%
8,800,000	1.1%	17.5%	39.6%	57.3%	66.8%	71.3%
8,900,000	1.3%	18.7%	41.6%	59.1%	68.6%	72.9%
9,000,000	1.4%	19.9%	43.6%	60.8%	70.3%	74.5%
9,100,000	1.6%	21.2%	45.6%	62.6%	72.0%	76.1%
9,200,000	1.8%	22.6%	47.6%	64.3%	73.6%	77.5%
9,300,000	2.0%	24.0%	49.7%	66.0%	75.2%	79.0%
9,400,000	2.3%	25.4%	51.7%	67.7%	76.7%	80.4%
9,500,000	2.6%	26.9%	53.8%	69.3%	78.1%	81.7%
9,600,000	2.9%	28.5%	55.8%	70.9%	79.6%	83.0%
9,700,000	3.2%	30.0%	57.8%	72.5%	80.9%	84.2%
9,800,000	3.5%	31.7%	59.8%	74.0%	82.2%	85.3%
9,900,000	3.9%	33.3%	61.7%	75.5%	83.5%	86.4%
10,000,000	4.4%	35.0%	63.7%	76.9%	84.6%	87.5%
10,100,000	4.8%	36.7%	65.6%	78.3%	85.8%	88.4%
10,200,000	5.3%	38.5%	67.4%	79.6%	86.8%	89.4%
10,300,000	5.9%	40.2%	69.3%	80.9%	87.8%	90.2%
10,400,000	6.5%	42.0%	71.0%	82.1%	88.8%	91.1%
10,500,000	7.1%	43.8%	72.8%	83.3%	89.7%	91.8%
10,600,000	7.8%	45.6%	74.4%	84.4%	90.6%	92.5%
10,700,000	8.5%	47.4%	76.1%	85.5%	91.4%	93.2%
10,800,000	9.3%	49.3%	77.6%	86.5%	92.1%	93.8%
10,900,000	10.1%	51.1%	79.1%	87.5%	92.8%	94.4%
11,000,000	11.0%	52.9%	80.6%	88.4%	93.4%	94.9%

Table 9.49 continued... Probability density functions for OFL in 2012-2017 for alternative run with Gulfwide shrimp effort.

	Probability of Exceeding OFL					
YIELD (mp)	2012	2013	2014	2015	2016	2017
11,100,000	11.9%	54.7%	81.9%	89.3%	94.0%	95.4%
11,200,000	12.9%	56.6%	83.2%	90.1%	94.6%	95.9%
11,300,000	13.9%	58.4%	84.5%	90.9%	95.1%	96.3%
11,400,000	15.0%	60.1%	85.7%	91.6%	95.6%	96.7%
11,500,000	16.2%	61.9%	86.8%	92.3%	96.0%	97.0%
11,600,000	17.4%	63.6%	87.9%	93.0%	96.4%	97.3%
11,700,000	18.6%	65.3%	88.9%	93.6%	96.8%	97.6%
11,800,000	20.0%	67.0%	89.8%	94.1%	97.1%	97.9%
11,900,000	21.3%	68.7%	90.7%	94.7%	97.4%	98.1%
12,000,000	22.8%	70.3%	91.5%	95.1%	97.7%	98.3%
12,100,000	24.2%	71.8%	92.3%	95.6%	98.0%	98.5%
12,200,000	25.8%	73.4%	93.0%	96.0%	98.2%	98.7%
12,300,000	27.4%	74.9%	93.7%	96.4%	98.4%	98.9%
12,400,000	29.0%	76.3%	94.3%	96.7%	98.6%	99.0%
12,500,000	30.7%	77.7%	94.8%	97.1%	98.7%	99.1%
12,600,000	32.4%	79.0%	95.4%	97.3%	98.9%	99.2%
12,700,000	34.1%	80.3%	95.8%	97.6%	99.0%	99.3%
12,800,000	35.9%	81.6%	96.3%	97.9%	99.2%	99.4%
12,900,000	37.7%	82.8%	96.7%	98.1%	99.3%	99.5%
13,000,000	39.6%	83.9%	97.0%	98.3%	99.4%	99.6%
13,100,000	41.4%	85.0%	97.4%	98.5%	99.4%	99.6%
13,200,000	43.3%	86.1%	97.7%	98.6%	99.5%	99.7%
13,300,000	45.2%	87.0%	97.9%	98.8%	99.6%	99.7%
13,400,000	47.1%	88.0%	98.2%	98.9%	99.6%	99.8%
13,500,000	49.0%	88.9%	98.4%	99.1%	99.7%	99.8%
13,600,000	51.0%	89.7%	98.6%	99.2%	99.7%	99.8%
13,700,000	52.9%	90.5%	98.8%	99.3%	99.8%	99.8%
13,800,000	54.8%	91.3%	98.9%	99.4%	99.8%	99.9%
13,900,000	56.7%	92.0%	99.0%	99.4%	99.8%	99.9%
14,000,000	58.6%	92.6%	99.2%	99.5%	99.9%	99.9%
14,100,000	60.4%	93.3%	99.3%	99.6%	99.9%	99.9%
14,200,000	62.3%	93.8%	99.4%	99.6%	99.9%	99.9%
14,300,000	64.1%	94.4%	99.5%	99.7%	99.9%	99.9%
14,400,000	65.9%	94.9%	99.5%	99.7%	99.9%	100.0%
14,500,000	67.6%	95.3%	99.6%	99.8%	99.9%	100.0%
14,600,000	69.3%	95.8%	99.7%	99.8%	99.9%	100.0%
14,700,000	71.0%	96.2%	99.7%	99.8%	100.0%	100.0%
14,800,000	72.6%	96.5%	99.7%	99.8%	100.0%	100.0%
14,900,000	74.2%	96.9%	99.8%	99.9%	100.0%	100.0%
15,000,000	75.8%	97.2%	99.8%	99.9%	100.0%	100.0%

Table 9.49 continued... Probability density functions for OFL in 2012-2017 for alternative run with Gulfwide shrimp effort.

	Probability of Exceeding OFL					
YIELD (mp)	2012	2013	2014	2015	2016	2017
15,100,000	77.2%	97.5%	99.8%	99.9%	100.0%	100.0%
15,200,000	78.7%	97.7%	99.9%	99.9%	100.0%	100.0%
15,300,000	80.0%	98.0%	99.9%	99.9%	100.0%	100.0%
15,400,000	81.4%	98.2%	99.9%	99.9%	100.0%	100.0%
15,500,000	82.6%	98.4%	99.9%	99.9%	100.0%	100.0%
15,600,000	83.8%	98.6%	99.9%	100.0%	100.0%	100.0%
15,700,000	85.0%	98.7%	99.9%	100.0%	100.0%	100.0%
15,800,000	86.1%	98.9%	100.0%	100.0%	100.0%	100.0%
15,900,000	87.1%	99.0%	100.0%	100.0%	100.0%	100.0%
16,000,000	88.1%	99.1%	100.0%	100.0%	100.0%	100.0%
16,100,000	89.0%	99.2%	100.0%	100.0%	100.0%	100.0%
16,200,000	89.9%	99.3%	100.0%	100.0%	100.0%	100.0%
16,300,000	90.7%	99.4%	100.0%	100.0%	100.0%	100.0%
16,400,000	91.5%	99.5%	100.0%	100.0%	100.0%	100.0%
16,500,000	92.2%	99.5%	100.0%	100.0%	100.0%	100.0%
16,600,000	92.9%	99.6%	100.0%	100.0%	100.0%	100.0%
16,700,000	93.5%	99.6%	100.0%	100.0%	100.0%	100.0%
16,800,000	94.1%	99.7%	100.0%	100.0%	100.0%	100.0%
16,900,000	94.7%	99.7%	100.0%	100.0%	100.0%	100.0%
17,000,000	95.2%	99.8%	100.0%	100.0%	100.0%	100.0%
17,100,000	95.6%	99.8%	100.0%	100.0%	100.0%	100.0%
17,200,000	96.1%	99.8%	100.0%	100.0%	100.0%	100.0%
17,300,000	96.5%	99.8%	100.0%	100.0%	100.0%	100.0%
17,400,000	96.8%	99.9%	100.0%	100.0%	100.0%	100.0%
17,500,000	97.1%	99.9%	100.0%	100.0%	100.0%	100.0%
17,600,000	97.4%	99.9%	100.0%	100.0%	100.0%	100.0%
17,700,000	97.7%	99.9%	100.0%	100.0%	100.0%	100.0%
17,800,000	98.0%	99.9%	100.0%	100.0%	100.0%	100.0%
17,900,000	98.2%	99.9%	100.0%	100.0%	100.0%	100.0%
18,000,000	98.4%	99.9%	100.0%	100.0%	100.0%	100.0%
18,100,000	98.6%	100.0%	100.0%	100.0%	100.0%	100.0%
18,200,000	98.7%	100.0%	100.0%	100.0%	100.0%	100.0%
18,300,000	98.9%	100.0%	100.0%	100.0%	100.0%	100.0%
18,400,000	99.0%	100.0%	100.0%	100.0%	100.0%	100.0%
18,500,000	99.1%	100.0%	100.0%	100.0%	100.0%	100.0%
18,600,000	99.3%	100.0%	100.0%	100.0%	100.0%	100.0%
18,700,000	99.3%	100.0%	100.0%	100.0%	100.0%	100.0%
18,800,000	99.4%	100.0%	100.0%	100.0%	100.0%	100.0%
18,900,000	99.5%	100.0%	100.0%	100.0%	100.0%	100.0%
19,000,000	99.6%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 9.50. Probability density functions for OFL in 2012-2017 for alternative run with eastern Gulf shrimp effort.

	Probability of Exceeding OFL					
YIELD (mp)	2012	2013	2014	2015	2016	2017
3,000,000	0.0%	0.0%	0.1%	0.6%	0.8%	1.1%
3,100,000	0.0%	0.0%	0.1%	0.7%	0.9%	1.2%
3,200,000	0.0%	0.0%	0.1%	0.8%	1.0%	1.4%
3,300,000	0.0%	0.0%	0.1%	0.9%	1.2%	1.6%
3,400,000	0.0%	0.0%	0.1%	1.0%	1.3%	1.8%
3,500,000	0.0%	0.0%	0.1%	1.1%	1.5%	2.0%
3,600,000	0.0%	0.0%	0.2%	1.3%	1.7%	2.2%
3,700,000	0.0%	0.0%	0.2%	1.4%	1.9%	2.5%
3,800,000	0.0%	0.0%	0.2%	1.6%	2.2%	2.8%
3,900,000	0.0%	0.1%	0.3%	1.8%	2.4%	3.1%
4,000,000	0.0%	0.1%	0.3%	2.0%	2.7%	3.5%
4,100,000	0.0%	0.1%	0.3%	2.2%	3.0%	3.9%
4,200,000	0.0%	0.1%	0.4%	2.5%	3.4%	4.3%
4,300,000	0.0%	0.1%	0.5%	2.8%	3.8%	4.8%
4,400,000	0.0%	0.1%	0.5%	3.1%	4.2%	5.3%
4,500,000	0.0%	0.1%	0.6%	3.4%	4.7%	5.9%
4,600,000	0.0%	0.2%	0.7%	3.8%	5.2%	6.5%
4,700,000	0.0%	0.2%	0.8%	4.2%	5.7%	7.1%
4,800,000	0.0%	0.2%	1.0%	4.6%	6.3%	7.8%
4,900,000	0.0%	0.2%	1.1%	5.1%	6.9%	8.5%
5,000,000	0.0%	0.3%	1.3%	5.6%	7.6%	9.3%
5,100,000	0.0%	0.3%	1.4%	6.1%	8.3%	10.2%
5,200,000	0.0%	0.4%	1.6%	6.7%	9.0%	11.1%
5,300,000	0.0%	0.4%	1.8%	7.4%	9.9%	12.0%
5,400,000	0.0%	0.5%	2.1%	8.0%	10.7%	13.0%
5,500,000	0.0%	0.6%	2.4%	8.7%	11.7%	14.1%
5,600,000	0.0%	0.6%	2.7%	9.5%	12.7%	15.2%
5,700,000	0.0%	0.7%	3.0%	10.3%	13.7%	16.4%
5,800,000	0.0%	0.8%	3.4%	11.1%	14.8%	17.6%
5,900,000	0.0%	0.9%	3.8%	12.0%	16.0%	18.9%
6,000,000	0.0%	1.0%	4.2%	13.0%	17.2%	20.3%
6,100,000	0.0%	1.2%	4.7%	14.0%	18.4%	21.7%
6,200,000	0.0%	1.3%	5.2%	15.1%	19.8%	23.1%
6,300,000	0.0%	1.5%	5.7%	16.2%	21.1%	24.7%
6,400,000	0.0%	1.7%	6.4%	17.3%	22.6%	26.2%
6,500,000	0.0%	1.9%	7.0%	18.5%	24.1%	27.9%
6,600,000	0.0%	2.1%	7.7%	19.8%	25.6%	29.5%
6,700,000	0.0%	2.3%	8.5%	21.1%	27.2%	31.2%
6,800,000	0.0%	2.6%	9.3%	22.5%	28.9%	33.0%
6,900,000	0.0%	2.9%	10.2%	23.9%	30.5%	34.8%
7,000,000	0.0%	3.2%	11.1%	25.3%	32.3%	36.6%

Table 9.50 continued... Probability density functions for OFL in 2012-2017 for alternative run with eastern Gulf shrimp effort.

	Probability of Exceeding OFL					
YIELD (mp)	2012	2013	2014	2015	2016	2017
7,100,000	0.0%	3.5%	12.1%	26.8%	34.0%	38.5%
7,200,000	0.0%	3.9%	13.2%	28.4%	35.8%	40.3%
7,300,000	0.0%	4.3%	14.3%	30.0%	37.7%	42.2%
7,400,000	0.1%	4.7%	15.5%	31.6%	39.5%	44.2%
7,500,000	0.1%	5.2%	16.7%	33.2%	41.4%	46.1%
7,600,000	0.1%	5.7%	18.0%	34.9%	43.3%	48.0%
7,700,000	0.1%	6.2%	19.4%	36.7%	45.3%	50.0%
7,800,000	0.1%	6.8%	20.8%	38.4%	47.2%	52.0%
7,900,000	0.1%	7.4%	22.3%	40.2%	49.1%	53.9%
8,000,000	0.1%	8.1%	23.9%	42.0%	51.1%	55.8%
8,100,000	0.2%	8.8%	25.5%	43.8%	53.0%	57.8%
8,200,000	0.2%	9.5%	27.2%	45.6%	55.0%	59.7%
8,300,000	0.2%	10.3%	28.9%	47.5%	56.9%	61.5%
8,400,000	0.3%	11.1%	30.6%	49.3%	58.8%	63.4%
8,500,000	0.3%	12.0%	32.5%	51.2%	60.7%	65.2%
8,600,000	0.4%	13.0%	34.3%	53.0%	62.5%	67.0%
8,700,000	0.4%	14.0%	36.2%	54.8%	64.4%	68.8%
8,800,000	0.5%	15.0%	38.1%	56.7%	66.2%	70.5%
8,900,000	0.5%	16.1%	40.1%	58.5%	67.9%	72.1%
9,000,000	0.6%	17.2%	42.1%	60.3%	69.7%	73.8%
9,100,000	0.7%	18.4%	44.1%	62.0%	71.3%	75.3%
9,200,000	0.8%	19.6%	46.1%	63.8%	73.0%	76.9%
9,300,000	0.9%	20.9%	48.1%	65.5%	74.6%	78.3%
9,400,000	1.1%	22.2%	50.1%	67.2%	76.1%	79.7%
9,500,000	1.2%	23.6%	52.2%	68.8%	77.6%	81.1%
9,600,000	1.4%	25.0%	54.2%	70.5%	79.0%	82.4%
9,700,000	1.5%	26.5%	56.2%	72.0%	80.4%	83.6%
9,800,000	1.7%	28.0%	58.2%	73.6%	81.7%	84.8%
9,900,000	1.9%	29.6%	60.2%	75.1%	83.0%	85.9%
10,000,000	2.2%	31.2%	62.1%	76.5%	84.2%	87.0%
10,100,000	2.4%	32.8%	64.1%	77.9%	85.3%	88.0%
10,200,000	2.7%	34.5%	66.0%	79.2%	86.4%	88.9%
10,300,000	3.1%	36.1%	67.8%	80.5%	87.5%	89.8%
10,400,000	3.4%	37.9%	69.6%	81.8%	88.4%	90.7%
10,500,000	3.8%	39.6%	71.4%	83.0%	89.4%	91.5%
10,600,000	4.2%	41.4%	73.1%	84.1%	90.2%	92.2%
10,700,000	4.6%	43.1%	74.7%	85.2%	91.0%	92.9%
10,800,000	5.1%	44.9%	76.3%	86.3%	91.8%	93.5%
10,900,000	5.6%	46.7%	77.9%	87.3%	92.5%	94.1%
11,000,000	6.2%	48.5%	79.4%	88.2%	93.2%	94.7%

Table 9.50 continued... Probability density functions for OFL in 2012-2017 for alternative run with eastern Gulf shrimp effort.

	Probability of Exceeding OFL					
YIELD (mp)	2012	2013	2014	2015	2016	2017
11,100,000	6.8%	50.4%	80.8%	89.1%	93.8%	95.2%
11,200,000	7.5%	52.2%	82.1%	89.9%	94.4%	95.7%
11,300,000	8.2%	54.0%	83.4%	90.7%	94.9%	96.1%
11,400,000	8.9%	55.8%	84.7%	91.5%	95.4%	96.5%
11,500,000	9.7%	57.6%	85.9%	92.2%	95.9%	96.9%
11,600,000	10.6%	59.3%	87.0%	92.8%	96.3%	97.2%
11,700,000	11.5%	61.1%	88.0%	93.4%	96.6%	97.5%
11,800,000	12.4%	62.8%	89.0%	94.0%	97.0%	97.8%
11,900,000	13.4%	64.5%	89.9%	94.5%	97.3%	98.0%
12,000,000	14.5%	66.2%	90.8%	95.0%	97.6%	98.2%
12,100,000	15.6%	67.9%	91.6%	95.5%	97.9%	98.4%
12,200,000	16.8%	69.5%	92.4%	95.9%	98.1%	98.6%
12,300,000	18.0%	71.0%	93.1%	96.3%	98.3%	98.8%
12,400,000	19.3%	72.6%	93.7%	96.7%	98.5%	98.9%
12,500,000	20.6%	74.1%	94.3%	97.0%	98.7%	99.1%
12,600,000	22.0%	75.5%	94.9%	97.3%	98.8%	99.2%
12,700,000	23.5%	76.9%	95.4%	97.6%	99.0%	99.3%
12,800,000	25.0%	78.3%	95.9%	97.8%	99.1%	99.4%
12,900,000	26.5%	79.6%	96.3%	98.0%	99.2%	99.5%
13,000,000	28.1%	80.9%	96.7%	98.3%	99.3%	99.5%
13,100,000	29.7%	82.1%	97.1%	98.4%	99.4%	99.6%
13,200,000	31.4%	83.2%	97.4%	98.6%	99.5%	99.6%
13,300,000	33.1%	84.4%	97.7%	98.8%	99.5%	99.7%
13,400,000	34.9%	85.4%	97.9%	98.9%	99.6%	99.7%
13,500,000	36.7%	86.4%	98.2%	99.0%	99.7%	99.8%
13,600,000	38.5%	87.4%	98.4%	99.2%	99.7%	99.8%
13,700,000	40.3%	88.3%	98.6%	99.3%	99.7%	99.8%
13,800,000	42.2%	89.2%	98.8%	99.3%	99.8%	99.9%
13,900,000	44.1%	90.0%	98.9%	99.4%	99.8%	99.9%
14,000,000	46.0%	90.8%	99.1%	99.5%	99.8%	99.9%
14,100,000	47.9%	91.5%	99.2%	99.6%	99.9%	99.9%
14,200,000	49.8%	92.2%	99.3%	99.6%	99.9%	99.9%
14,300,000	51.7%	92.8%	99.4%	99.7%	99.9%	99.9%
14,400,000	53.6%	93.4%	99.5%	99.7%	99.9%	99.9%
14,500,000	55.5%	94.0%	99.5%	99.7%	99.9%	100.0%
14,600,000	57.4%	94.5%	99.6%	99.8%	99.9%	100.0%
14,700,000	59.3%	95.0%	99.7%	99.8%	100.0%	100.0%
14,800,000	61.1%	95.5%	99.7%	99.8%	100.0%	100.0%
14,900,000	63.0%	95.9%	99.7%	99.9%	100.0%	100.0%
15,000,000	64.7%	96.3%	99.8%	99.9%	100.0%	100.0%

Table 9.50 continued... Probability density functions for OFL in 2012-2017 for alternative run with eastern Gulf shrimp effort.

	Probability of Exceeding OFL					
YIELD (mp)	2012	2013	2014	2015	2016	2017
15,100,000	66.5%	96.6%	99.8%	99.9%	100.0%	100.0%
15,200,000	68.2%	96.9%	99.8%	99.9%	100.0%	100.0%
15,300,000	69.9%	97.3%	99.9%	99.9%	100.0%	100.0%
15,400,000	71.6%	97.5%	99.9%	99.9%	100.0%	100.0%
15,500,000	73.2%	97.8%	99.9%	99.9%	100.0%	100.0%
15,600,000	74.7%	98.0%	99.9%	100.0%	100.0%	100.0%
15,700,000	76.2%	98.2%	99.9%	100.0%	100.0%	100.0%
15,800,000	77.7%	98.4%	99.9%	100.0%	100.0%	100.0%
15,900,000	79.1%	98.6%	100.0%	100.0%	100.0%	100.0%
16,000,000	80.4%	98.7%	100.0%	100.0%	100.0%	100.0%
16,100,000	81.7%	98.9%	100.0%	100.0%	100.0%	100.0%
16,200,000	83.0%	99.0%	100.0%	100.0%	100.0%	100.0%
16,300,000	84.2%	99.1%	100.0%	100.0%	100.0%	100.0%
16,400,000	85.3%	99.2%	100.0%	100.0%	100.0%	100.0%
16,500,000	86.4%	99.3%	100.0%	100.0%	100.0%	100.0%
16,600,000	87.4%	99.4%	100.0%	100.0%	100.0%	100.0%
16,700,000	88.4%	99.5%	100.0%	100.0%	100.0%	100.0%
16,800,000	89.3%	99.5%	100.0%	100.0%	100.0%	100.0%
16,900,000	90.1%	99.6%	100.0%	100.0%	100.0%	100.0%
17,000,000	90.9%	99.6%	100.0%	100.0%	100.0%	100.0%
17,100,000	91.7%	99.7%	100.0%	100.0%	100.0%	100.0%
17,200,000	92.4%	99.7%	100.0%	100.0%	100.0%	100.0%
17,300,000	93.1%	99.8%	100.0%	100.0%	100.0%	100.0%
17,400,000	93.7%	99.8%	100.0%	100.0%	100.0%	100.0%
17,500,000	94.3%	99.8%	100.0%	100.0%	100.0%	100.0%
17,600,000	94.8%	99.8%	100.0%	100.0%	100.0%	100.0%
17,700,000	95.3%	99.9%	100.0%	100.0%	100.0%	100.0%
17,800,000	95.7%	99.9%	100.0%	100.0%	100.0%	100.0%
17,900,000	96.1%	99.9%	100.0%	100.0%	100.0%	100.0%
18,000,000	96.5%	99.9%	100.0%	100.0%	100.0%	100.0%
18,100,000	96.9%	99.9%	100.0%	100.0%	100.0%	100.0%
18,200,000	97.2%	99.9%	100.0%	100.0%	100.0%	100.0%
18,300,000	97.5%	99.9%	100.0%	100.0%	100.0%	100.0%
18,400,000	97.8%	100.0%	100.0%	100.0%	100.0%	100.0%
18,500,000	98.0%	100.0%	100.0%	100.0%	100.0%	100.0%
18,600,000	98.2%	100.0%	100.0%	100.0%	100.0%	100.0%
18,700,000	98.4%	100.0%	100.0%	100.0%	100.0%	100.0%
18,800,000	98.6%	100.0%	100.0%	100.0%	100.0%	100.0%
18,900,000	98.8%	100.0%	100.0%	100.0%	100.0%	100.0%
19,000,000	98.9%	100.0%	100.0%	100.0%	100.0%	100.0%

12 Figures

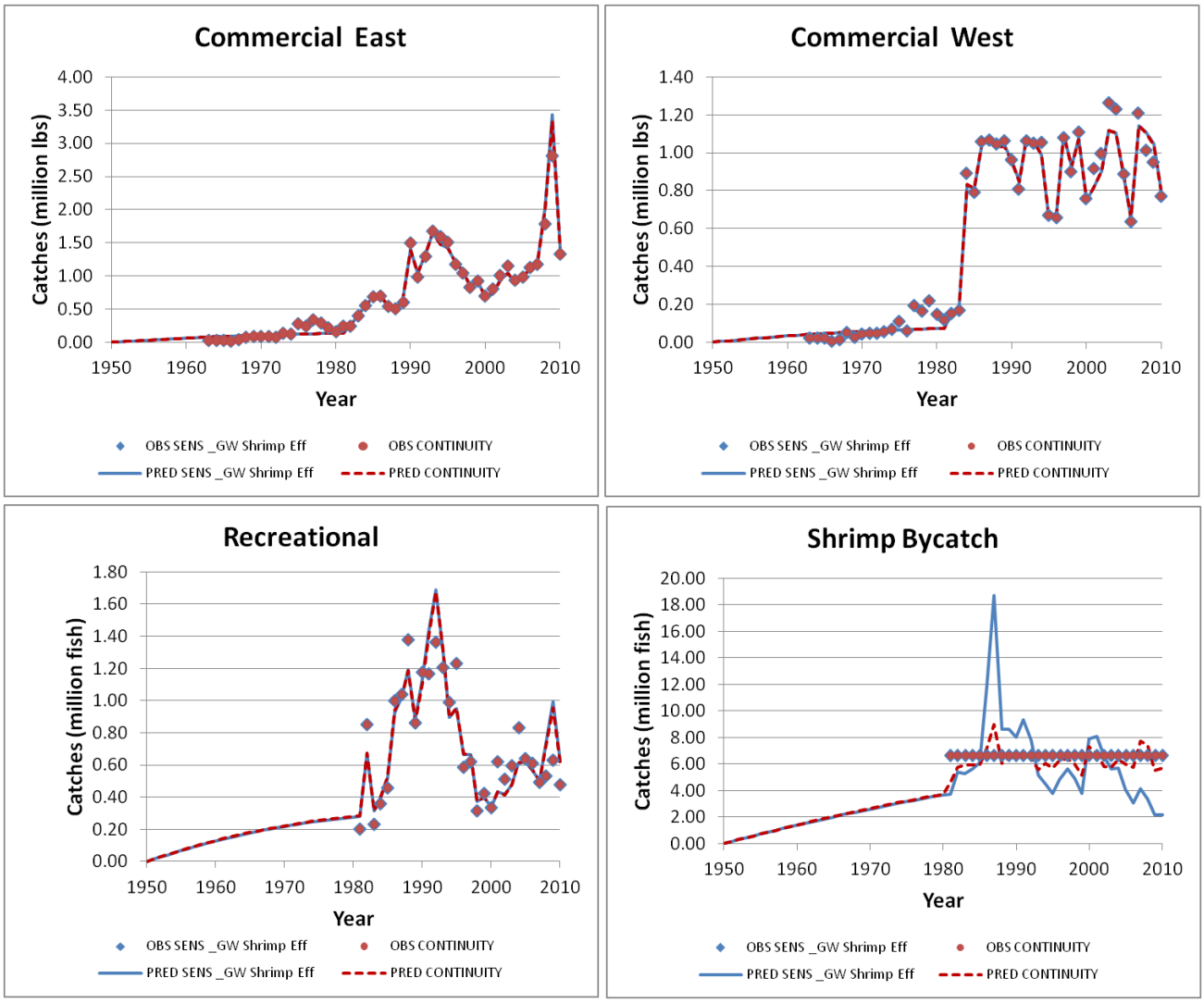


Figure 8.1. Comparison of the fits to the catch series for the alternative run with Gulfwide shrimp effort (blue) and the continuity run (red).

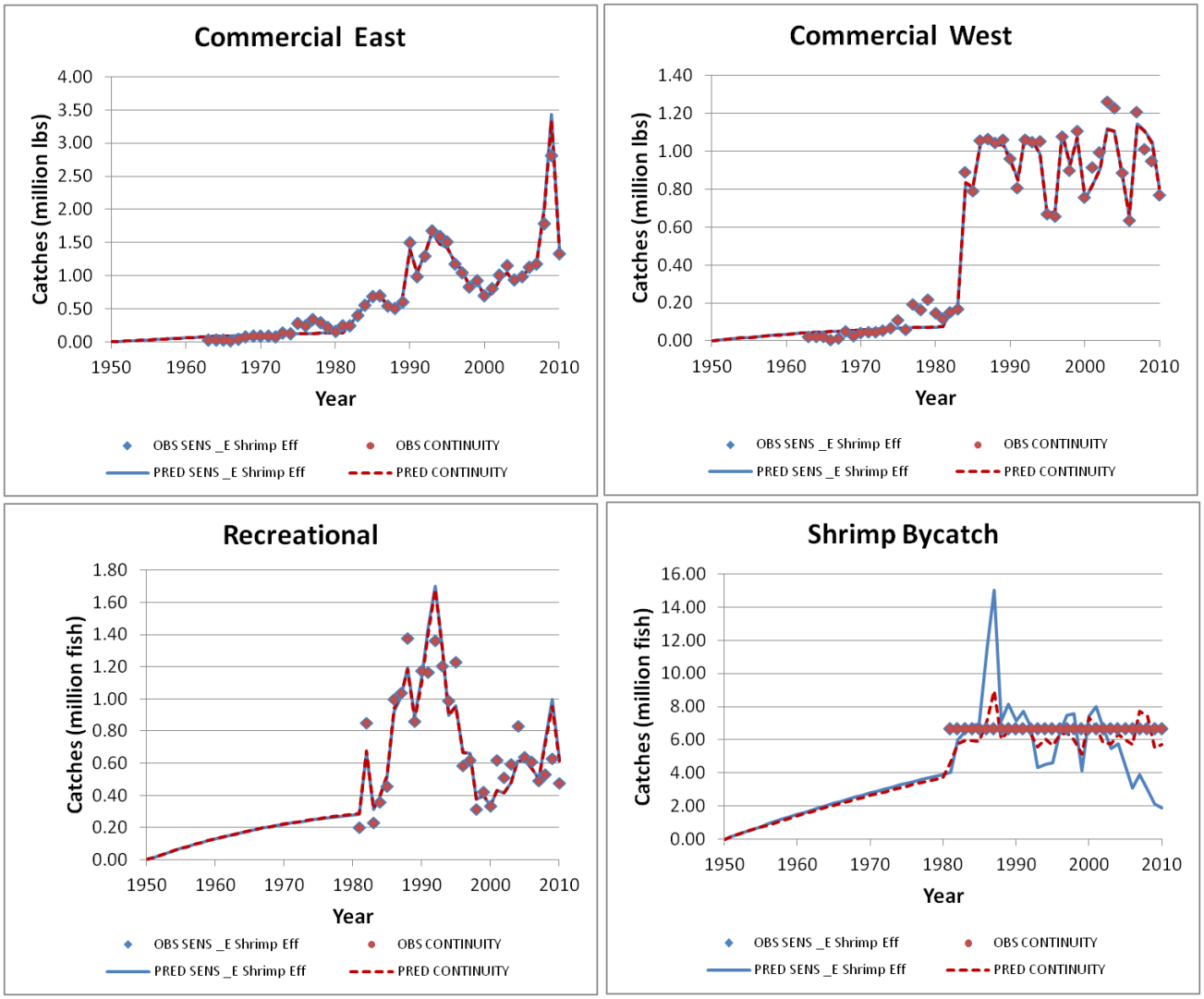


Figure 8.2. Comparison of the fits to the catch series for the alternative run with eastern Gulf shrimp effort (blue) and the continuity run (red).

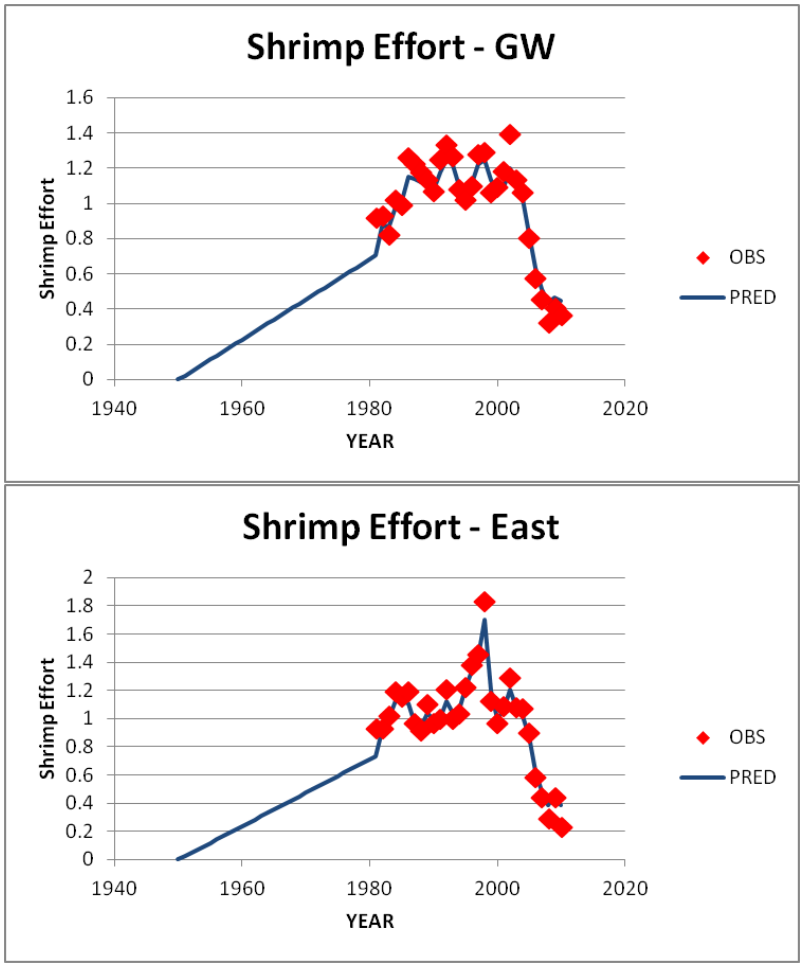


Figure 8.3. Fits to the shrimp fishery effort series for the alternative run with Gulfwide shrimp effort (GW) and eastern Gulf shrimp effort (East).

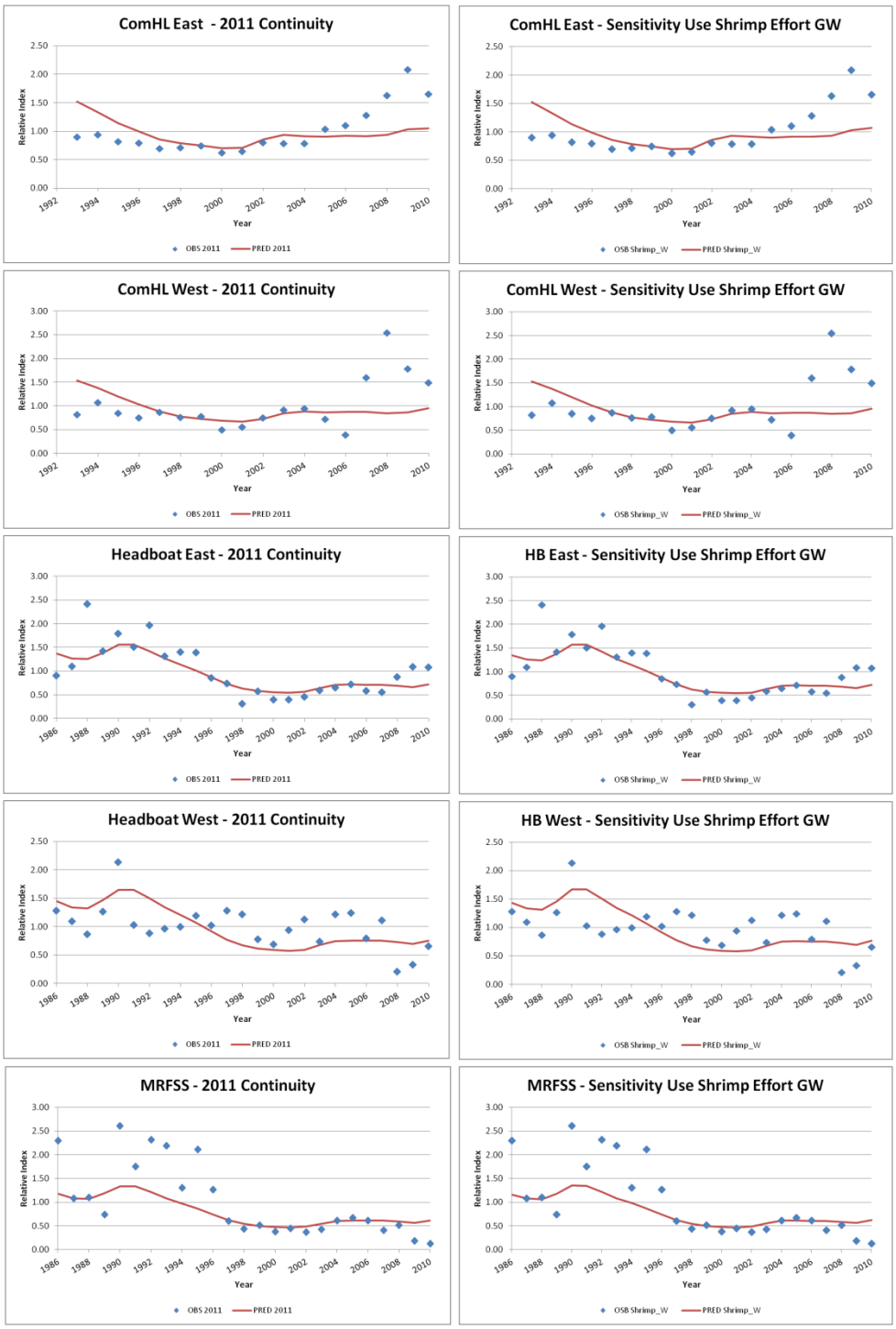


Figure 8.4. Comparison of fits to the indices of abundance for the continuity run (left) and the alternative run with Gulfwide shrimp effort (right).

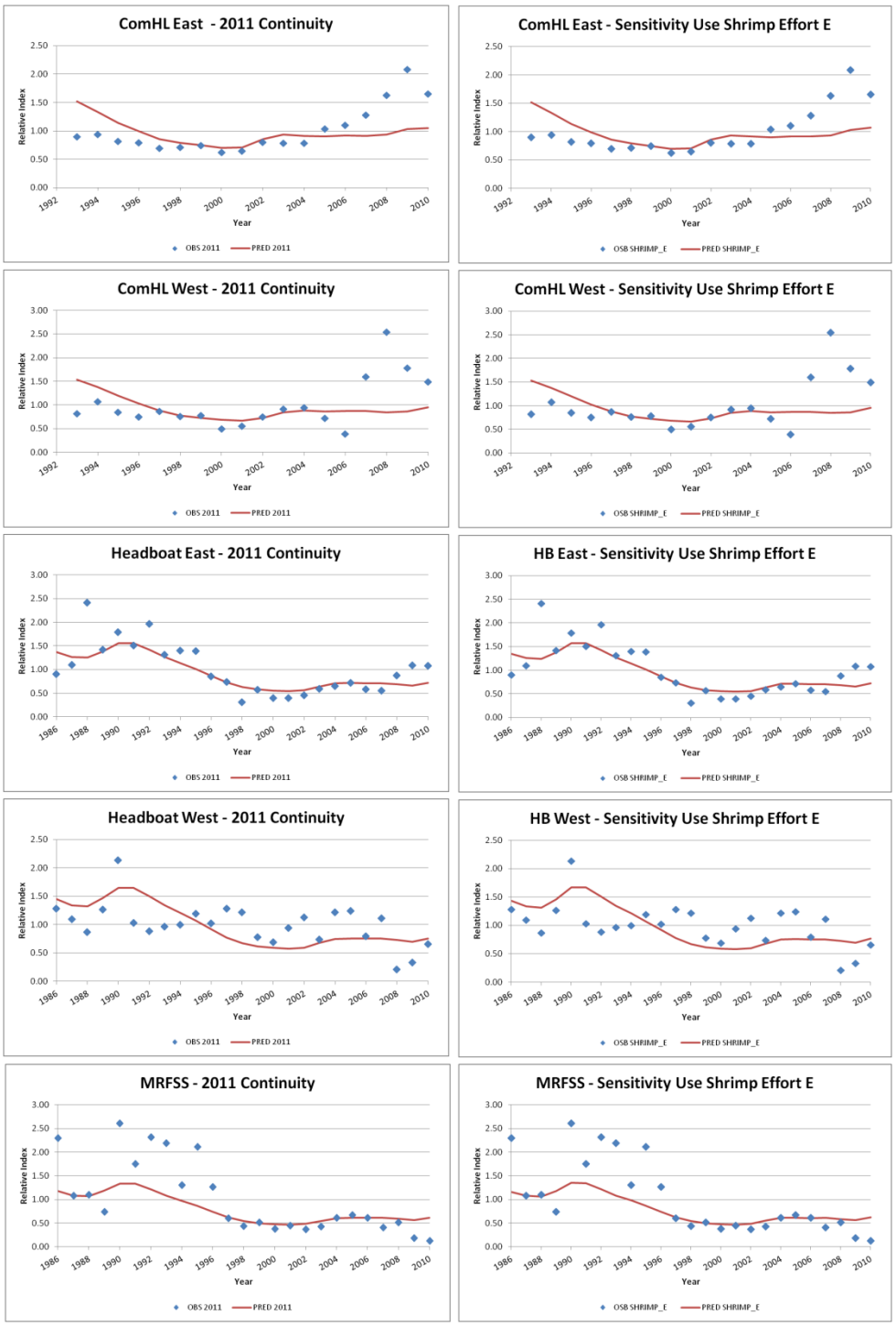


Figure 8.5. Comparison of fits to the indices of abundance for the continuity run (left) and the alternative run with eastern Gulf shrimp effort (right).

COMMERCIAL HANDLINE EAST

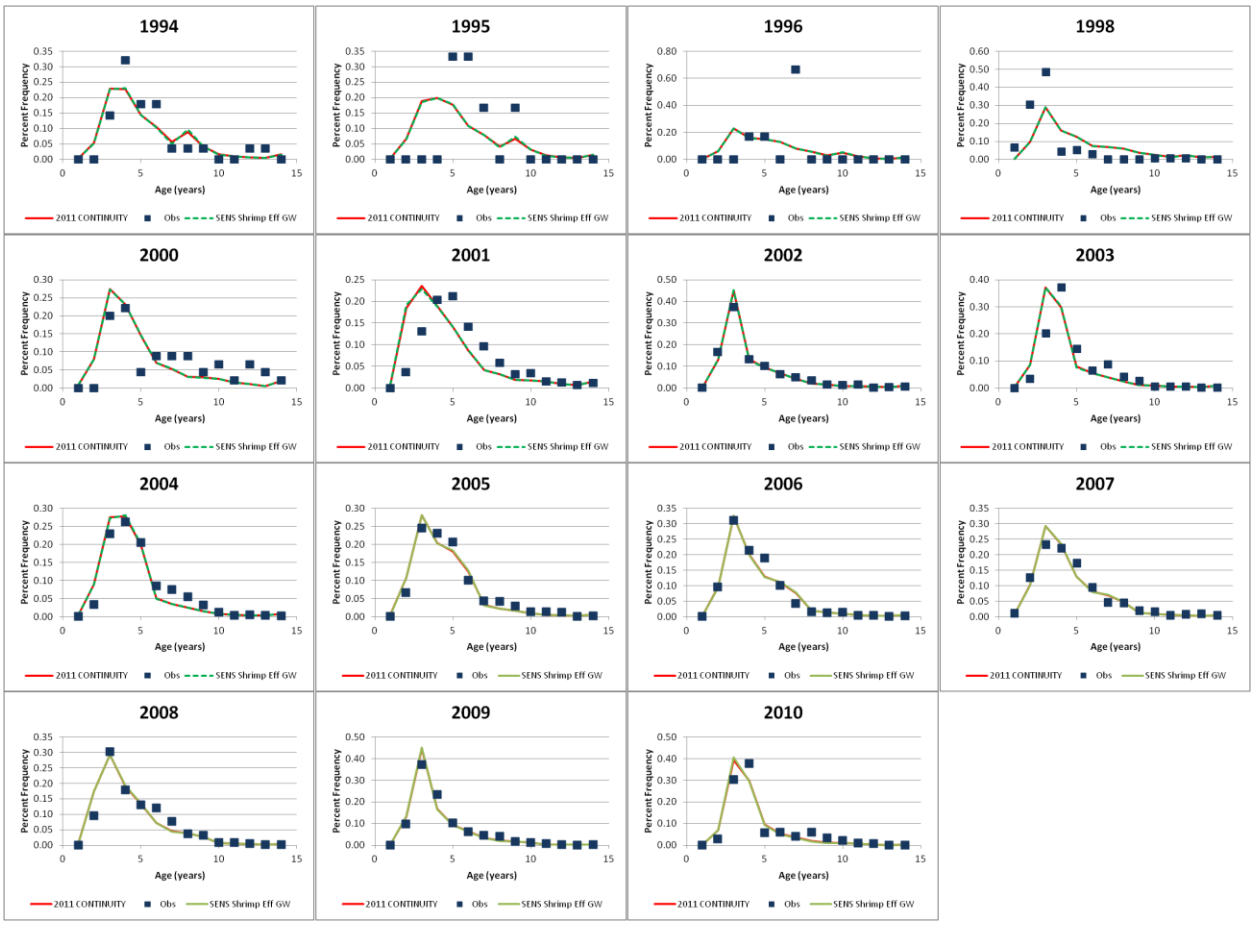


Figure 8.6. Comparison of fits to the observed age composition for the commercial handline fishery in the eastern Gulf of Mexico. The predicted age composition for the alternative run with Gulfwide shrimp effort is indicated with a green broken line; the continuity run with a solid red line.

COMMERCIAL HANDLINE WEST

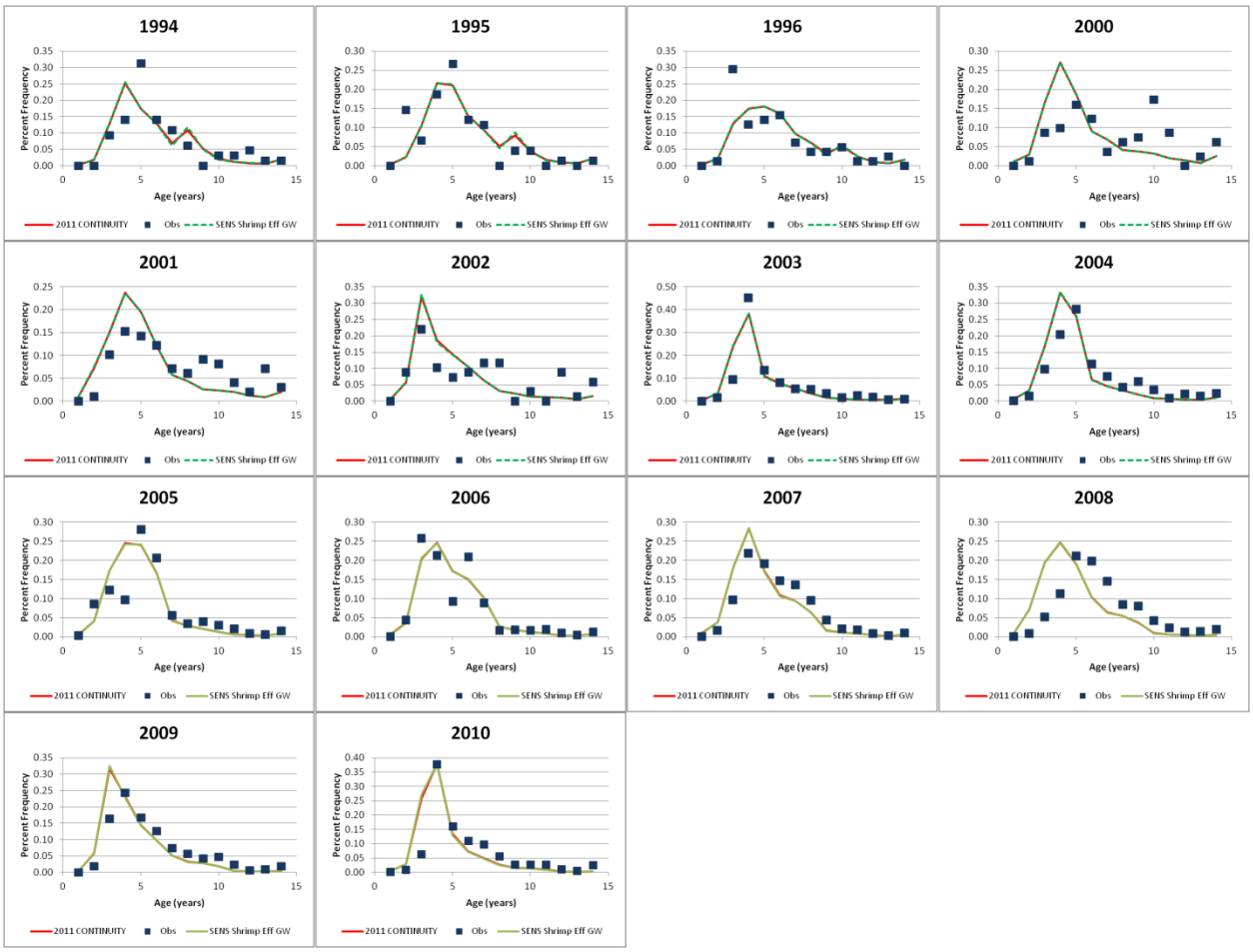


Figure 8.7. Comparison of fits to the observed age composition for the commercial handline fishery in the western Gulf of Mexico. The predicted age composition for the alternative run with Gulfwide shrimp effort is indicated with a green broken line; the continuity run with a solid red line.

RECREATIONAL FISHERY - GULFWIDE

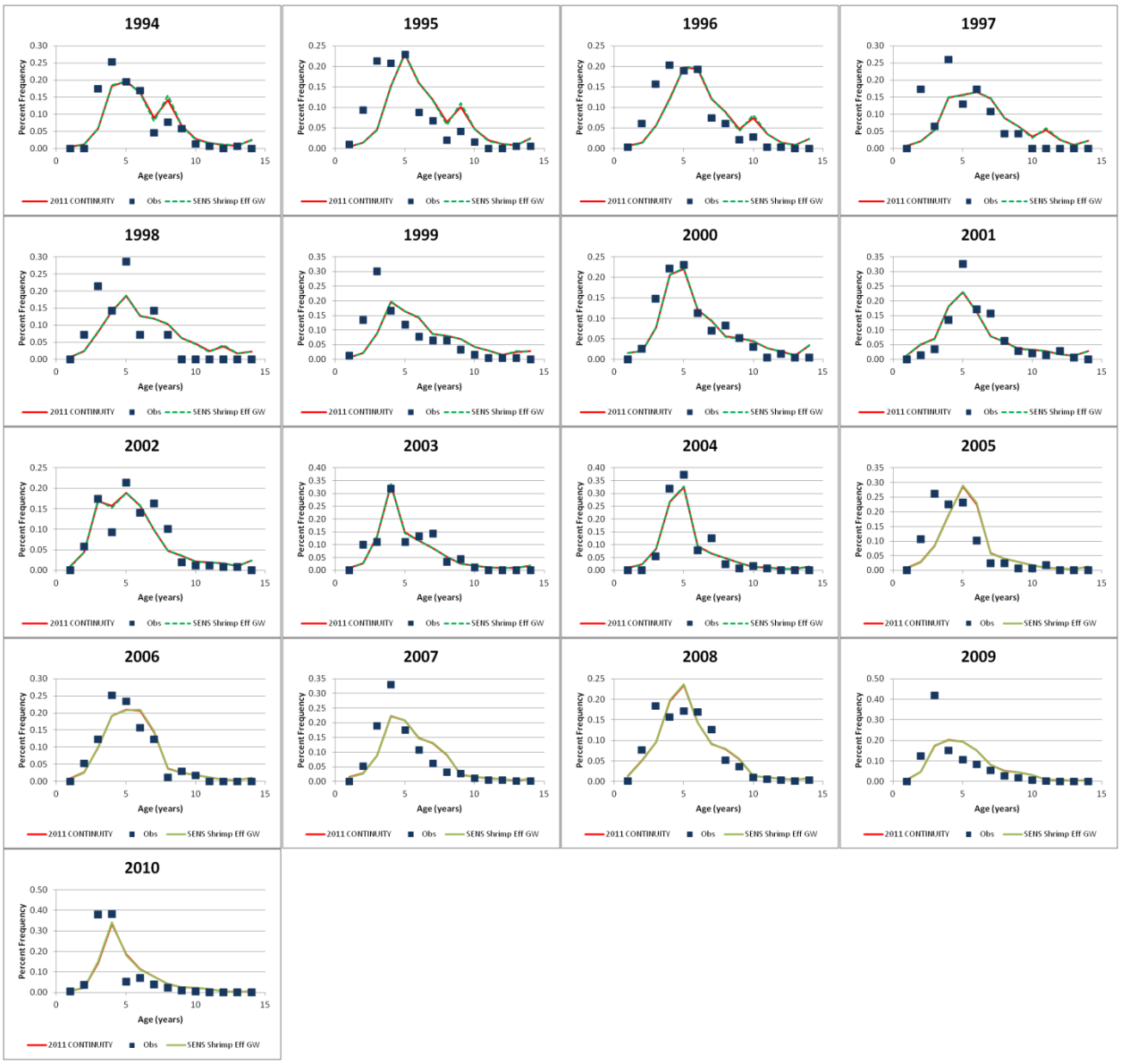


Figure 8.8. Comparison of fits to the observed age composition for the recreational fishery in the Gulf of Mexico. The predicted age composition for the alternative run with Gulfwide shrimp effort is indicated with a green broken line; the continuity run with a solid red line.

COMMERCIAL HANDLINE EAST

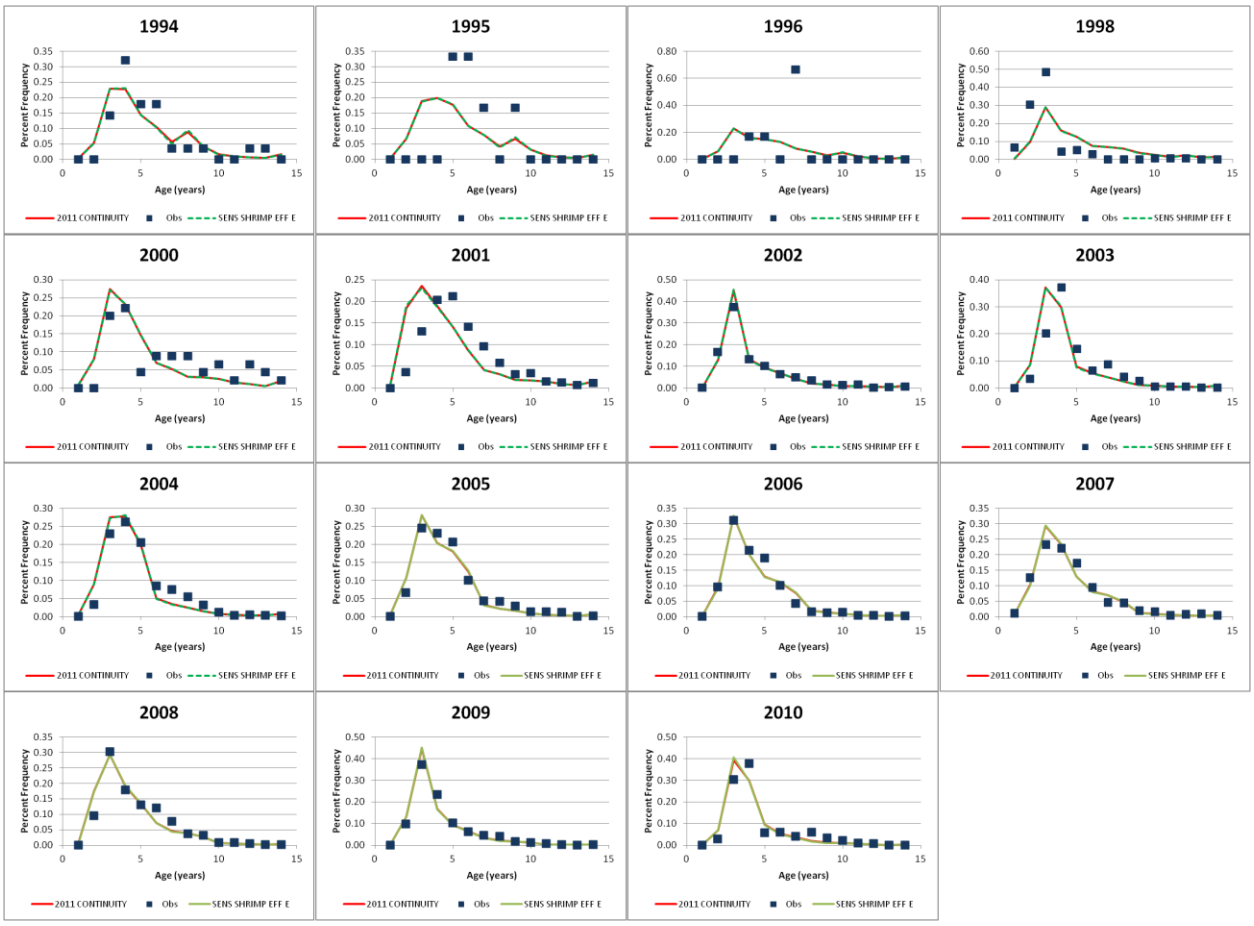


Figure 8.9. Comparison of fits to the observed age composition for the commercial handline fishery in the eastern Gulf of Mexico. The predicted age composition for the alternative run with eastern Gulf shrimp effort is indicated with a green broken line; the continuity run with a solid red line.

COMMERCIAL HANDLINE WEST

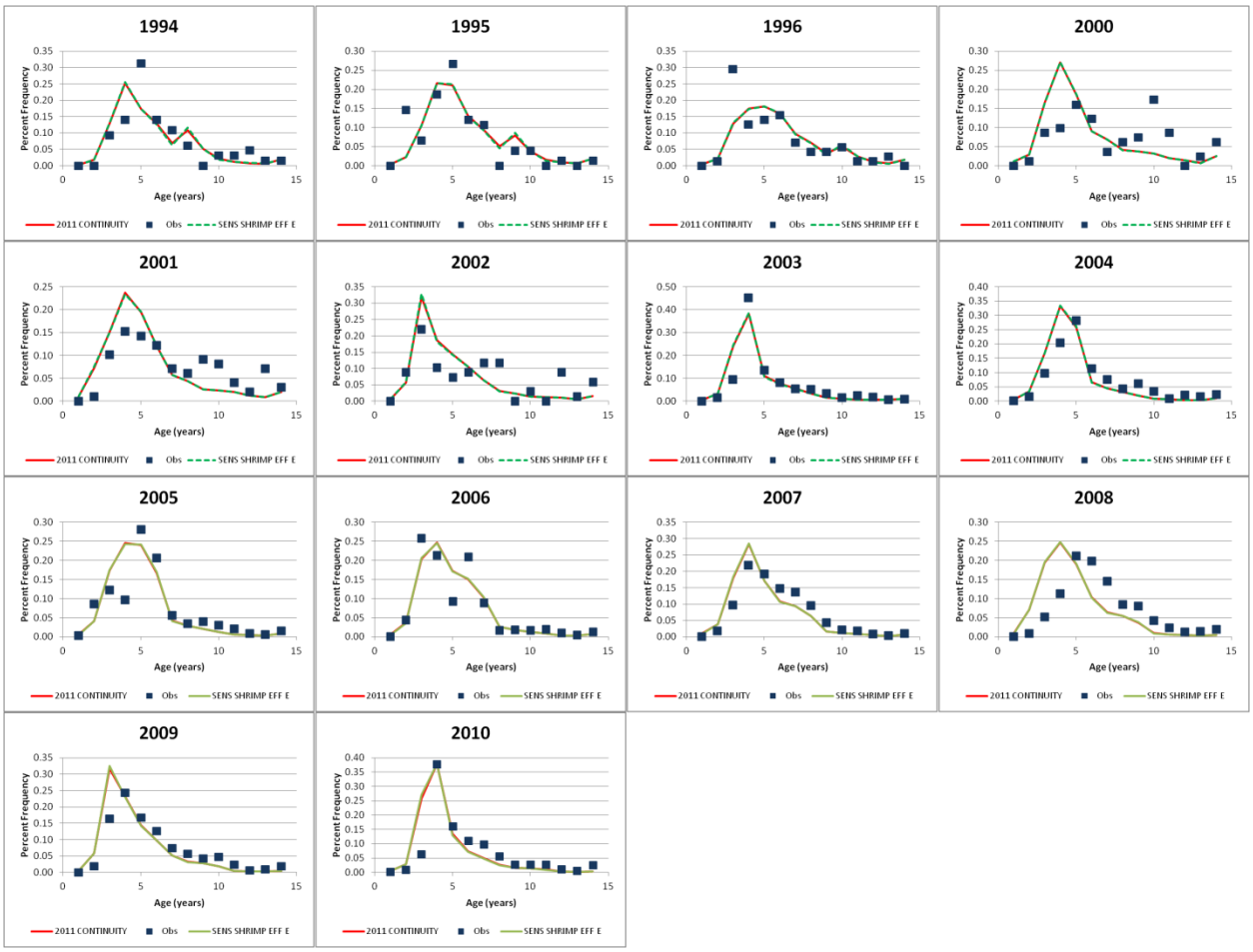


Figure 8.10. Comparison of fits to the observed age composition for the commercial handline fishery in the western Gulf of Mexico. The predicted age composition for the alternative run with eastern Gulf shrimp effort is indicated with a green broken line; the continuity run with a solid red line.

RECREATIONAL FISHERY - GULFWIDE

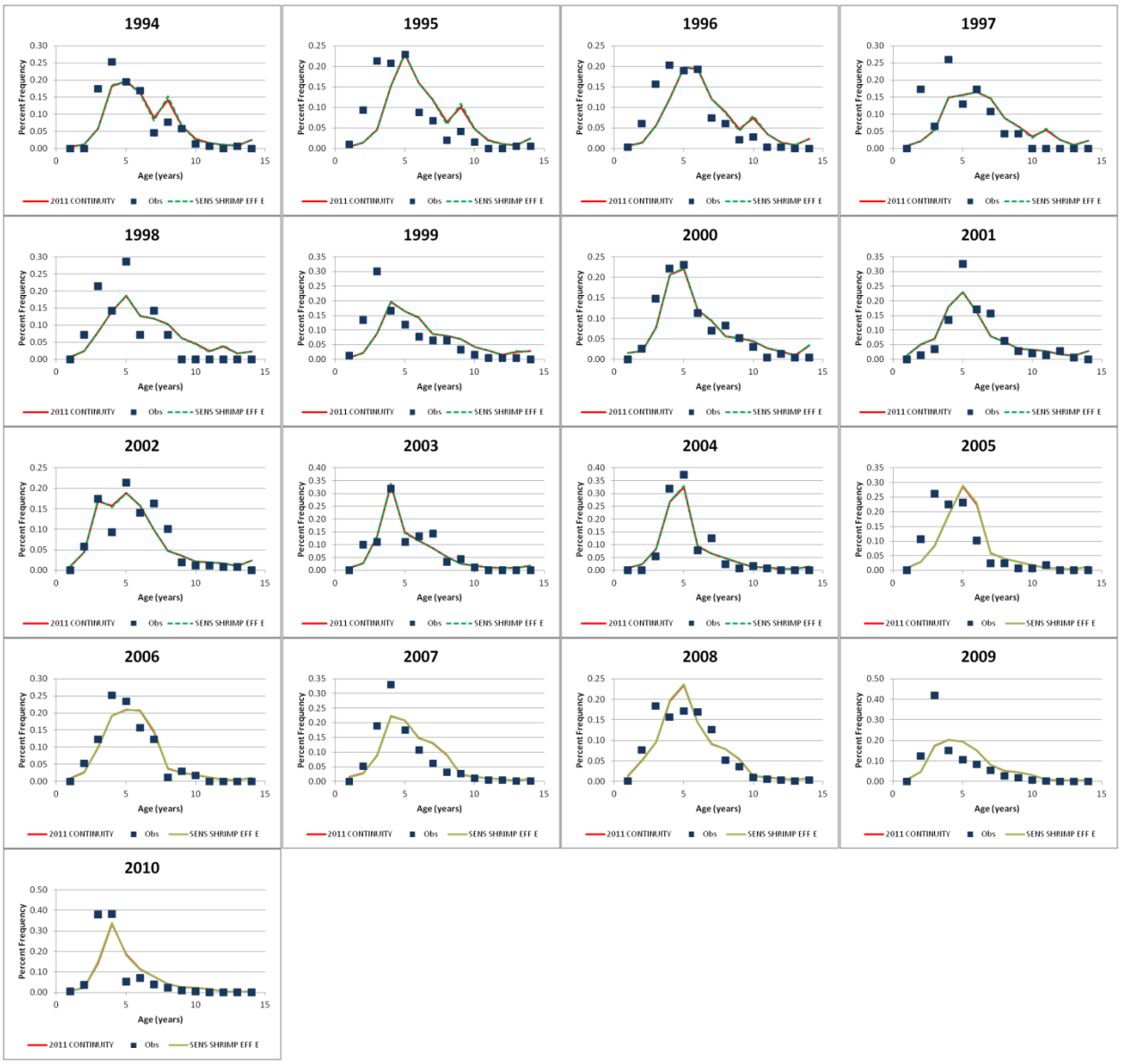


Figure 8.11. Comparison of fits to the observed age composition for the recreational fishery in the Gulf of Mexico. The predicted age composition for the alternative run with eastern Gulf shrimp effort is indicated with a green broken line; the continuity run with a solid red line.

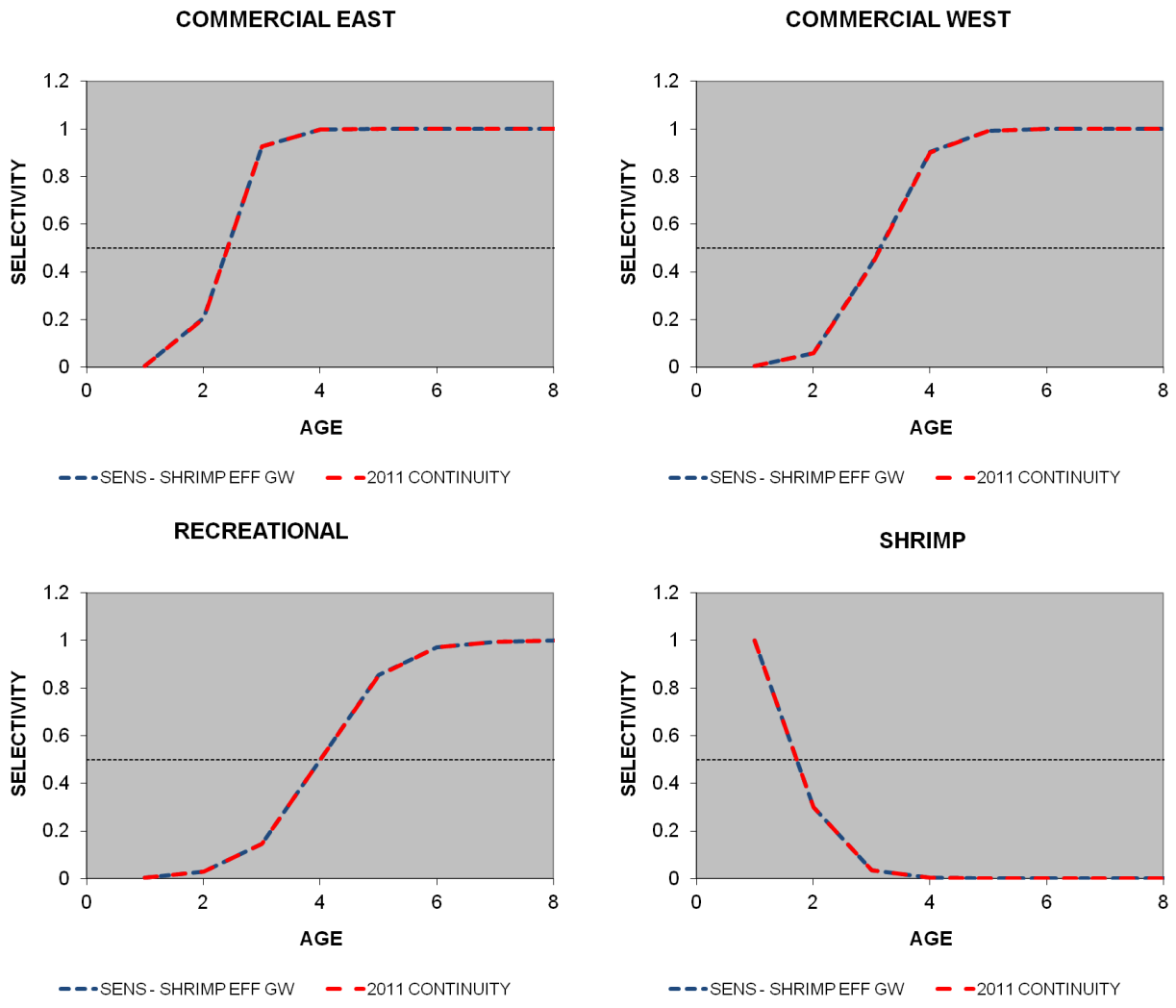


Figure 8.12. Comparison of relative selectivity functions for the alternative run with Gulfwide shrimp effort (dotted blue line) and the continuity run (red).

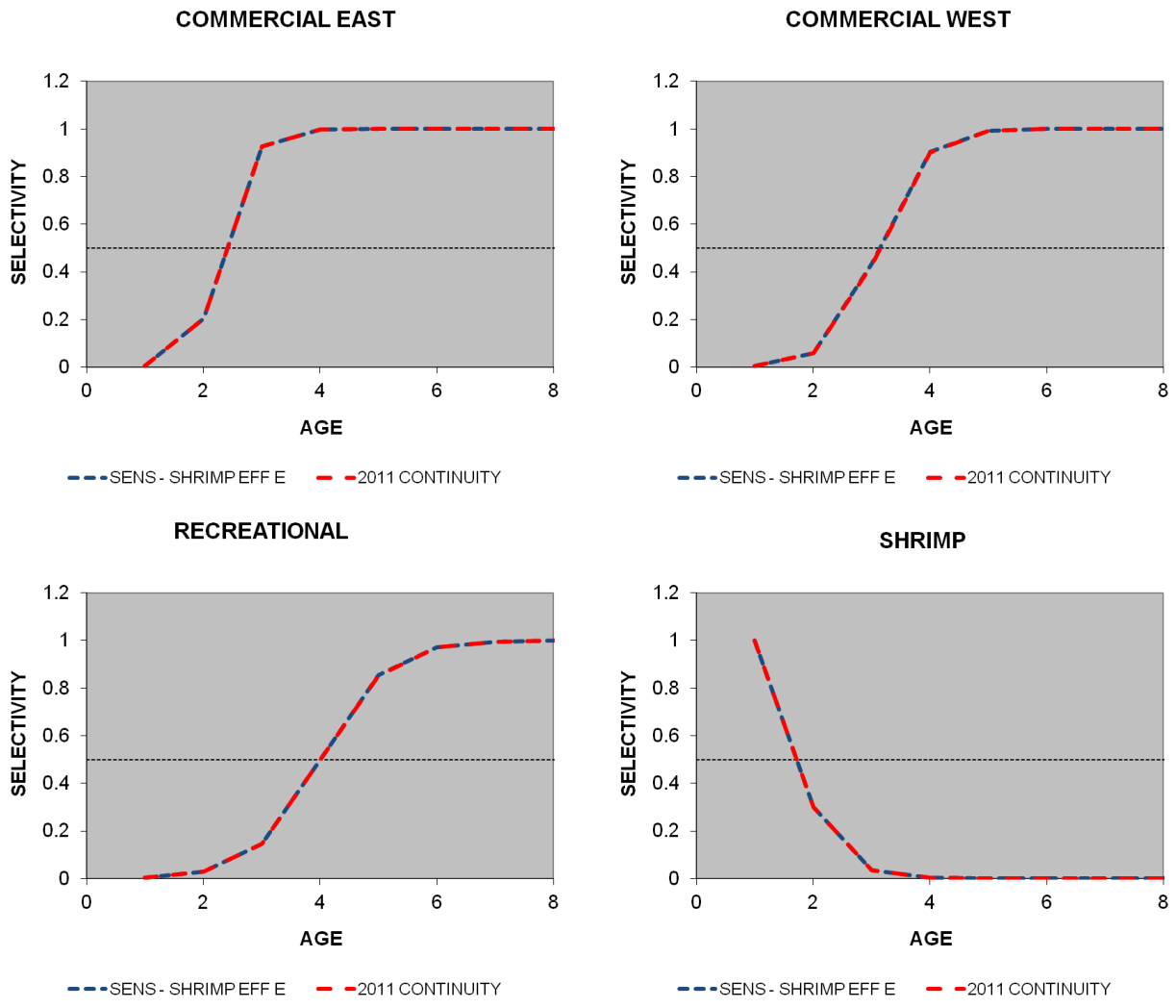


Figure 8.13. Comparison of relative selectivity functions for the alternative run with eastern Gulf shrimp effort (dotted blue line) and the continuity run (red).

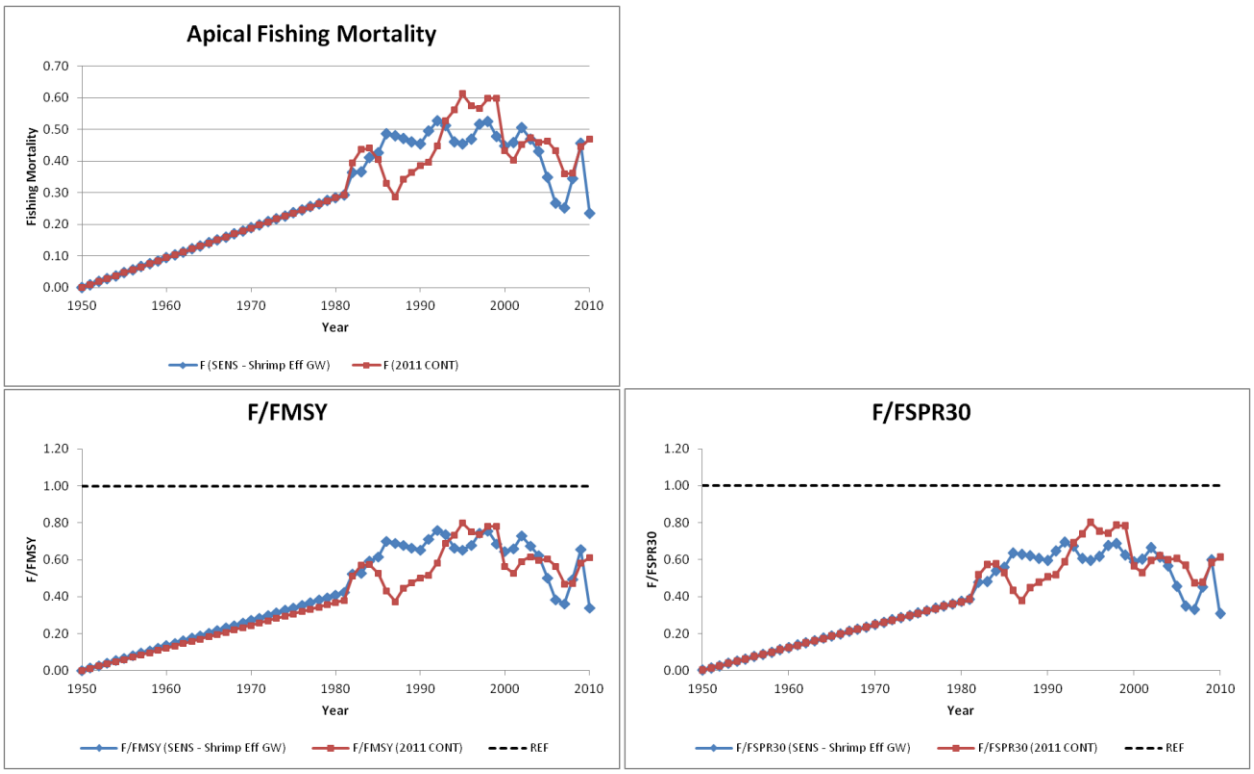


Figure 8.14. Comparison of annual estimates of F, F/F_{MSY} and $F/F_{SPR30\%}$ for the alternative run with Gulfwide shrimp effort (blue) and the continuity run (red).

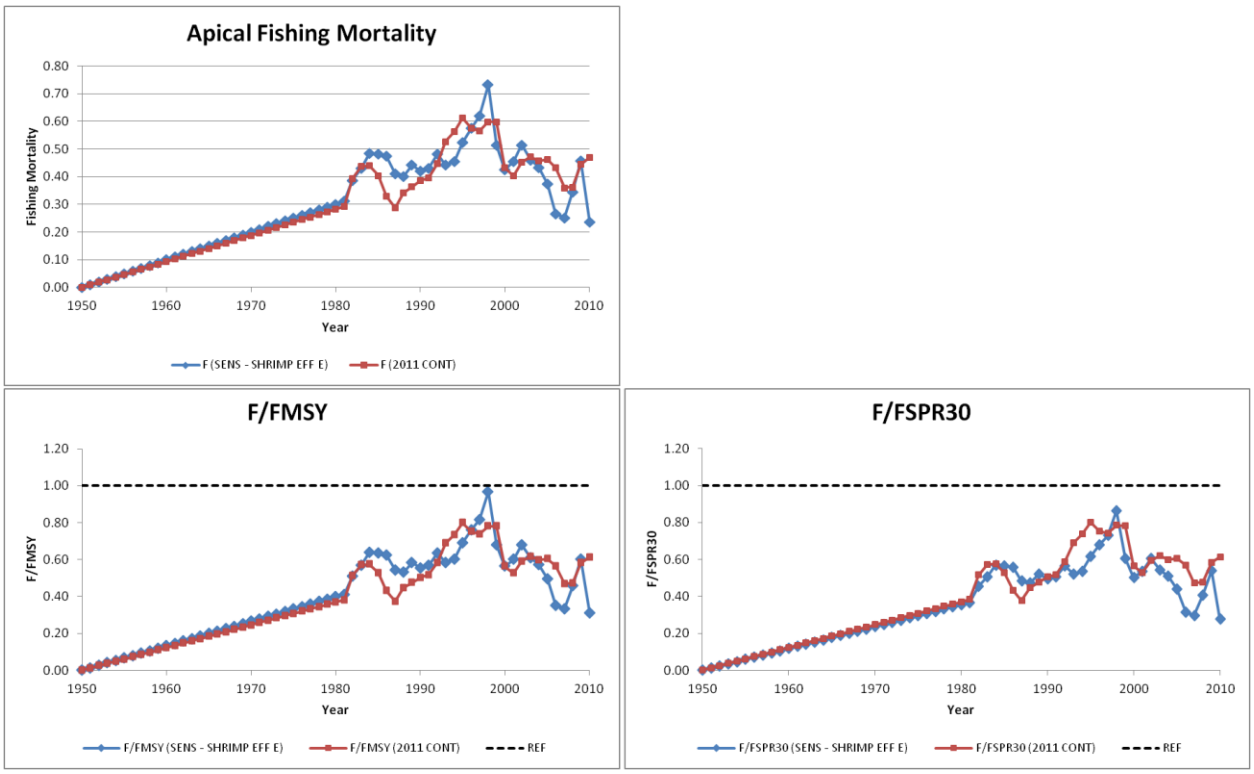


Figure 8.15. Comparison of annual estimates of F, F/F_{MSY} and $F/F_{SPR30\%}$ for the alternative run with eastern Gulf shrimp effort (blue) and the continuity run (red).

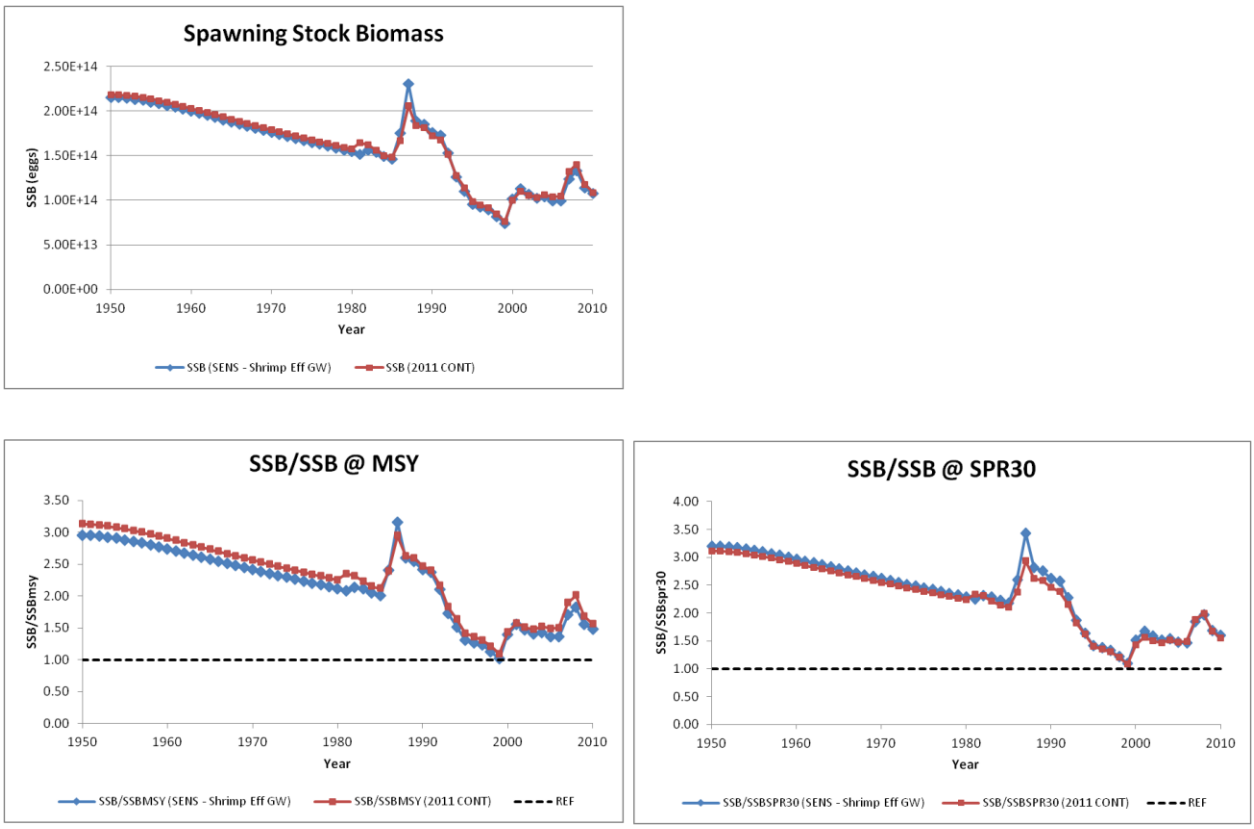


Figure 8.16. Comparison of annual estimates of SSB, SSB/SSB_{MSY} and $SSB/SSB_{SPR30\%}$ for the alternative run with Gulfwide shrimp effort (blue) and the 2011 continuity run (red).

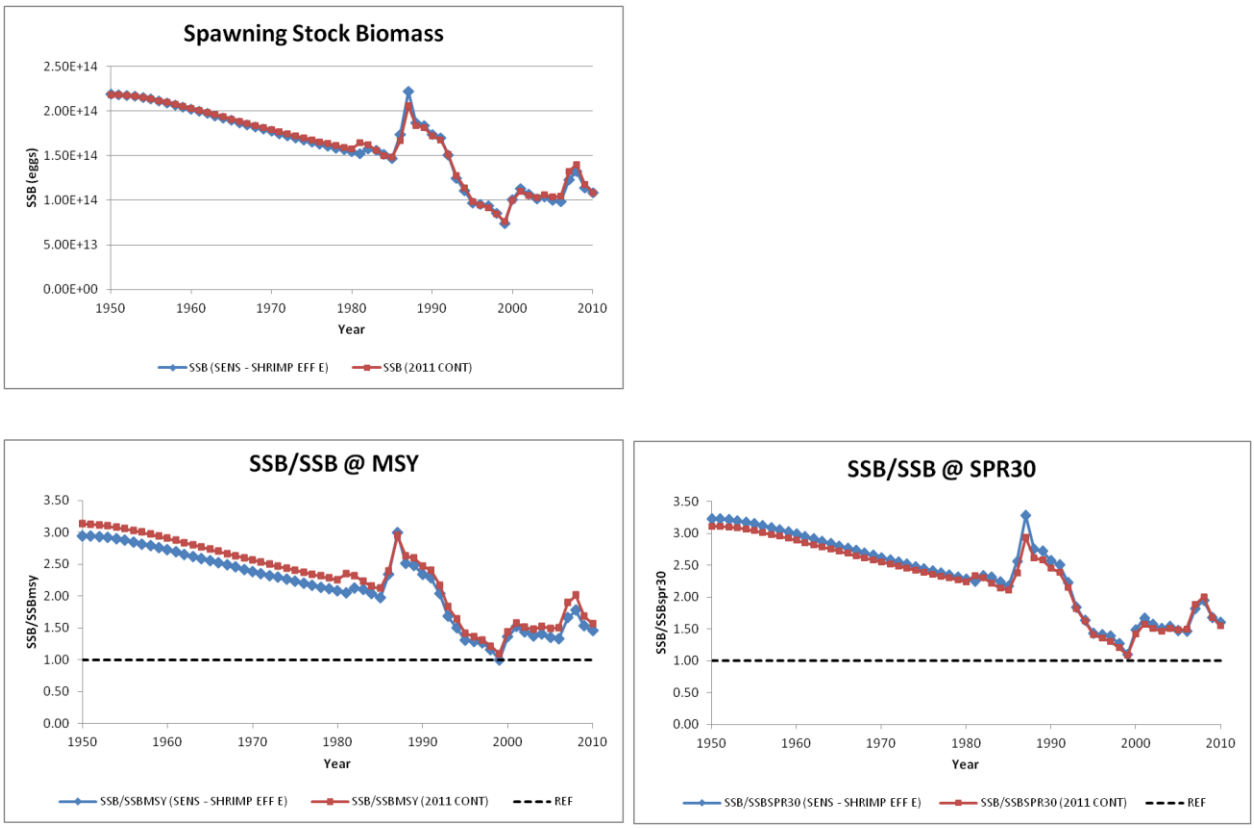


Figure 8.17. Comparison of annual estimates of SSB, SSB/SSB_{MSY} and $SSB/SSB_{SPR30\%}$ for the alternative run with eastern Gulf shrimp effort (blue) and the 2011 continuity run (red).

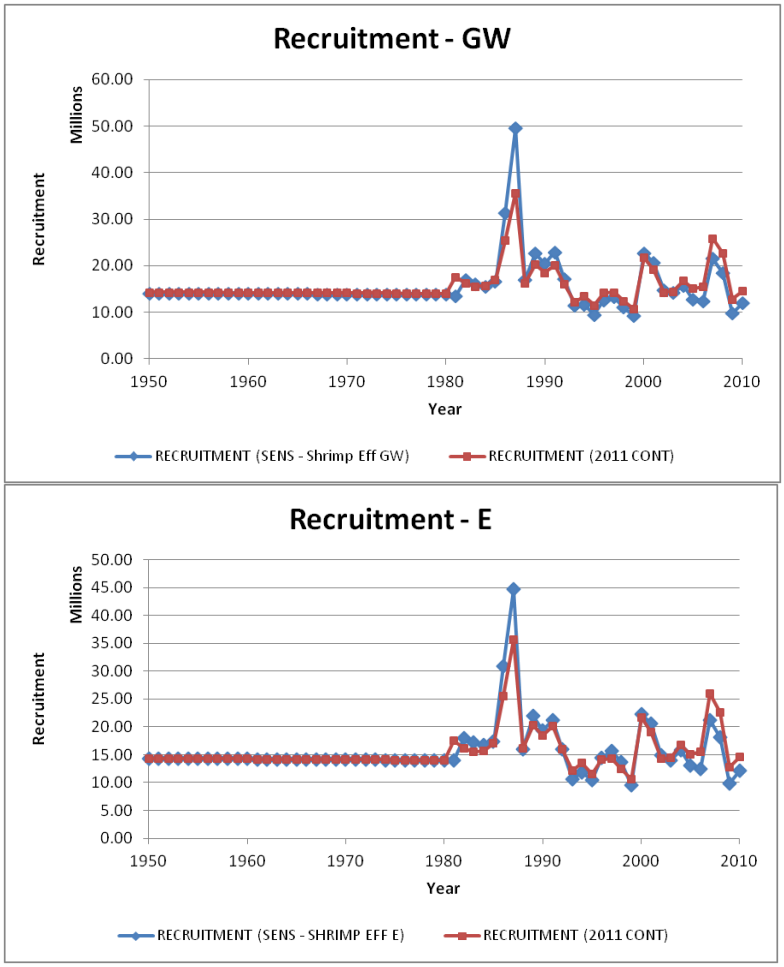


Figure 8.18. Comparison of annual estimates of recruitment (number of Age -1 individuals) for the alternative run (blue) and the 2011 continuity run (red). The alternative run with Gulfwide shrimp effort (GW) is shown on the top panel. The alternative run with eastern Gulf shrimp effort (E) is shown on the bottom panel.

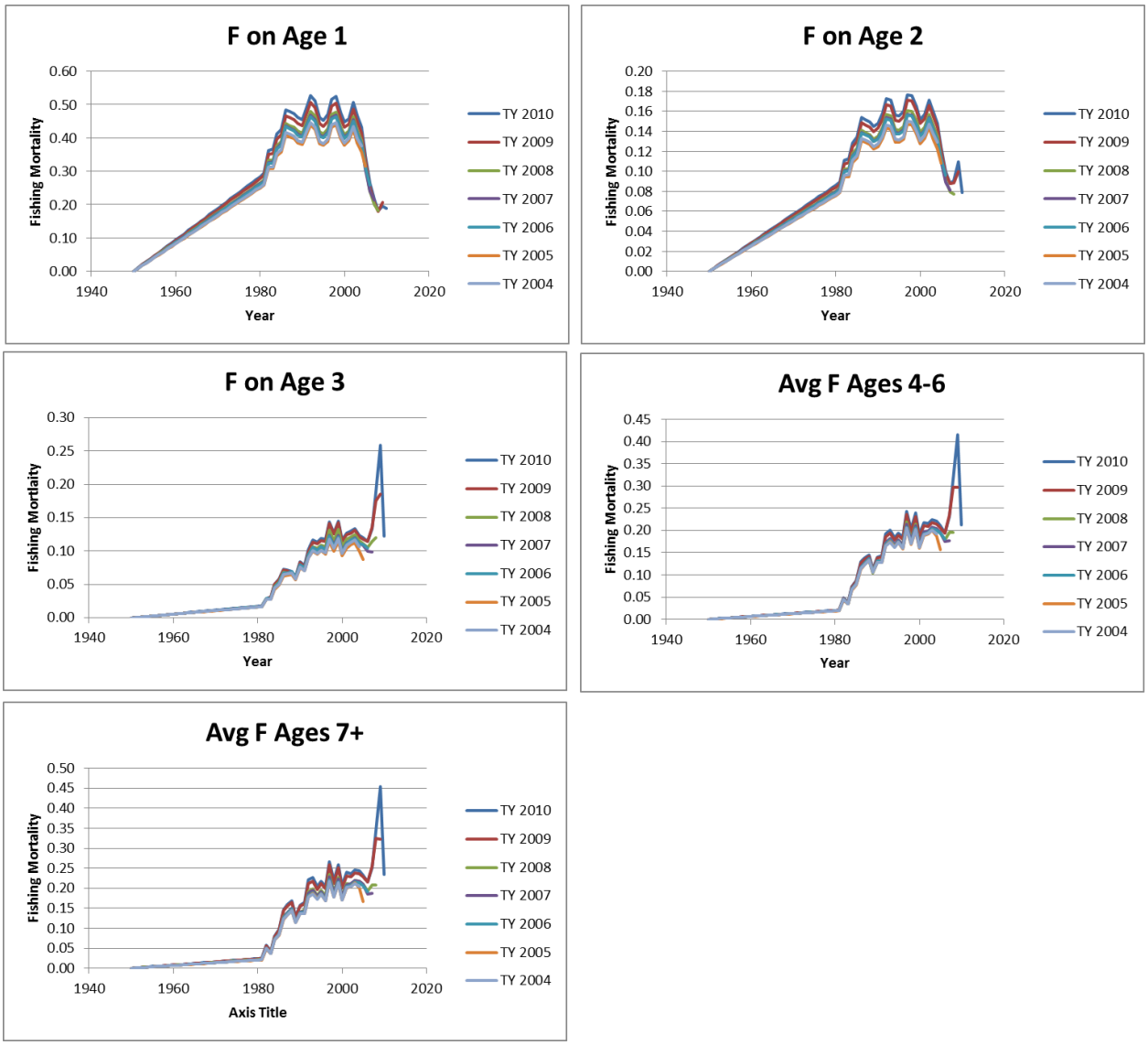


Figure 8.19. Retrospective analysis of F at age for the alternative run with Gulfwide shrimp effort.

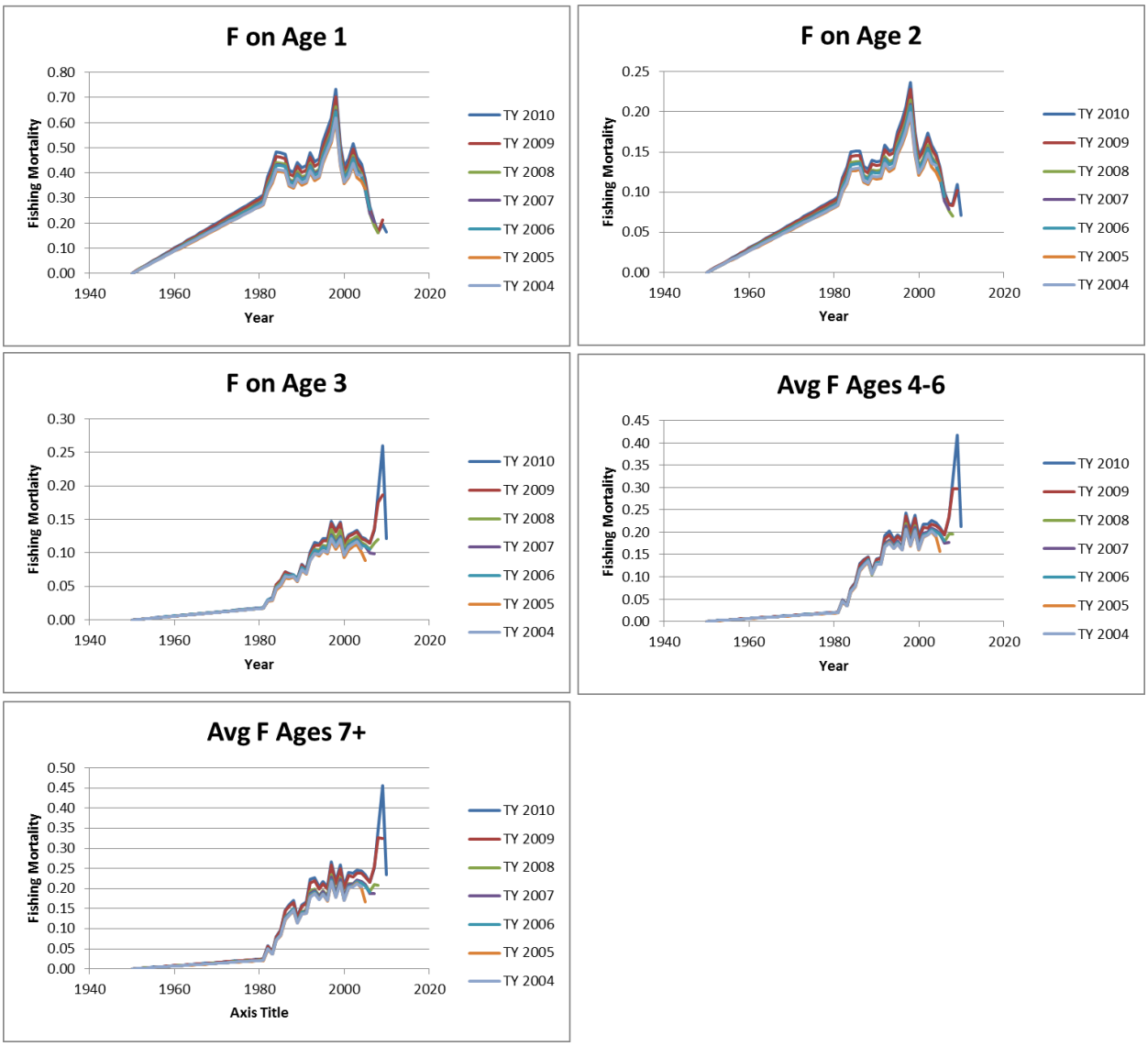


Figure 8.20. Retrospective analysis of F at age for the alternative run with eastern Gulf shrimp effort.

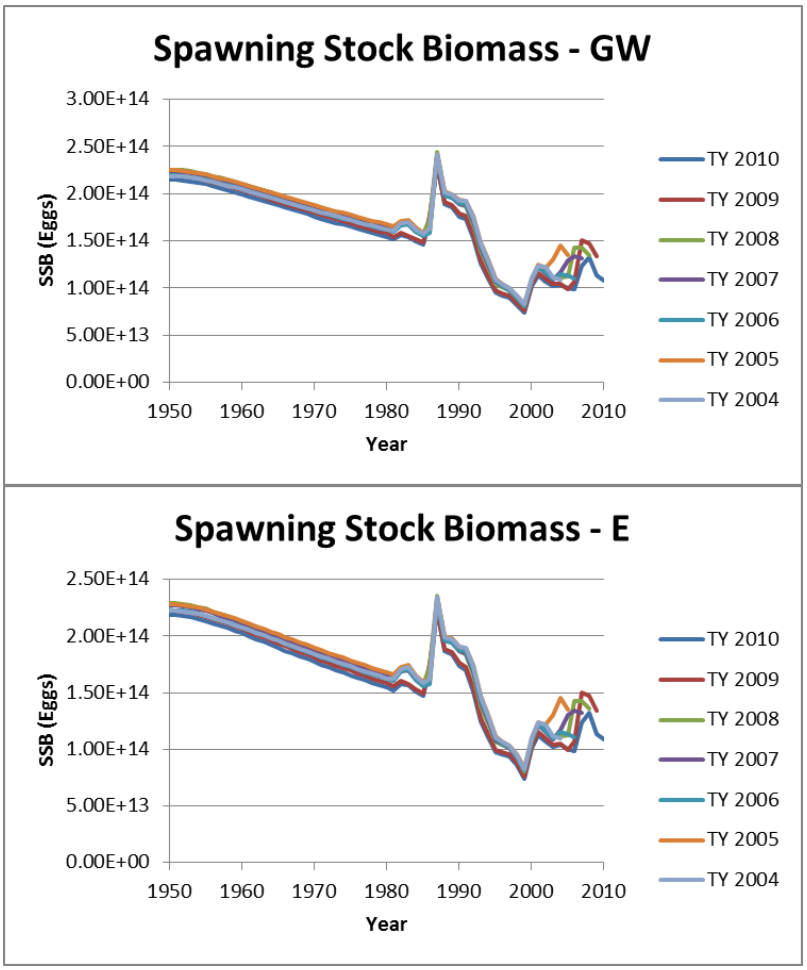


Figure 8.21. Retrospective analysis of SSB for the alternative run. The alternative run with Gulfwide shrimp effort (GW) is shown on the top panel. The alternative run with eastern Gulf shrimp effort (E) is shown on the bottom panel.

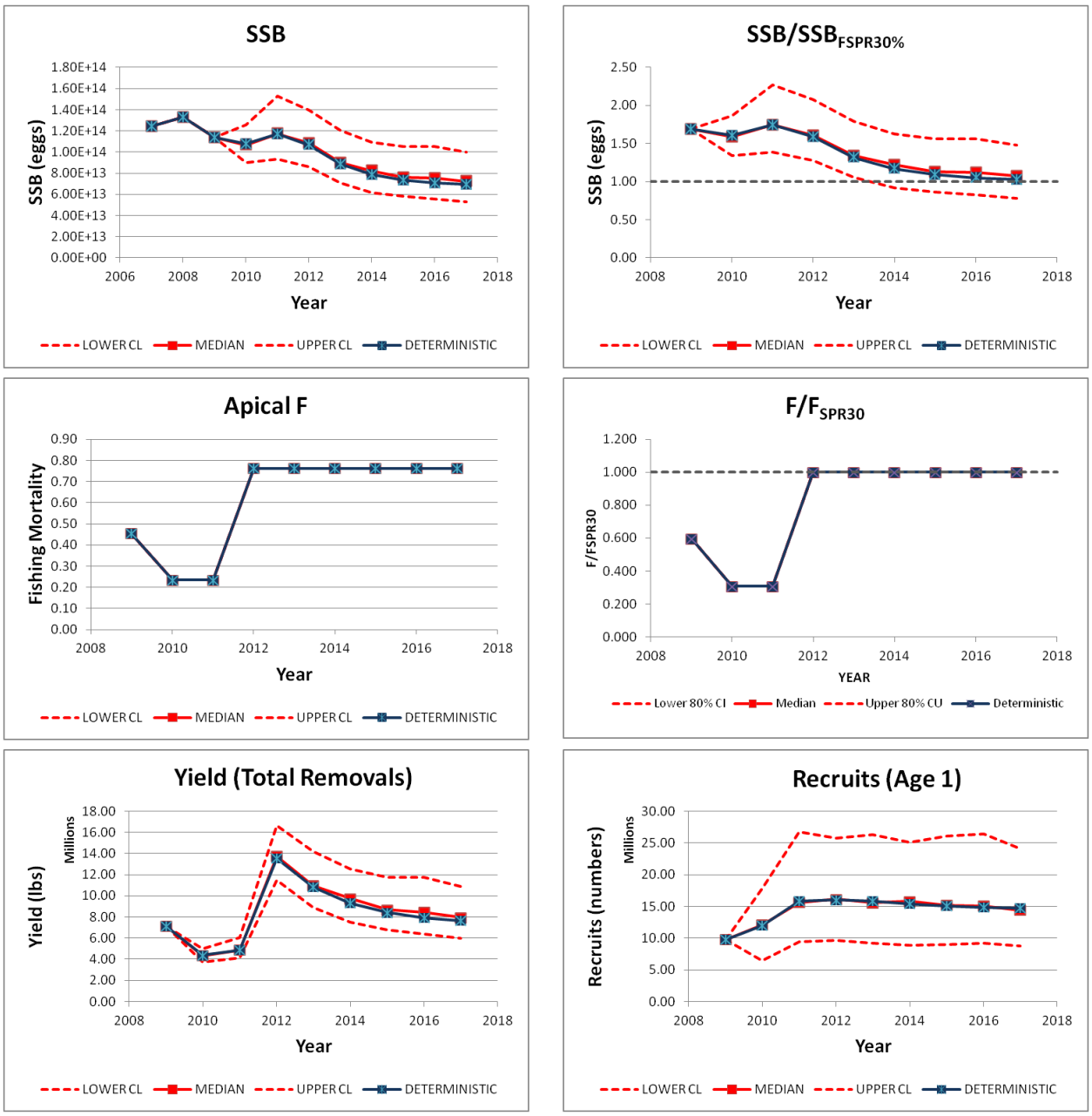


Figure 9.1. Projected SSB, SSB/SSB$_{FSPR30\%}$, F, F/F$_{SPR30\%}$, yield and recruitment for the SSASPM alternative run with Gulfwide shrimp effort projected at F$_{SPR30\%}$ (the F$_{MSY}$ proxy).

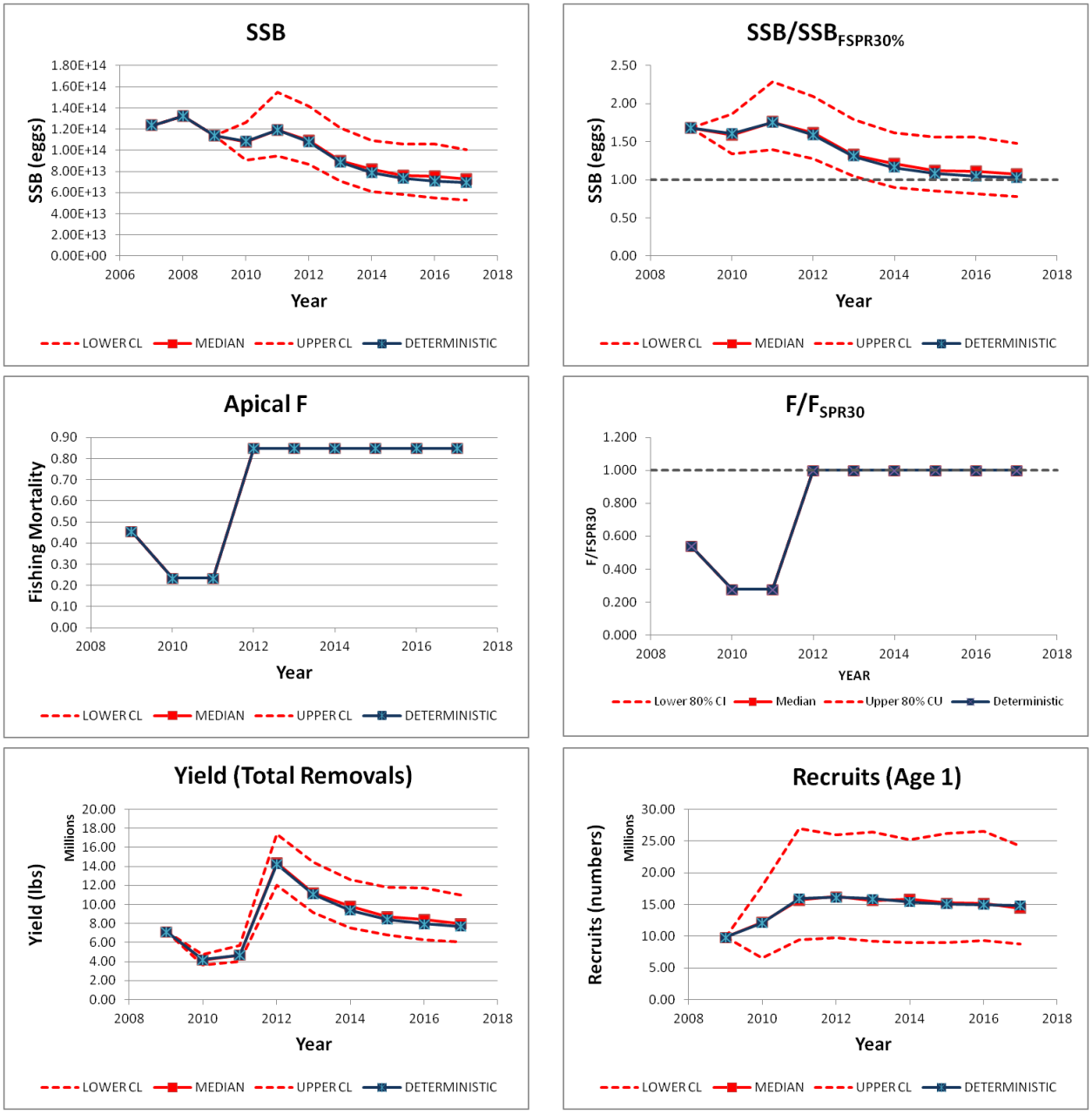


Figure 9.2. Projected SSB, SSB/SSB$_{FSPR30\%}$, F, F/F$_{SPR30\%}$, yield and recruitment for the SSASPM alternative run with eastern Gulf shrimp effort projected at F$_{SPR30\%}$ (the F$_{MSY}$ proxy).

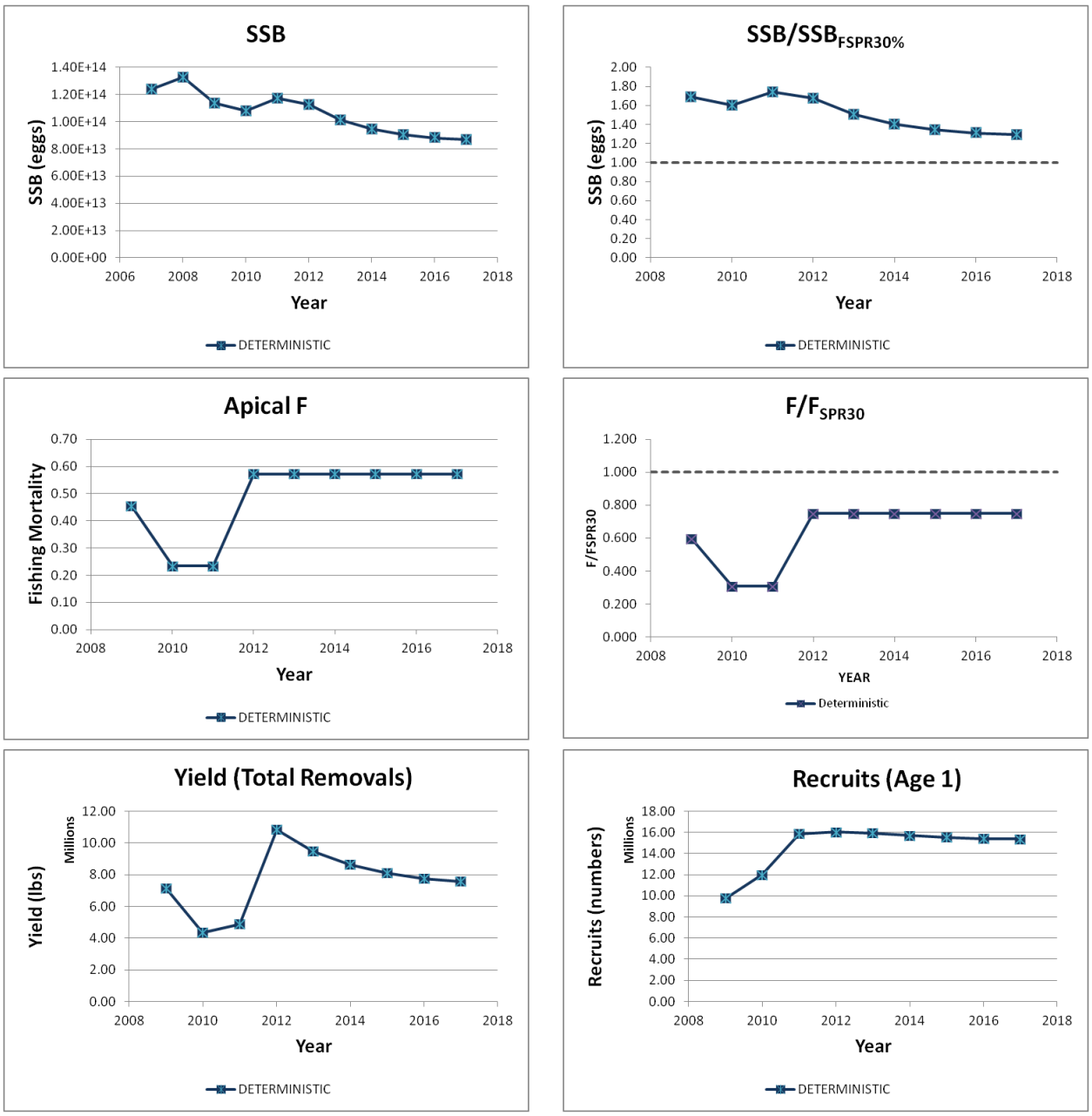


Figure 9.3. Projected SSB, SSB/$SSB_{FSPR30\%}$, F, F/$F_{SPR30\%}$, yield and recruitment for the SSASPM alternative run with Gulfwide shrimp effort projected at 75% of $F_{SPR30\%}$ (F_{OY}).

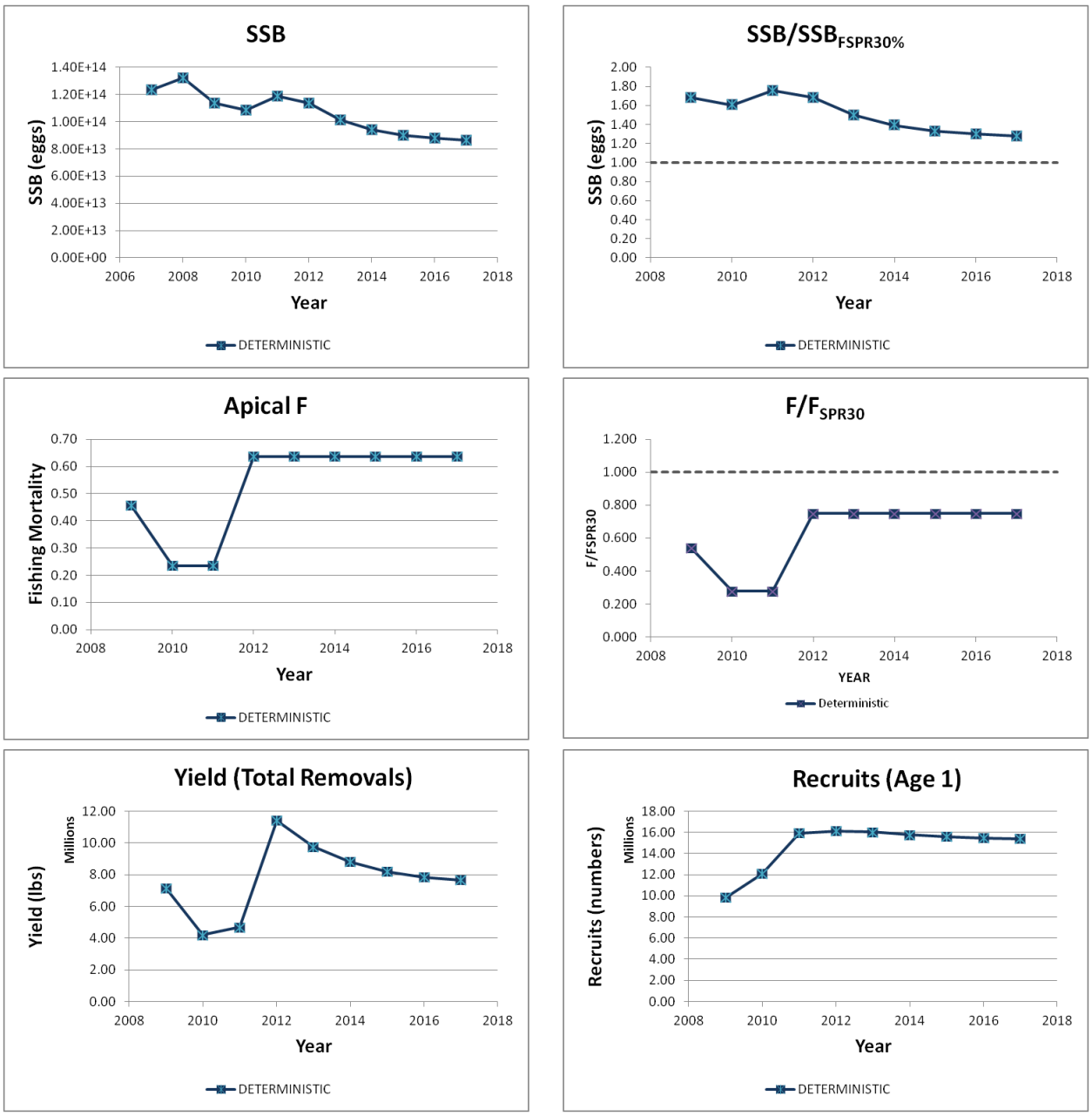


Figure 9.4. Projected SSB, $SSB/SSB_{FSPR30\%}$, F, $F/F_{SPR30\%}$, yield and recruitment for the SSASPM alternative run with eastern Gulf shrimp effort projected at 75% of $F_{SPR30\%}$ (F_{OY}).

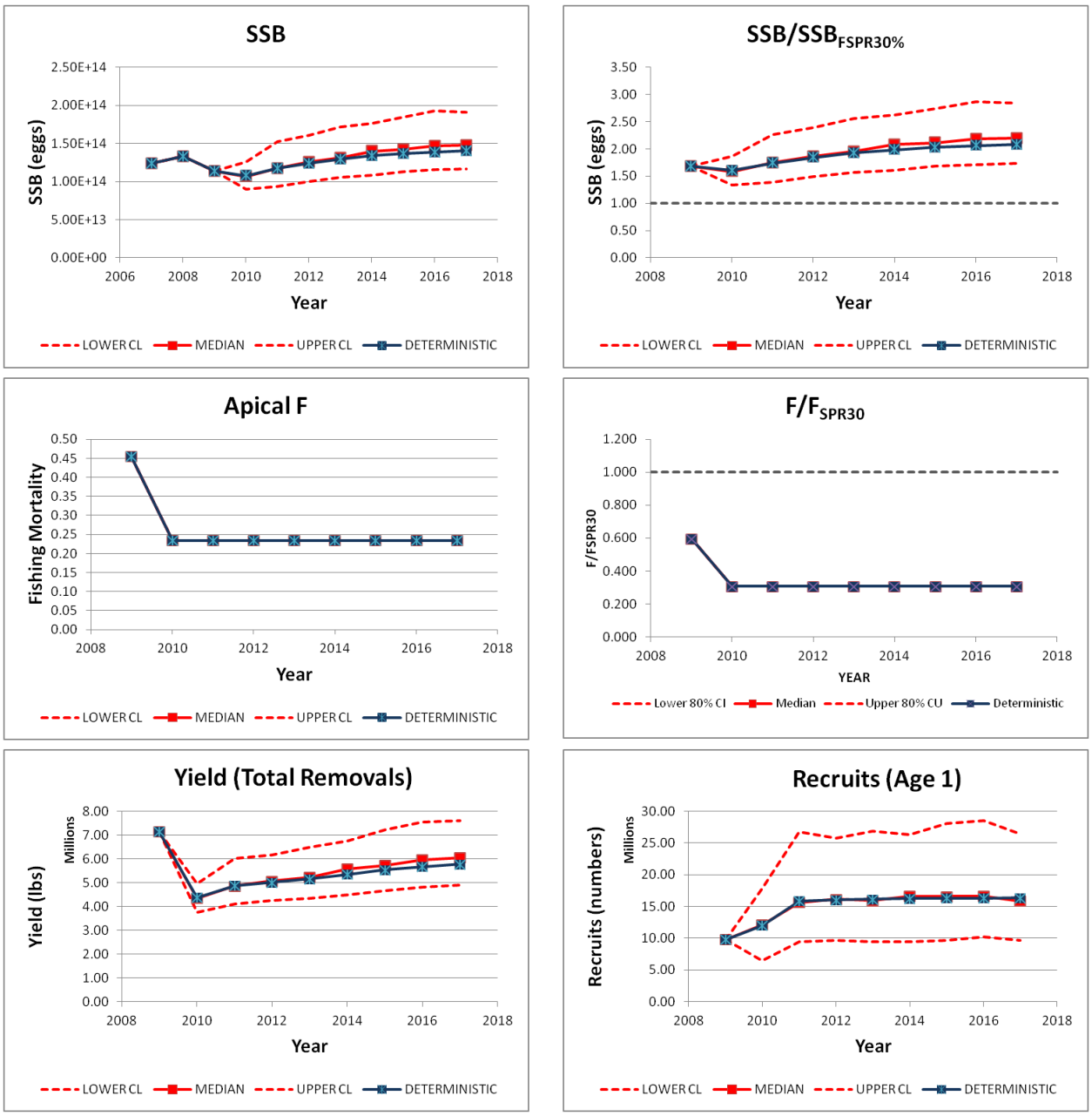


Figure 9.5. Projected SSB, SSB/SSB$_{FSPR30\%}$, F, F/F$_{SPR30\%}$, yield and recruitment for the SSASPM alternative run with Gulfwide shrimp effort projected at F$_{CURRENT}$.

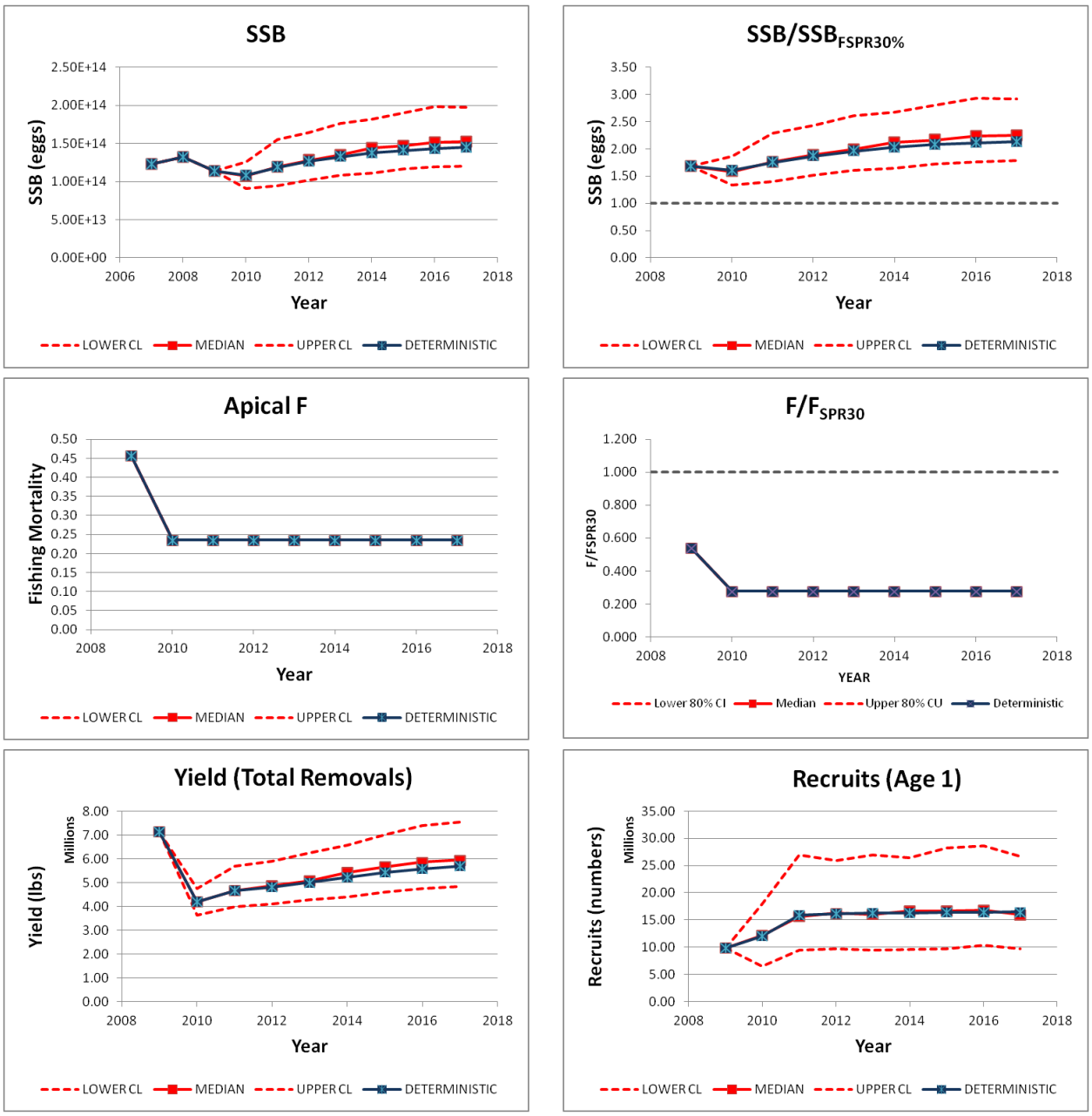


Figure 9.6. Projected SSB, $SSB/SSB_{FSPR30\%}$, F, $F/F_{SPR30\%}$, yield and recruitment for the SSASPM alternative run with eastern Gulf shrimp effort projected at $F_{CURRENT}$.

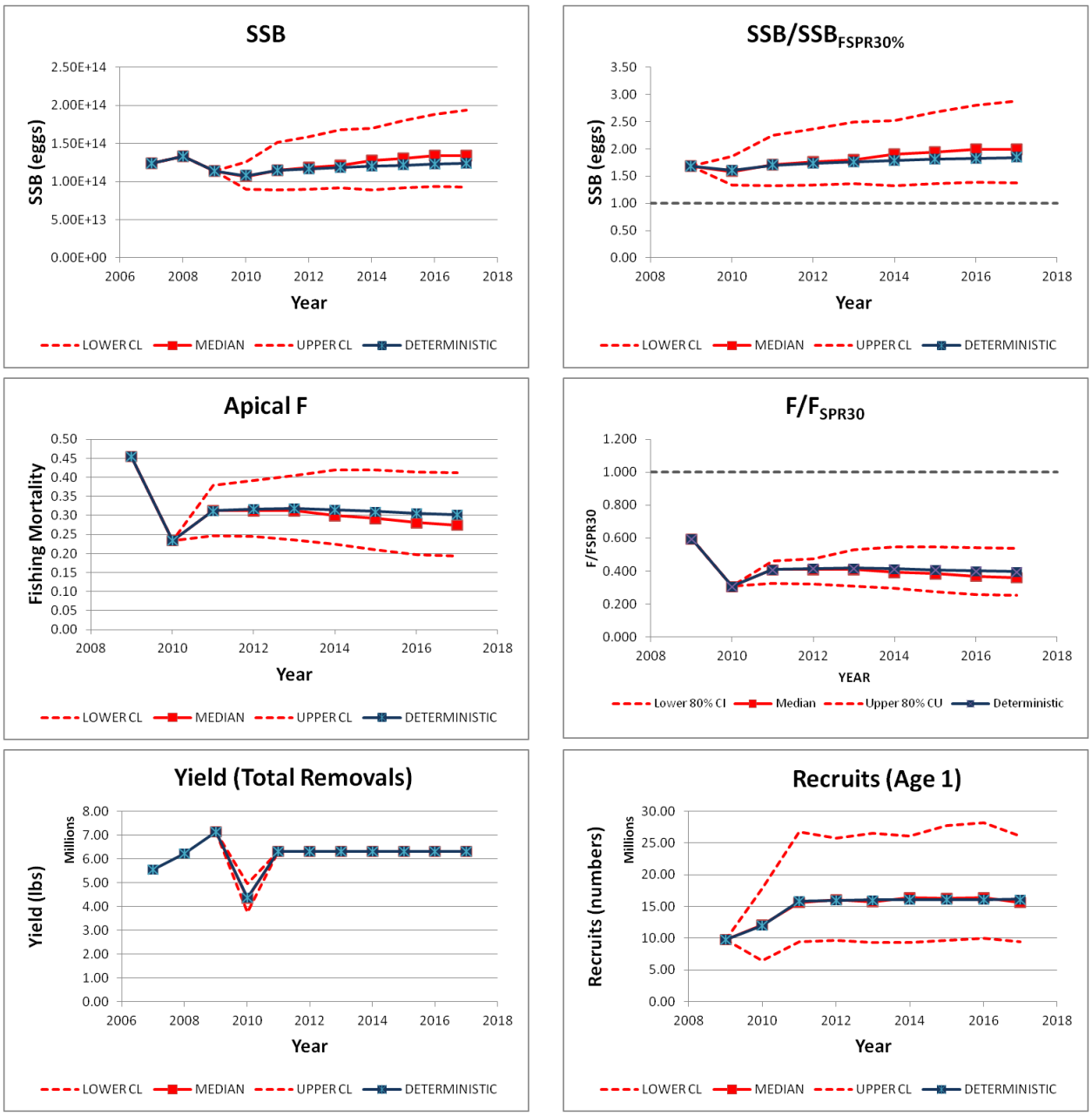


Figure 9.7. Projected SSB, SSB/SSB$_{FSPR30\%}$, F, F/F$_{SPR30\%}$, yield and recruitment for the SSASPM alternative run with Gulfwide shrimp effort projected at recent yield.

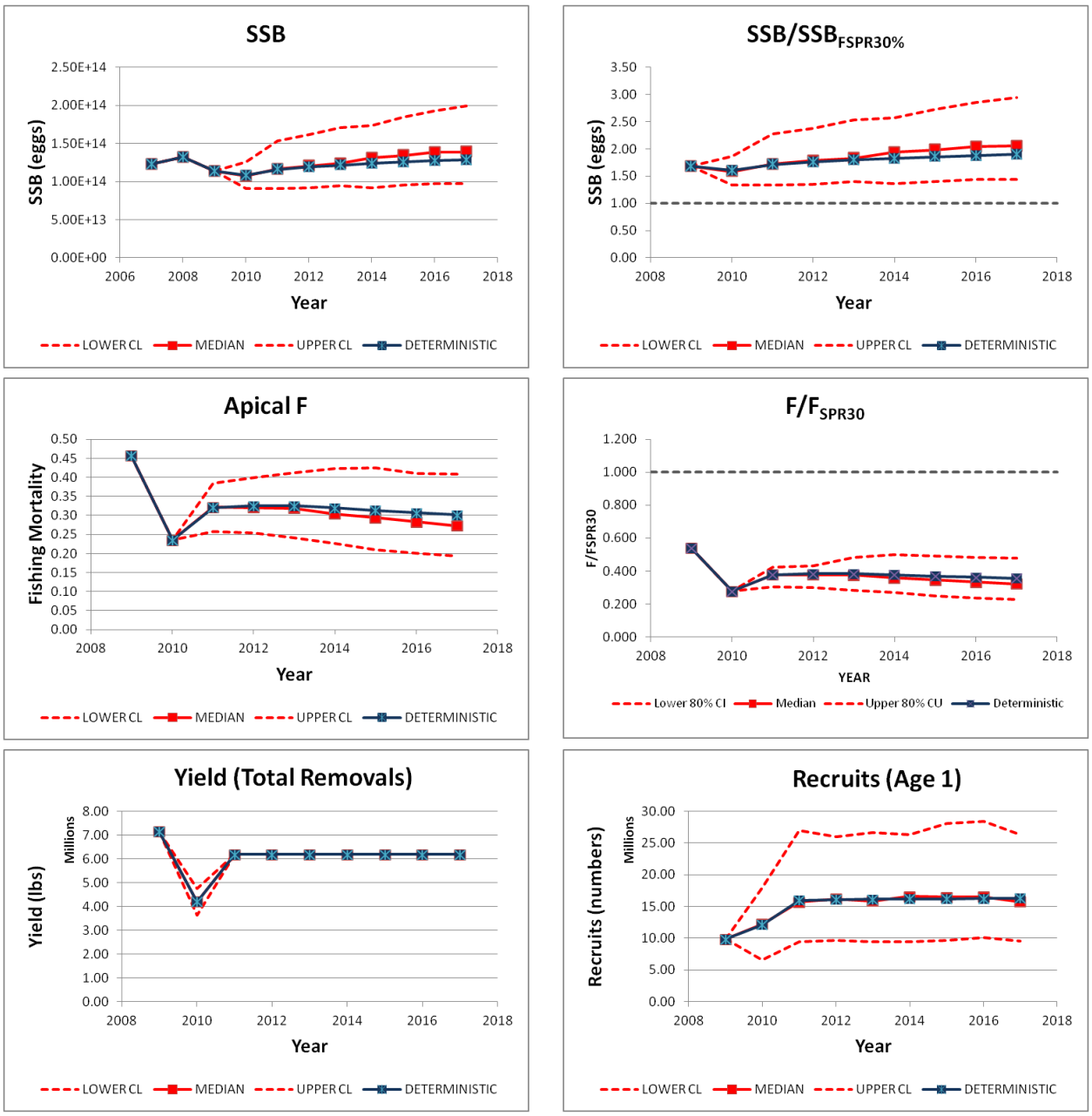


Figure 9.8. Projected SSB, SSB/SSB$_{FSPR30\%}$, F, F/F$_{SPR30\%}$, yield and recruitment for the SSASPM alternative run with eastern Gulf shrimp effort projected at recent yield.

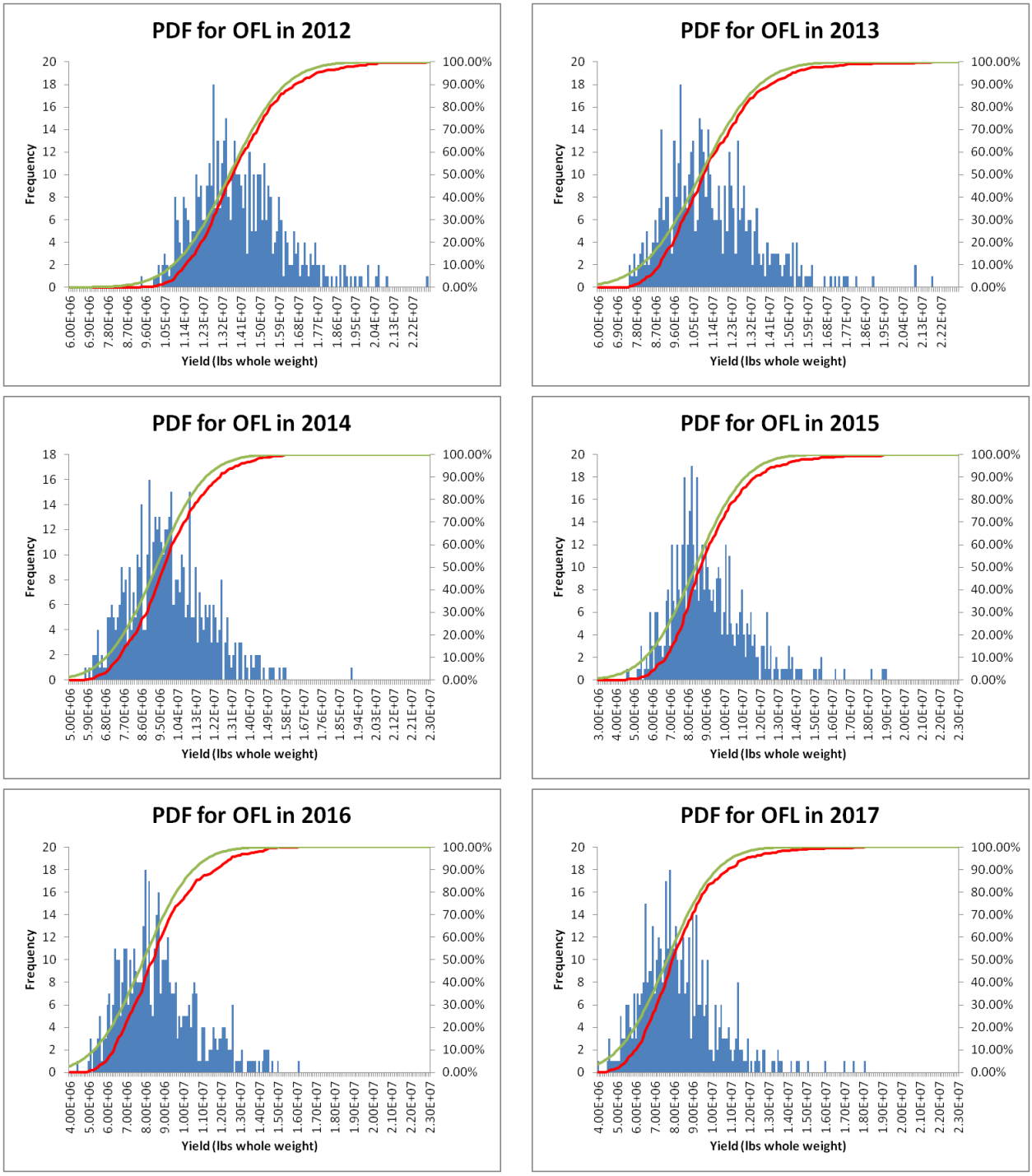


Figure 9.9. Probability density function for OFL during 2012-2017 for alternative run with Gulfwide shrimp effort. The red line is the median result. The green line is the deterministic result.

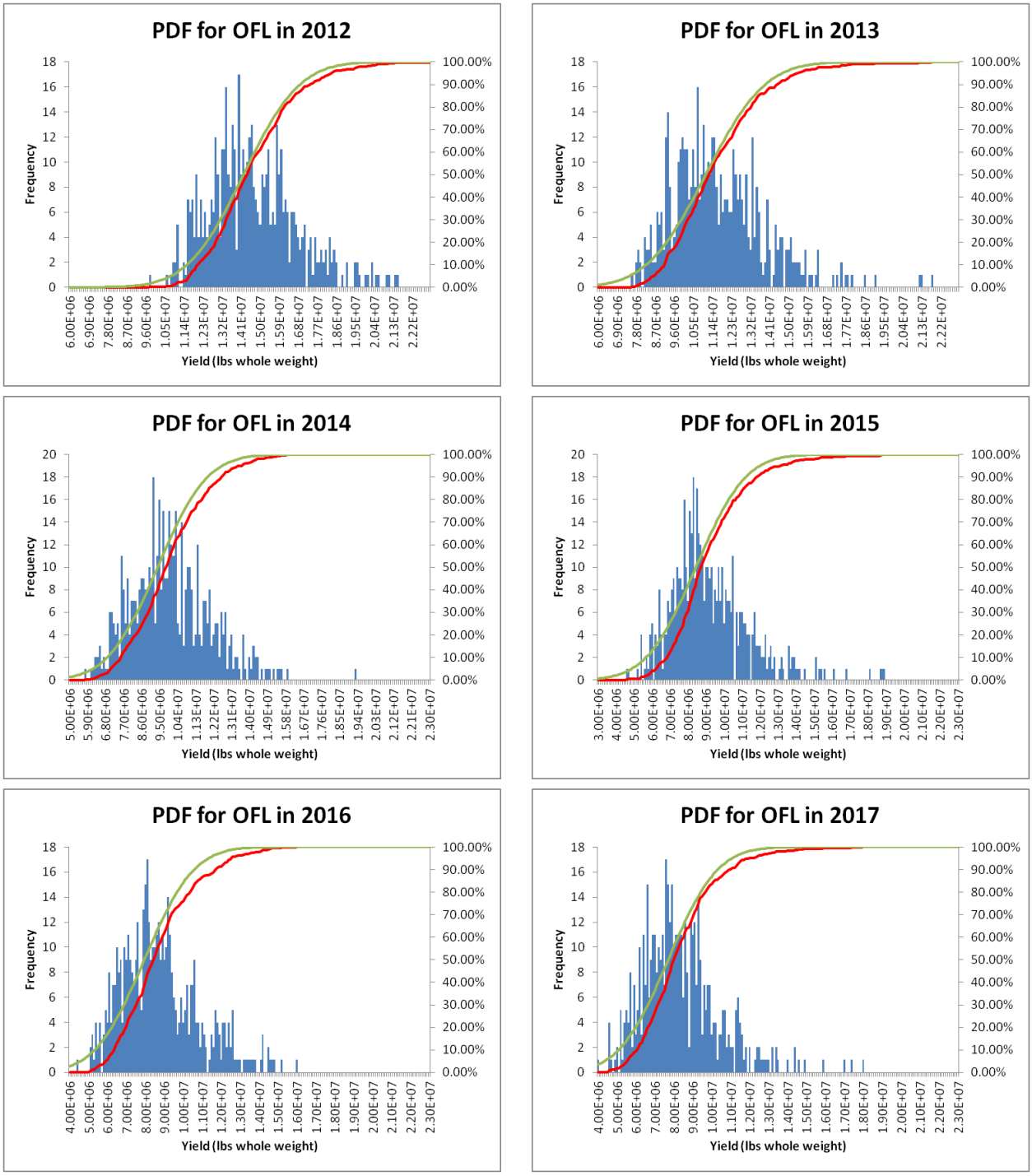


Figure 9.10. Probability density function for OFL during 2012-2017 for alternative run with eastern Gulf shrimp effort. The red line is the median result. The green line is the deterministic result.

SEDAR 9 Update Stock Assessment Report

Section II:

Addendum and Supplementary Information

SEDAR UPDATE STOCK ASSESSMENT OF VERMILION SNAPPER IN THE GULF OF MEXICO

-- ADDENDUM --

Report of Update Assessment
Southeast Fishery Science Center Staff
Miami, Florida
October, 2011

Introduction

At the Scientific and Statistical Committee (SSC) meeting held in Tampa, Florida on October 11-13, 2011, the SSC selected the alternative run with Gulfwide shrimp effort (Linton et al. 2011) as their preferred assessment model for providing management advice for Gulf of Mexico vermilion snapper (*Rhomboplites aurorubens*). They requested that the projections and reference points be calculated using the selectivity pattern derived from the geometric mean of the fishing mortality estimates from 2007-2009. They also requested the projections and reference points be calculated in terms of landings rather than total removals. The projections presented in previous update assessment reports (SEDAR 2011, Linton et al. 2011) had been calculated using the 2010 selectivity pattern and in terms of total removals (i.e., directed landings and shrimp fishery bycatch). This addendum presents reference points and projections of the alternative Gulf-wide offshore shrimp effort assessment model assuming the 2007-2009 geometric mean selectivity pattern and using the currency of landings rather than total removals.

Projection Methods

Projections were made using PRO-2BOX (Porch, 2002) in accordance with the terms of reference, as described in **Table 1**. As in the previous update assessment projection runs, the projections were made using recalculated S/R parameters that considered only the recent years of data (SEDAR 2011, Linton et al. 2011).

For all projection scenarios, in 2011 the projected catch was estimated with the assumption that F_{2011} = 2007-2009 geometric mean F. In the previous projection runs, F_{2011} was set equal to F_{2010} (SEDAR 2011, Linton et al. 2011). The SSC felt that the 2007-2009 geometric mean F would more accurately reflect recent levels of F, given the impact of the Deepwater Horizon oil spill on the 2010 fishing season. In subsequent years (2012-2017), the population was projected at constant F using the scenarios listed below.

The following scenarios were evaluated:

1) F 2012-2017 set equal to $F_{SPR30\%}$.
2) F 2012-2017 set equal to F_{OY} = 75% of $F_{SPR30\%}$.
3) F 2012-2017 set equal to $F_{CURRENT}$ = 2007-2009 geometric mean F.

In the previous projection runs, $F_{CURRENT}$ was set equal to F_{2010} (SEDAR 2011, Linton et al. 2011). As stated previously, the SSC felt that the 2007-2009 geometric mean F would more accurately reflect recent levels of F.

Two sources of model uncertainty were carried into the projections:

1) The variance in estimated numbers at age in the last year of the assessment.
2) The variance in future recruitment (SD=0.4, no autocorrelation).

Projection Results

All projected yields presented in the following results represent only yield from the directed fisheries.

The results of the projection described in Scenario 1 (FSPR30; above) are summarized in **Figure 1** and **Tables 1-6**. Since the stock is currently estimated to be above the $SSB_{FSPR30\%}$ reference level, projections at F_{SPR30} allow annual yields during 2012-2017 that are above the equilibrium yield at F_{SPR30} and fish the stock biomass down toward the equilibrium SSB_{FSPR30}. The projected apical F and F/FSPR30% are constant at F_{SPR30} throughout the projection (2012-1017). Annual recruitment estimates are nearly constant during the projection interval, although the confidence intervals are wide.

The results of the projection described in Scenario 2 (75% of FSPR30; above) are summarized in **Figure 2** and **Tables 7-12**. Since the stock is currently estimated to be above the SSB_{OY} reference level, projections at F_{OY} allow annual yields during 2012-2017 that are above the equilibrium yield at F_{OY} and fish the stock biomass down toward the equilibrium SSB_{OY}. The projected apical F and F/FSPR30% are constant at F_{OY} throughout the projection (2012-1017). Annual recruitment estimates are nearly constant during the projection interval, although the confidence intervals are wide.

The results of the projection described in Scenario 3 ($F_{CURRENT}$; above) are summarized in **Figure 3** and **Tables 13-18**. Fishing at $F_{CURRENT}$ is intended to evaluate the trajectories in SSB, F, Yield, etc. if the fleets were allowed to fish at current levels throughout the projection (e.g. no new management effort). Since the stock is currently estimated to be above MSST while $F_{CURRENT}$ is below $F_{SPR30\%}$, the trajectories of SSB and yield slowly increase during the projection interval. Recruitment is constant during the projection interval, although the confidence intervals are wide.

The benchmarks and reference points resulting from the directed yield projections are summarized in **Table 19**. Again, the selectivity pattern projected forward in time for the direct yield runs differs from the selectivity pattern used in the previous total removal projection runs (SEDAR 2011, Linton et al. 2011) due to the change from using 2010 to using the 2007-2009 geometric mean to represent current stock conditions. The benchmarks and reference points from the directed yield runs are therefore not directly comparable to the benchmarks and reference points from the total removal runs (SEDAR 2011, Linton et al. 2011). The directed yield runs suggest that vermilion snapper are not overfished, nor are they undergoing overfishing. This result does not differ substantially from the projection runs using total removals (SEDAR 2011, Linton et al. 2011).

According to the directed yield projection results (**Table 19**), equilibrium yield at the F_{MSY} proxy ($F_{SPR30\%}$) is less than equilibrium yield at F_{OY} (75% of $F_{SPR30\%}$). In this case, 75% of $F_{SPR30\%}$ (0.45) happens to be closer to the actual estimate of F_{MSY} (0.46) than the F_{MSY} proxy of $F_{SPR30\%}$ (0.60). This situation highlights one of the potential shortcomings of using a proxy for F_{MSY}.

Probability density functions for OFL were constructed by projecting at $F=F_{SPR30\%}$ during the projection interval. These PDFs can be used to produce ABC advice using the GFMSC control rule. Directed landings ranging from 1.0 mp – 9.0 mp were considered. The results are summarized in **Table 20** and **Figure 4**.

Literature Cited

Linton, B., S. L. Cass-Calay, and C. E. Porch. 2011. An Alternative SSASPM Stock Assessment of Gulf of Mexico Vermilion Snapper that Incorporates the Recent Decline in Shrimp Effort. NOAA Fisheries, Southeast Fisheries Science Center, Sustainable Fisheries Division Contribution SFD-XXXX-XXX.

Porch, C. E. 2002. PRO-2BOX user's guide (version 2.01). NOAA Fisheries, Southeast Fisheries Science Center, Sustainable Fisheries Division Contribution SFD-02/03-182.

SEDAR. 2011. SEDAR Update Stock Assessment of Vermilion Snapper in the Gulf of Mexico: Continuity Run.

Tables

Table 1. Projected SSB (eggs) for alternative run with Gulfwide shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	8.88E+13	1.12E+14	1.46E+14	1.11E+14	2.26E+13
2013	8.28E+13	1.05E+14	1.40E+14	1.03E+14	2.39E+13
2014	7.82E+13	1.04E+14	1.36E+14	9.88E+13	2.27E+13
2015	7.78E+13	1.00E+14	1.37E+14	9.64E+13	2.49E+13
2016	7.61E+13	1.01E+14	1.38E+14	9.50E+13	2.48E+13
2017	7.41E+13	9.87E+13	1.32E+14	9.42E+13	2.40E+13

Table 2. Projected $SSB/SSB_{FSPR30\%}$ for alternative run with Gulfwide shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.952	1.206	1.567	1.189	0.243
2013	0.889	1.126	1.501	1.106	0.257
2014	0.839	1.111	1.455	1.061	0.244
2015	0.834	1.074	1.466	1.034	0.267
2016	0.816	1.081	1.485	1.020	0.266
2017	0.795	1.060	1.415	1.011	0.258

Table 3. Projected fishing mortality for alternative run with Gulfwide shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.603	0.603	0.603	0.603	0.000
2013	0.603	0.603	0.603	0.603	0.000
2014	0.603	0.603	0.603	0.603	0.000
2015	0.603	0.603	0.603	0.603	0.000
2016	0.603	0.603	0.603	0.603	0.000
2017	0.603	0.603	0.603	0.603	0.000

Table 4. Projected F/FSPR30% for alternative run with Gulfwide shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.000	1.000	1.000	1.000	0.000
2013	1.000	1.000	1.000	1.000	0.000
2014	1.000	1.000	1.000	1.000	0.000
2015	1.000	1.000	1.000	1.000	0.000
2016	1.000	1.000	1.000	1.000	0.000
2017	1.000	1.000	1.000	1.000	0.000

Table 5. Projected yield (directed fisheries) in lbs for alternative run with Gulfwide shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	5.74E+06	6.64E+06	7.68E+06	6.66E+06	7.06E+05
2013	4.60E+06	5.63E+06	7.01E+06	5.60E+06	8.93E+05
2014	4.10E+06	5.09E+06	6.68E+06	5.02E+06	9.64E+05
2015	3.85E+06	4.84E+06	6.21E+06	4.69E+06	9.89E+05
2016	3.70E+06	4.69E+06	6.11E+06	4.51E+06	9.79E+05
2017	3.65E+06	4.60E+06	6.10E+06	4.40E+06	1.04E+06

Table 6. Projected recruitment (at age 1) in numbers for alternative run with Gulfwide shrimp effort.

PROJECT FSPR30%

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	9.65E+06	1.61E+07	2.57E+07	1.60E+07	6.96E+06
2013	9.23E+06	1.56E+07	2.64E+07	1.59E+07	7.23E+06
2014	9.14E+06	1.62E+07	2.57E+07	1.57E+07	6.65E+06
2015	9.35E+06	1.59E+07	2.71E+07	1.56E+07	7.58E+06
2016	9.69E+06	1.59E+07	2.75E+07	1.56E+07	6.92E+06
2017	9.17E+06	1.51E+07	2.52E+07	1.55E+07	7.24E+06

Table 7. Projected SSB (eggs) for alternative run with Gulfwide shrimp effort.

PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.15E+14	0.00E+00
2013	N/A	N/A	N/A	1.13E+14	0.00E+00
2014	N/A	N/A	N/A	1.12E+14	0.00E+00
2015	N/A	N/A	N/A	1.12E+14	0.00E+00
2016	N/A	N/A	N/A	1.11E+14	0.00E+00
2017	N/A	N/A	N/A	1.11E+14	0.00E+00

Table 8. Projected $SSB/SSB_{FSPR30\%}$ for altenative run with Gulfwide shrimp effort.

PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.234	0.000
2013	N/A	N/A	N/A	1.213	0.000
2014	N/A	N/A	N/A	1.202	0.000
2015	N/A	N/A	N/A	1.196	0.000
2016	N/A	N/A	N/A	1.192	0.000
2017	N/A	N/A	N/A	1.190	0.000

Table 9. Projected fishing mortality for alternative run with Gulfwide shrimp effort.

PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	0.453	0.000
2013	N/A	N/A	N/A	0.453	0.000
2014	N/A	N/A	N/A	0.453	0.000
2015	N/A	N/A	N/A	0.453	0.000
2016	N/A	N/A	N/A	0.453	0.000
2017	N/A	N/A	N/A	0.453	0.000

Table 10. Projected F/FSPR30% for alternative run with Gulfwide shrimp effort.

PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	0.750	0.000
2013	N/A	N/A	N/A	0.750	0.000
2014	N/A	N/A	N/A	0.750	0.000
2015	N/A	N/A	N/A	0.750	0.000
2016	N/A	N/A	N/A	0.750	0.000
2017	N/A	N/A	N/A	0.750	0.000

Table 11. Projected yield (directed fisheries) in lbs for alternative run with Gulfwide shrimp effort.
PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	5.28E+06	0.00E+00
2013	N/A	N/A	N/A	4.88E+06	0.00E+00
2014	N/A	N/A	N/A	4.73E+06	0.00E+00
2015	N/A	N/A	N/A	4.66E+06	0.00E+00
2016	N/A	N/A	N/A	4.62E+06	0.00E+00
2017	N/A	N/A	N/A	4.59E+06	0.00E+00

Table 12. Projected recruitment (at age 1) in numbers for alternative run with Gulfwide shrimp effort.
PROJECT 75% FSPR30

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	N/A	N/A	N/A	1.60E+07	0.00E+00
2013	N/A	N/A	N/A	1.60E+07	0.00E+00
2014	N/A	N/A	N/A	1.59E+07	0.00E+00
2015	N/A	N/A	N/A	1.59E+07	0.00E+00
2016	N/A	N/A	N/A	1.59E+07	0.00E+00
2017	N/A	N/A	N/A	1.59E+07	0.00E+00

Table 13. Projected SSB (eggs) for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	9.49E+13	1.20E+14	1.55E+14	1.18E+14	2.38E+13
2013	9.83E+13	1.23E+14	1.62E+14	1.21E+14	2.67E+13
2014	9.94E+13	1.29E+14	1.65E+14	1.24E+14	2.64E+13
2015	1.03E+14	1.31E+14	1.72E+14	1.25E+14	2.91E+13
2016	1.04E+14	1.34E+14	1.77E+14	1.26E+14	2.94E+13
2017	1.04E+14	1.33E+14	1.75E+14	1.27E+14	2.88E+13

Table 14. Projected $SSB/SSB_{FSPR30\%}$ for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	1.018	1.284	1.660	1.268	0.256
2013	1.055	1.323	1.743	1.301	0.286
2014	1.066	1.389	1.774	1.326	0.283
2015	1.106	1.401	1.841	1.344	0.312
2016	1.116	1.436	1.903	1.354	0.315
2017	1.113	1.428	1.879	1.362	0.309

Table 15. Projected fishing mortality for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.340	0.340	0.340	0.340	0.000
2013	0.340	0.340	0.340	0.340	0.000
2014	0.340	0.340	0.340	0.340	0.000
2015	0.340	0.340	0.340	0.340	0.000
2016	0.340	0.340	0.340	0.340	0.000
2017	0.340	0.340	0.340	0.340	0.000

Table 16. Projected F/FSPR30% for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	0.564	0.564	0.564	0.564	0.000
2013	0.564	0.564	0.564	0.564	0.000
2014	0.564	0.564	0.564	0.564	0.000
2015	0.564	0.564	0.564	0.564	0.000
2016	0.564	0.564	0.564	0.564	0.000
2017	0.564	0.564	0.564	0.564	0.000

Table 17. Projected yield (directed fisheries) in lbs for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	3.58E+06	4.13E+06	4.75E+06	4.13E+06	4.32E+05
2013	3.42E+06	4.14E+06	5.08E+06	4.12E+06	6.08E+05
2014	3.52E+06	4.28E+06	5.50E+06	4.23E+06	7.49E+05
2015	3.61E+06	4.48E+06	5.68E+06	4.36E+06	8.45E+05
2016	3.71E+06	4.63E+06	5.89E+06	4.45E+06	8.78E+05
2017	3.80E+06	4.77E+06	6.04E+06	4.51E+06	9.36E+05

Table 18. Projected recruitment (at age 1) in numbers for alternative run with Gulfwide shrimp effort.

PROJECT F CURRENT

YEAR	Lower 80% CI	Median	Upper 80% CU	Deterministic	Std. Dev.
2012	9.65E+06	1.61E+07	2.57E+07	1.60E+07	6.96E+06
2013	9.31E+06	1.58E+07	2.67E+07	1.60E+07	7.28E+06
2014	9.40E+06	1.65E+07	2.61E+07	1.61E+07	6.79E+06
2015	9.62E+06	1.64E+07	2.78E+07	1.61E+07	7.78E+06
2016	1.01E+07	1.65E+07	2.83E+07	1.61E+07	7.14E+06
2017	9.52E+06	1.57E+07	2.62E+07	1.62E+07	7.52E+06

Table 19. Required SFA and MSRA evaluations for the alternative run with Gulfwide shrimp effort. SSB measures are in eggs.

Criteria	Definition	Alt Run w/ Gulfwide Shrimp Effort
Mortality Rate Criteria		
F_{MSY}	SEDAR 9 used $F_{SPR30\%}$ as proxy	0.60
MFMT (Amend 23)	$F_{SPR30\%}$	0.60
F_{OY} (Amend 23)	75% of $F_{SPR30\%}$	0.45
$F_{CURRENT}$	2007-2009 mean F	0.34
$F_{CURRENT}$/MFMT	2007-2009 mean F/$F_{SPR30\%}$	0.57
Base M	M = 0.25 all ages	0.25
Biomass Criteria		
SSB_{MSY}	Equil. egg production @ $F_{SPR30\%}$	9.32E+13
MSST	(I-M)*$SSB_{SPR30\%}$ where M=0.25	6.99E+13
$SSB_{CURRENT}$	SSB_{2010}	1.08E+14
$SSB_{CURRENT}/SSB_{MSY}$	$SSB_{2010}/SSB_{SPR30\%}$	1.16
$SSB_{CURRENT}$/MSST		1.54
Equilibrium MSY	Equilibrium Yield @ $F_{SPR30\%}$	4.27 mp (WW)
Equilibrium OY	Equilibrium Yield @ 75% of $F_{SPR30\%}$	4.56 mp (WW)
OFL (Directed Fisheries)	Annual Yield @ MFMT	
	2012	6.66 mp
	2013	5.60 mp
	2014	5.02 mp
	2015	4.69 mp
	2016	4.51 mp
	2017	4.40 mp
Annual OY (Directed Fisheries)	Annual Yield @ F_{OY}	
	2012	5.28 mp
	2013	4.88 mp
	2014	4.73 mp
	2015	4.66 mp
	2016	4.62 mp
	2017	4.59 mp

Table 20. Probability density functions for OFL in 2012-2017.

	Probability of Exceeding OFL					
YIELD (mp)	2012	2013	2014	2015	2016	2017
1,000,000	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
1,100,000	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
1,200,000	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
1,300,000	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
1,400,000	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%
1,500,000	0.0%	0.0%	0.0%	0.1%	0.1%	0.3%
1,600,000	0.0%	0.0%	0.0%	0.1%	0.1%	0.3%
1,700,000	0.0%	0.0%	0.0%	0.1%	0.2%	0.5%
1,800,000	0.0%	0.0%	0.0%	0.2%	0.3%	0.6%
1,900,000	0.0%	0.0%	0.1%	0.2%	0.4%	0.8%
2,000,000	0.0%	0.0%	0.1%	0.3%	0.5%	1.0%
2,100,000	0.0%	0.0%	0.1%	0.4%	0.7%	1.3%
2,200,000	0.0%	0.0%	0.2%	0.6%	0.9%	1.7%
2,300,000	0.0%	0.0%	0.2%	0.8%	1.2%	2.1%
2,400,000	0.0%	0.0%	0.3%	1.0%	1.6%	2.7%
2,500,000	0.0%	0.0%	0.4%	1.3%	2.0%	3.3%
2,600,000	0.0%	0.0%	0.6%	1.7%	2.6%	4.1%
2,700,000	0.0%	0.1%	0.8%	2.2%	3.3%	5.0%
2,800,000	0.0%	0.1%	1.1%	2.8%	4.1%	6.1%
2,900,000	0.0%	0.1%	1.4%	3.5%	5.0%	7.4%
3,000,000	0.0%	0.2%	1.8%	4.3%	6.2%	8.8%
3,100,000	0.0%	0.3%	2.3%	5.4%	7.6%	10.5%
3,200,000	0.0%	0.4%	2.9%	6.5%	9.1%	12.3%
3,300,000	0.0%	0.5%	3.7%	7.9%	10.9%	14.4%
3,400,000	0.0%	0.7%	4.6%	9.5%	12.9%	16.7%
3,500,000	0.0%	0.9%	5.7%	11.4%	15.2%	19.2%
3,600,000	0.0%	1.3%	7.0%	13.4%	17.8%	22.0%
3,700,000	0.0%	1.7%	8.5%	15.7%	20.5%	24.9%
3,800,000	0.0%	2.2%	10.2%	18.3%	23.6%	28.1%
3,900,000	0.0%	2.9%	12.2%	21.1%	26.8%	31.4%
4,000,000	0.0%	3.7%	14.4%	24.1%	30.3%	34.9%
4,100,000	0.0%	4.7%	16.9%	27.4%	33.9%	38.6%
4,200,000	0.0%	5.9%	19.6%	30.9%	37.8%	42.3%
4,300,000	0.0%	7.3%	22.6%	34.5%	41.7%	46.1%
4,400,000	0.1%	9.0%	25.9%	38.3%	45.7%	50.0%
4,500,000	0.1%	11.0%	29.3%	42.2%	49.8%	53.8%
4,600,000	0.2%	13.2%	33.0%	46.2%	53.9%	57.6%
4,700,000	0.3%	15.7%	36.8%	50.2%	57.9%	61.4%
4,800,000	0.4%	18.6%	40.8%	54.3%	61.8%	65.0%
4,900,000	0.6%	21.7%	44.9%	58.2%	65.7%	68.5%
5,000,000	0.9%	25.2%	49.0%	62.1%	69.4%	71.8%

Table 20 *continued*... Probability density functions for OFL in 2012-2017.

	Probability of Exceeding OFL					
YIELD (mp)	2012	2013	2014	2015	2016	2017
5,100,000	1.4%	28.9%	53.1%	65.9%	72.8%	75.0%
5,200,000	1.9%	32.8%	57.2%	69.6%	76.1%	78.0%
5,300,000	2.7%	37.0%	61.3%	73.0%	79.2%	80.7%
5,400,000	3.7%	41.3%	65.2%	76.2%	82.0%	83.3%
5,500,000	5.0%	45.7%	68.9%	79.2%	84.5%	85.6%
5,600,000	6.7%	50.1%	72.5%	82.0%	86.8%	87.6%
5,700,000	8.7%	54.6%	75.8%	84.5%	88.9%	89.5%
5,800,000	11.2%	59.0%	79.0%	86.8%	90.7%	91.2%
5,900,000	14.1%	63.3%	81.8%	88.9%	92.3%	92.6%
6,000,000	17.6%	67.4%	84.4%	90.7%	93.7%	93.9%
6,100,000	21.5%	71.3%	86.8%	92.2%	94.8%	95.0%
6,200,000	25.8%	75.0%	88.9%	93.6%	95.8%	95.9%
6,300,000	30.6%	78.5%	90.7%	94.8%	96.7%	96.7%
6,400,000	35.7%	81.6%	92.3%	95.8%	97.4%	97.3%
6,500,000	41.1%	84.4%	93.7%	96.6%	97.9%	97.9%
6,600,000	46.7%	86.9%	94.9%	97.3%	98.4%	98.3%
6,700,000	52.4%	89.2%	95.9%	97.9%	98.8%	98.7%
6,800,000	58.0%	91.1%	96.7%	98.3%	99.0%	99.0%
6,900,000	63.4%	92.8%	97.4%	98.7%	99.3%	99.2%
7,000,000	68.6%	94.2%	98.0%	99.0%	99.5%	99.4%
7,100,000	73.4%	95.4%	98.4%	99.3%	99.6%	99.5%
7,200,000	77.9%	96.4%	98.8%	99.4%	99.7%	99.7%
7,300,000	81.9%	97.2%	99.1%	99.6%	99.8%	99.7%
7,400,000	85.3%	97.8%	99.3%	99.7%	99.8%	99.8%
7,500,000	88.4%	98.3%	99.5%	99.8%	99.9%	99.9%
7,600,000	90.9%	98.8%	99.6%	99.8%	99.9%	99.9%
7,700,000	93.0%	99.1%	99.7%	99.9%	99.9%	99.9%
7,800,000	94.7%	99.3%	99.8%	99.9%	100.0%	99.9%
7,900,000	96.1%	99.5%	99.9%	99.9%	100.0%	100.0%
8,000,000	97.1%	99.6%	99.9%	100.0%	100.0%	100.0%
8,100,000	97.9%	99.7%	99.9%	100.0%	100.0%	100.0%
8,200,000	98.6%	99.8%	100.0%	100.0%	100.0%	100.0%
8,300,000	99.0%	99.9%	100.0%	100.0%	100.0%	100.0%
8,400,000	99.3%	99.9%	100.0%	100.0%	100.0%	100.0%
8,500,000	99.5%	99.9%	100.0%	100.0%	100.0%	100.0%
8,600,000	99.7%	100.0%	100.0%	100.0%	100.0%	100.0%
8,700,000	99.8%	100.0%	100.0%	100.0%	100.0%	100.0%
8,800,000	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%
8,900,000	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%
9,000,000	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Figures

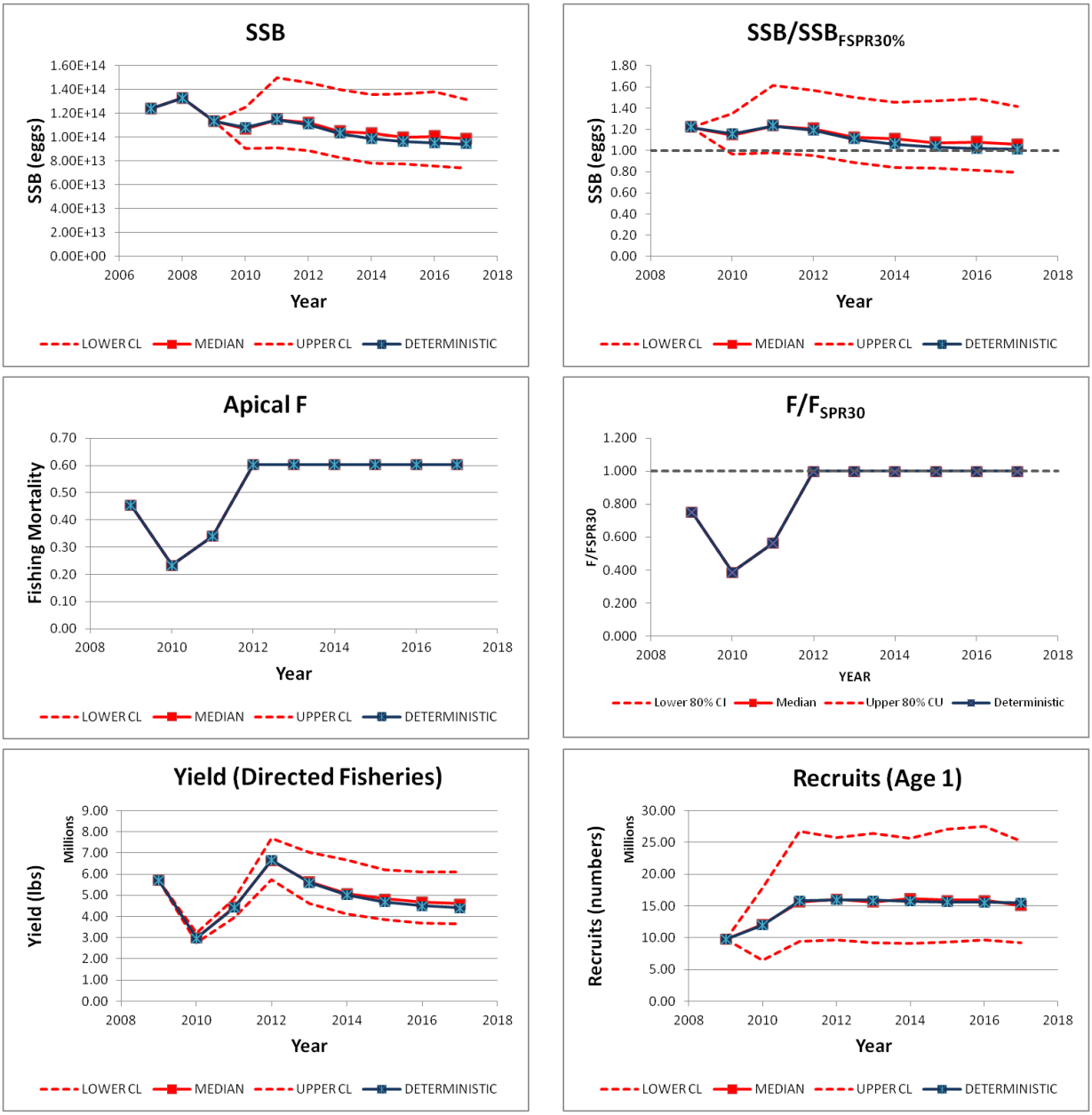


Figure 1. Projected SSB, SSB/SSB$_{FSPR30}$, F, F/F$_{SPR30\%}$, yield and recruitment for the alternative run with Gulfwide shrimp effort projected at F$_{SPR30}$ (the F$_{MSY}$ proxy).

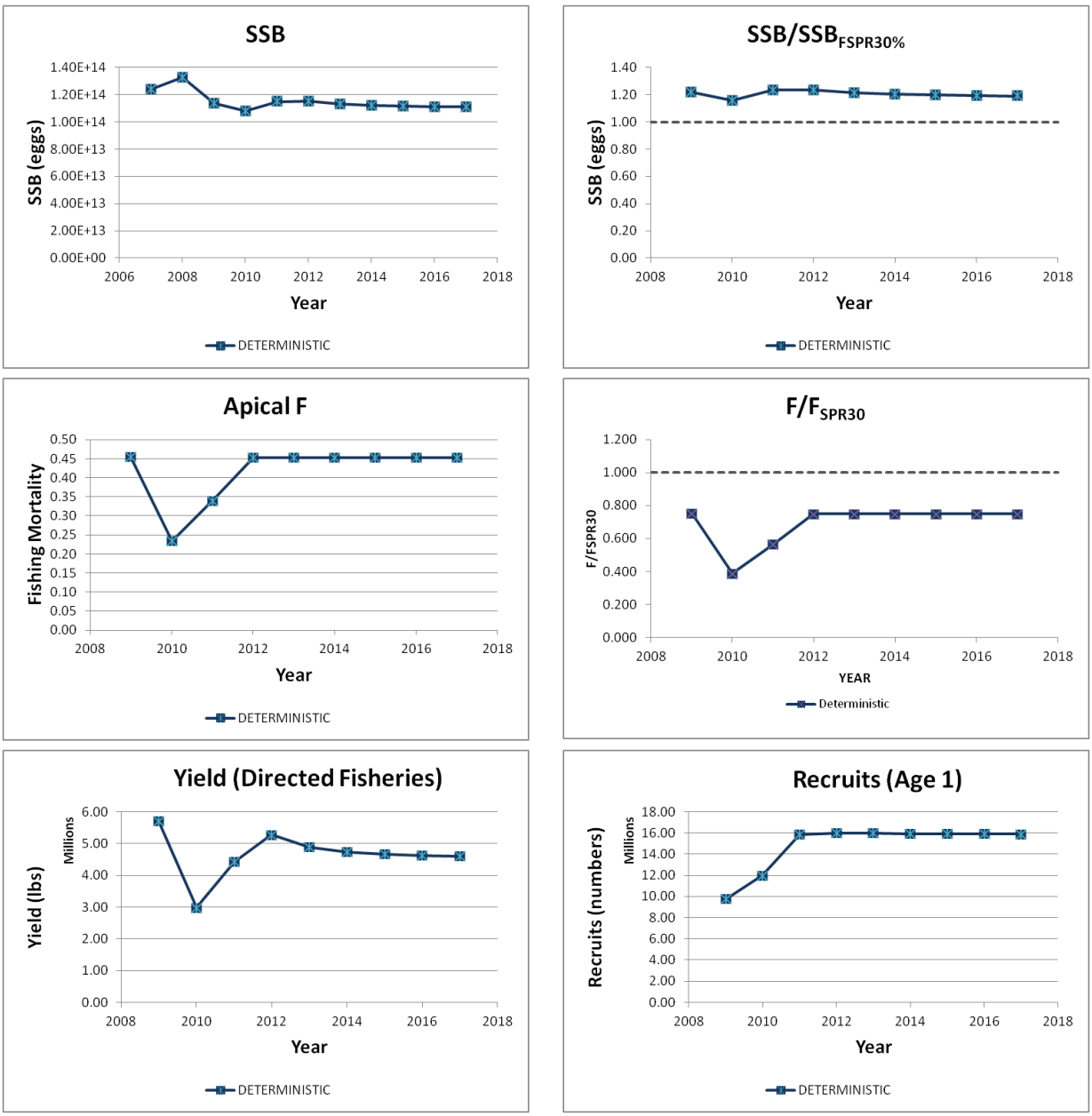


Figure 2. Projected SSB, SSB/SSB$_{FSPR30}$, F, F/F$_{SPR30\%}$, yield and recruitment for the SSASPM continuity run projected at 75% of F $_{SPR30}$ (the OY proxy). PRO-2BOX is not currently programmed to provide bootstrap estimates for an OY projection. Therefore, only the deterministic outcome is available.

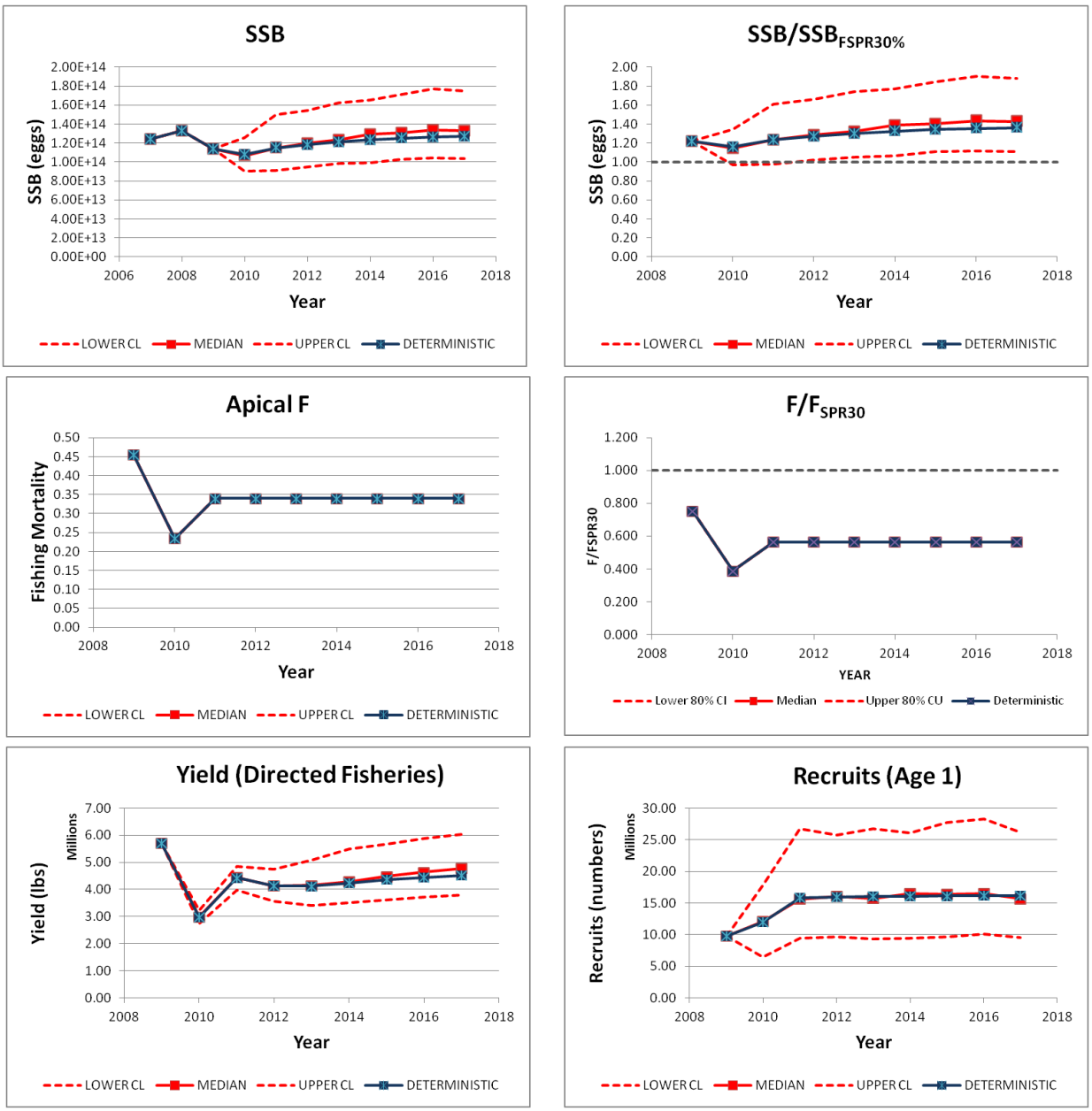


Figure 3. Projected SSB, SSB/SSB_{FSPR30}, F, $F/F_{SPR30\%}$, yield and recruitment for the alternative run with Gulfwide shrimp effort projected at $F_{CURRENT}$ (the 2007-2009 mean F).

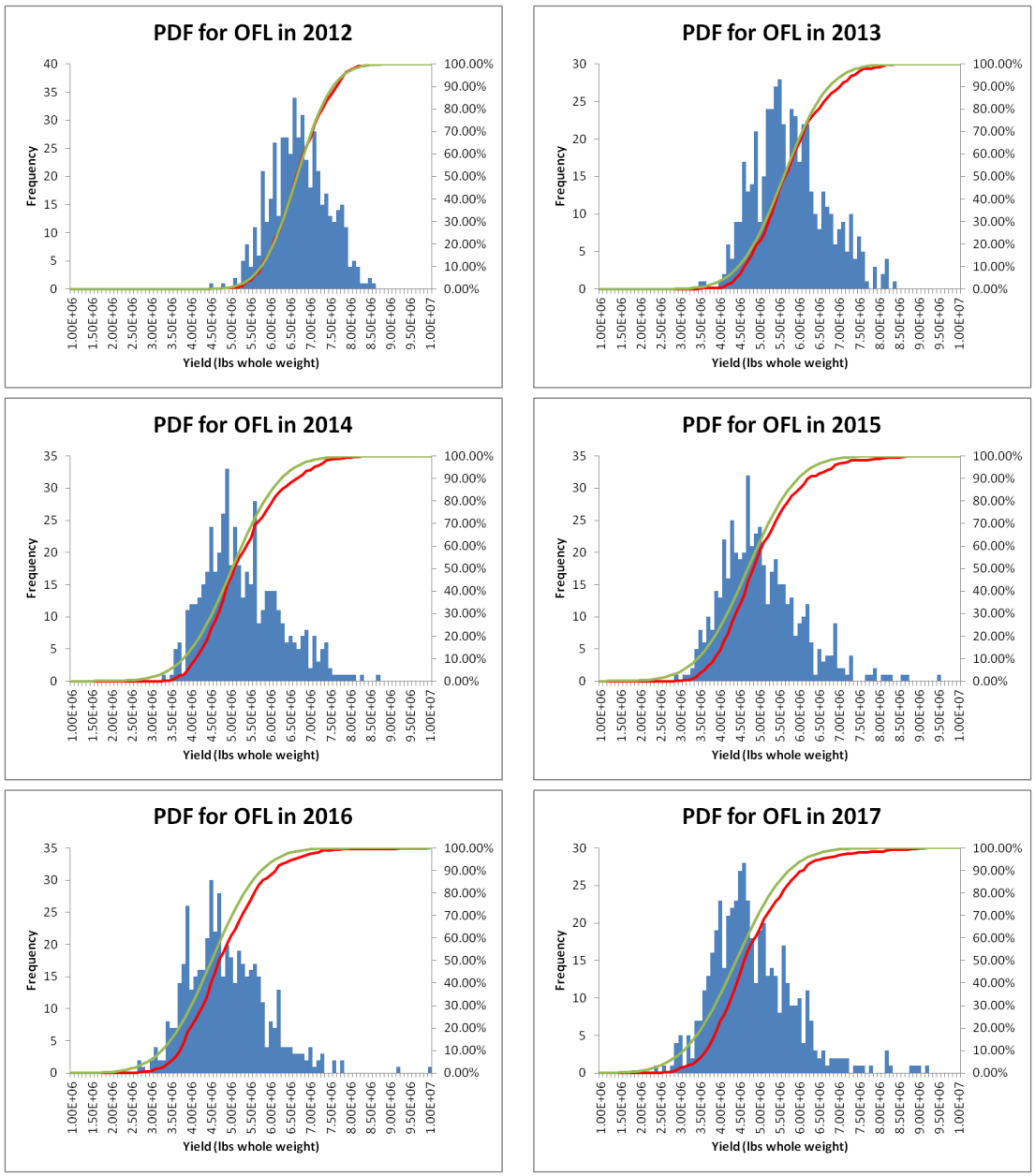


Figure 4. Probability density function for OFL during 2012-2017. The red line is the median result. The green line is the deterministic result.

SEDAR 9 Update Stock Assessment Report

Section III:

Gulf of Mexico Fishery Management Council Scientific and Statistical Committee Review Report

2011 SEDAR 9 Update Assessment for Vermilion Snapper
Gulf of Mexico Fishery Management Council Scientific and Statistical Committee Review Summary Report

21 May 2012

Review of Vermilion Snapper Update Assessment

Southeast Fisheries Science Center (SEFSC) staff presented the vermilion snapper update assessment, which consisted of three runs. A continuity run using SSASPM was conducted using exactly the same data inputs and methodology used in the 2009 SEDAR benchmark assessment (except for updating of data streams). One concern about this methodology is that shrimp bycatch is set at the annual value for 1981-2010. This ignores recent declines in shrimp effort. Therefore, a second run, referred to as the alternative shrimp bycatch run, included shrimp fishery effort data in the model which allows a decline in effort and identifies shrimp effort specifically for depths greater than 10 fathoms. This alternative run explored using Gulfwide shrimp effort vs. using shrimp effort from the eastern Gulf. A third run was made using the Stock Synthesis model, but this was exploratory in nature and not considered part of the update assessment. Stock Synthesis will be used as the base model in the next benchmark assessment.

Both the base continuity run and the alternative shrimp bycatch runs showed a good fit to the data, and nearly identical estimates of current spawning stock biomass and F_{MSY}. However, the alternative shrimp bycatch runs produced a smaller spawning stock biomass at MSY, and a smaller estimate of $F_{current}$. All of the model runs showed the $F_{current}/F_{MSY}$ ratio to be below the overfishing threshold, and the $SSB_{current}$ to be above SSB_{MSY} and above the overfished threshold.

SSC members felt that the alternative shrimp bycatch run was the more realistic model, but questioned whether they could use it since it did not meet the definition of a strict update. SSC members felt that enough information was presented to justify moving away from the continuity model. However, SEFSC staff cautioned that there has not been a full review of the changes in the alternative run. He also noted that the distribution of vermilion snapper recruits relative to shrimp effort or depth range has not been examined.

> **The SSC accepts the 2011 vermilion snapper update assessment, recommends that the preferred model be the alternative shrimp effort gulf-wide model configuration, and use that as the base run for the 2011 vermilion snapper update assessment.**
>
> Motion passed 13-2.

The SSC applied Tier 1 of the new ABC Control Rule to the assessment. After assigning scores to the elements of the P* table, a score of P* = 0.398 resulted, indicating that, within a range of 30% to 50%, a probability of 39.8% was an appropriate level of risk of overfishing due to scientific uncertainty in assessment.

Vermilion Snapper - October 2011

$$P^* = exp\left[-a - b\sum_{i\ dimension} Dimension\ score_i\right]$$

P* = 0.398

S_{hi} = 3.998

Maximum Risk **0.50** a= 0.693

Minimum Risk **0.30** b= 0.1277703

$$a = -ln(0.45) \qquad b = -\frac{a + ln(0.15)}{S_{hi}} \qquad S_{hi} = highest\ possible\ score$$

Element scores are scaled from zero to a maximum. In this example the maximum is 2.00, but this can be changed

Dimension	Dimension Wt	Tier No.	Tier Wt	Element Score	Element	Score it	Element Result	Tier Result	Dimension Result
Assessment Information	1	1	1	0.00	Quantitative, age-structured assessment that provides estimates of exploitation and biomass; includes MSY-derived benchmarks.		0.67	0.67	0.67
				0.67	Quantitative, age-structured assessment provides estimates of either exploitation or biomass, but requires proxy reference points.	x			
				1.33	Quantitative, non-age-structured assessment. Reference points may be based on proxy.				
				2.00	Quantitative assessment that provides relative reference points (absolute measures of status are unavailable) and require proxies.				
Characterization of Uncertainty	1	1	.333	0.0	The OFL pdf provided by the assessment model includes an appropriate characterization of "within model" and "between model/model structure" error. The uncertainty in important inputs (such as natural mortality, discard rates, discard mortality, age and growth parameters, landings before consistent reporting) has been described with using Bayesian priors and/or bootstrapping and/or Monte Carlo simulation and the full uncertainty has been carried forward into the projections		1.33	0.4429	1.11
				0.67	The OFL pdf provided by the assessment model includes an approximation of observation and process error. The uncertainty in important inputs (such as natural mortality, discard rates, discard mortality, age and growth parameters, landings before consistent reporting) has been described with *SENSITIVITY RUNS* and the full uncertainty has been carried forward into the projections.				
				1.33	The OFL pdf provided by the assessment model includes an incomplete approximation of observation and process error. The uncertainty in important inputs (such as natural mortality, discard rates, discard mortality, age and growth parameters, landings before consistent reporting) has been described with *SENSITIVITY RUNS* but the full uncertainty *HAS NOT* been carried forward into the projections.	x			
				2.0	The OFL provided by the assessment *DOES NOT* include uncertainty in important inputs and parameters.				
		2	.333	0.0	Retrospective patterns have been described, and are not significant.	x	0.0	0	
				1.0	Retrospective patterns have been described and are moderately significant.				
				2.0	Retrospective patterns *have not* been described *or* are large.				
		3	0				0	0	
					NOT USED				
						z			
		4	.333	0.0	Known environmental covariates are accounted for in the assessment.		2.0	0.666	
				1.0	Known environmental covariates are partially accounted for in the assessment.				
				2.0	Known environmental covariates *are not* accounted for in the assessment.	x			

The SSC discussed making changes to the elements for environmental covariates. However, it was noted that the ABC control rule has been accepted by the Council in its current format and forwarded to NMFS for approval. Therefore, any changes now need to be made through the framework procedure.

The assessment projections for OFL and the probability distribution functions for determining yield at a given P* were initially presented in terms of total removals, including shrimp bycatch. In order to provide OFL and ABC for the directed fishery, bycatch removals needed to be excluded from the probability distribution functions. Since the alternative model run with declining shrimp effort was used, bycatch removals had to be calculated separately for each year. The SSC deferred making a recommendation for OFL and ABC until the NMFS/SEFSC staff was able to do the calculations and provide revised outputs for just the directed fishery removals. This occurred on the second day, and revised status determination criteria were provided for the

directed fishery (Table 1). After applying the P* of 39.8% to the revised probability function, the SSC passed the following motion.

> **The SSC moves to set the ABC for vermilion snapper at the P* level of 0.398, which corresponds to a probability of overfishing of 39.8% as applied to the OFL PDFs for years 2012-2014. Thereafter, OFL will be set at equilibrium MSY (equilibrium yield at $F_{30\%\ SPR}$).**
>
> | | OFL | ABC (P* = 39.8%) |
> |---|---|---|
> | **2012** | **6.66mp** | **6.48mp** |
> | **2013** | **5.60mp** | **5.37mp** |
> | **2014** | **5.02mp** | **4.78mp** |
>
> Motion passed unanimously.

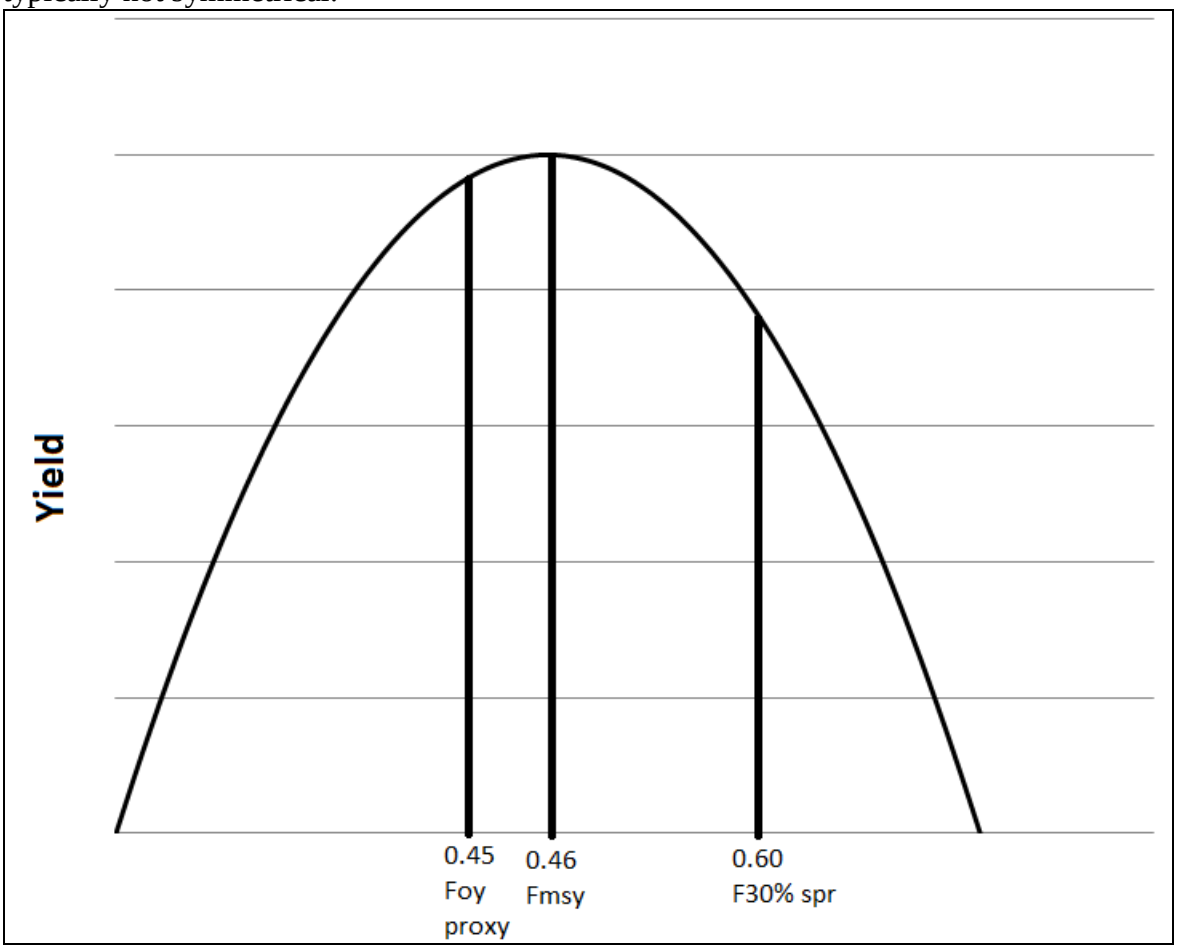
The value for "equilibrium MSY (equilibrium yield at $F_{30\%\ SPR}$)" is 4.27 million pounds.

Note: The vermilion snapper OFL and ABC proposed in the Generic Annual Catch Limits/Accountability Measures Amendment, based on Tier 3a, are OFL = 4.08 million pounds, and ABC = 3.42 million pounds. These values would be replaced by the OFLs and ABCs in the above motion.

The SSC noted that the yield stream resulted in declining ABCs over time. This is because the stock is currently above its OY biomass level. If fished at the ABC yield each year, the stock would be fished down to its equilibrium ABC level. However, the annual catch of vermilion snapper has never been higher than about 3.5 million pounds.

It was noted that the directed fishery values for equilibrium OY and equilibrium MSY in Table 1 show OY at a higher value than MSY (4.56 mp vs. 4.27 mp), the opposite of what would be expected. It was explained by SEFSC staff that this was because of a difference between the proxies used for F_{MSY} and F_{OY}, and the estimate of true F_{MSY} from the assessment model. The proxy for F_{MSY} is $F_{30\%\ SPR}$, which is a numerical value of 0.60. The F_{OY} proxy is 75% of that, or 0.45. The estimate of true F_{MSY} in the assessment model is 0.46, which is much closer to the F_{OY} proxy than the $F_{30\%\ SPR}$. Thus, the F_{OY} proxy is higher on the calculated yield curve and results in a higher yield than $F_{30\%\ SPR}$ (Figure 1). This brought up a question of whether the actual estimate of F_{MSY} should have been used rather than the $F_{30\%\ SPR}$ proxy. The SSC rejected the use of the actual estimate for two reasons. First, changing from a proxy to the actual F_{MSY} estimate changes the input parameters and is not allowed under a strict update assessment. Second, the estimate of F_{MSY} is dependent on the steepness value used in the spawner-recruit curve. The model had produced an unusually high steepness value, bringing into question the accuracy of the F_{MSY} estimate. The high steepness allows the model to better fit the input data, but it is an issue that should be reevaluated in the next benchmark assessment.

Figure 1. Relative yields for $F_{30\%\ SPR}$ (F_{MSY} proxy), estimate of true F_{MSY}, and F_{OY} proxy. The yield curve shown is a hypothetical example for illustrative purposes. Actual yield curves are typically not symmetrical.



The next vermilion snapper assessment is tentatively on the SEDAR schedule for 2013, but with the type of assessment to be determined. In order to proceed with the plans to convert the vermilion snapper assessment to the Stock Synthesis model, the next assessment will have to be a benchmark assessment since standard and update assessments do not allow a change in the model used.

> **The SSC moves that the vermilion snapper assessment currently scheduled for 2013 should be a benchmark assessment.**

Motion passed 14-1.