Standardized Catch Rate Indices for Scamp (*Mycteroperca phenax*) and Yellowmouth Grouper (*Mycteroperca interstitialis*) during 1986-2020 by the U.S. Gulf of Mexico Headboat Recreational Fishery

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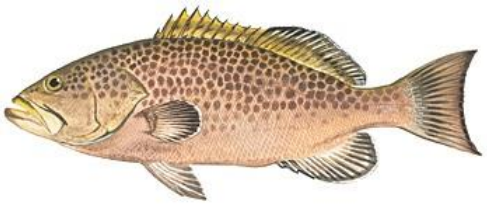

Standardized Catch Rate Indices for Scamp (*Mycteroperca phenax*) and Yellowmouth Grouper (*Mycteroperca interstitialis*) during 1986-2020 by the U.S. Gulf of Mexico Headboat Recreational Fishery

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Keywords

Catch, fishing effort, CPUE, recreational fisheries, headboat, Scamp and Yellowmouth Grouper

Abstract

A delta-lognormal index of abundance for the U.S. Gulf of Mexico headboat recreational fishery was constructed for the SEDAR 68 Operational Track Scamp and Yellowmouth Grouper stock assessment. The index in this document uses data from the Southeast Region Headboat Survey (SRHS) and was developed following improved data filtering techniques and modifications to the trip selection approach as implemented in the South Atlantic region. For the U.S. Gulf of Mexico, the SEDAR 68 Operational Track standardized index indicates catch rates were relatively low throughout the 1990s, increased during the 2000s, and have declined since 2011 to record low levels in recent years.

Introduction

The recreational fishery in the Gulf of Mexico is surveyed by the Marine Recreational Information Program (MRIP) conducted by NOAA Fisheries (formerly the Marine Recreational Fisheries Statistics Survey, MRFSS), the Texas Marine Sport-Harvest Monitoring Program conducted by the Texas Parks and Wildlife Department (TPWD), and the Southeast Region Headboat Survey (SRHS) conducted by NOAA Fisheries. The SRHS has monitored catch and fishing effort from party (head) boats in the Gulf of Mexico since 1986. Data from the SRHS were used to construct an index of Scamp and Yellowmouth Grouper abundance in the U.S. Gulf of Mexico following the same procedures used in previous SEDAR assessments. The index was constructed using a delta-lognormal generalized linear model.

Materials and Methods

Data Source

The SRHS collects data on the catch and effort for individual headboat trips. Reported information includes landing date and location, vessel identification, the number of anglers, a single fishing location (10' x 10' rectangle of latitude and longitude) for the entire trip, trip duration and/or type (half/three-quarter/full/multi-day, day/night, morning/afternoon), and catch by species in number and weight.

Catch per unit effort (CPUE) was calculated on an individual trip basis. The CPUE for each trip was estimated as the number of Scamp and Yellowmouth Grouper landed on a trip divided by the fishing effort, where effort was the product of the number of anglers and the total hours fished. To estimate effort for each trip type (i.e., trip duration), the following assumptions were adopted: Half day trip = 5 hours fished; Three-quarter day trip = 7.5 hours fished, and Full day trip = 10 hours fished.

Data Filtering

The following data preparation and filtering techniques were applied to the 1986-2020 SRHS dataset:

1. Vessels that had fewer than 30 trips in the logbook database were excluded (34 vessels, resulted in 0.11% of trips removed). Logbooks submitted by vessels that participated infrequently in the fishery are likely to be less accurate and may add noise to the data. Even if a vessel fished infrequently for one year, the number of trips should be greater than 30.

2. Trips with 6 or fewer anglers were excluded (1.5% of trips). It is rare for a headboat to fish with few anglers. There is anecdotal information that headboats would sometimes fish with just the crew and that logbooks for these trips were submitted. Experienced crew are likely to be more efficient at catching fish than paying customers. Captains may also limit distance to reduce fuel costs for trips with few paying customers.

3. Observations were included from all states across the Gulf of Mexico (Florida/Alabama = 75.94%, Mississippi = 0.04%, Louisiana = 1.33%, and Texas = 22.68%).

4. Observations were included from half-day trips (East: 14.59%, West: 0.48%), three-quarter day trips (East: 37.06%, West: 0%), and full-day trips (East: 34.29%, West: 78.65%).

5. Trips with possible errors in catch and effort information were excluded including trips with multiple records for a species (East: 0.01% of trips removed, West: 0.1% of trips removed), trips with potentially duplicated effort (East: 0.26% of trips removed, West: 0.1% of trips removed), trips with an unusually large number of target species (East: 0.01% of trips removed, West: 0.01% of trips removed), trips with the largest 0.5% values for catch for each region (East: 0.49% of trips removed, West: 0.41% of trips removed), trips with the largest 0.5% values for CPUE for each region (East: 0.48% of

trips removed, West: 0.49% of trips removed), and trips with the largest 0.5% values for anglers for each region (East: 0.46% of trips removed, West: 0.11% of trips removed).

6. Trips during the closed season for shallow-water groupers were excluded (East: 1.95% of trips removed, West: 1.05% of trips removed).

7. Trips that reached bag limits (East: 0.004% of trips, West: 0% of trips) and exceeded bag limits (East: 0.03% of trips, West: 0.002% of trips) for aggregate groupers were retained.

Subsetting Trips: Species Association

A method to infer targeting for each trip was used to develop the index because no direct targeting information was available. The Stephens and MacCall (2004) approach was used to restrict the dataset to trips that likely encountered Scamp and Yellowmouth Grouper based on the catch species composition. This approach was applied separately for the Eastern U.S. Gulf of Mexico and Western U.S. Gulf of Mexico due to suspected differences in species compositions between regions. Substantial differences in habitat type have been noted between regions, as the Eastern U.S. Gulf of Mexico is dominated more by hard bottom habitats whereas the Western U.S. Gulf of Mexico has less hard structure (SEDAR 2011). In applying the Stephens and MacCall (2004) approach, the species considered were limited to reef fish species that were on the headboat logbook forms across all years (**Table 1**). Species with seasonal or quota closures in recent years were also omitted because of the potential for erroneously removing trips likely to have caught Scamp and Yellowmouth Grouper during years of restrictions (**Figure 1**).

Standardization

A two-stage delta-lognormal generalized linear model (GLM; Lo et al. 1992) was used to standardize for variability and non-randomness in CPUE data collection methods not caused by the year effect (i.e., to factor out year to year variations in CPUE not due to changes in abundance). This method combines two separate generalized linear model (GLM) analyses of the proportion of trips that caught at least one Scamp and Yellowmouth Grouper (i.e., proportion of positive trips) and the catch rates of the positive trips to construct a single standardized index of abundance. In the first step, the proportion positive is modeled using a logit regression assuming a binomial distribution of the response variable. In the second step, the logarithm of CPUE on positive trips (those that caught the target species) was used as the response variable assuming a normal distribution and an identity link function. The two models were then combined to provide the final standardized index of abundance. Parameterization of each model was accomplished using a GLM procedure. For the lognormal models, the response variable, ln(*CPUE*), was calculated:

ln(CPUE) = ln(Catch) / (anglers x hours fished)

A forward stepwise regression approach was utilized within the GENMOD procedure of SAS 9.2 (SAS Institute, 2008). In this procedure, factors were added to the base model one at a time based on the percent reduction in deviance per degree of freedom. With each run of the model, the factor that caused the highest reduction in deviance was added to the base model (assuming the factor was significant based on a Chi-Square test with probability ≤ 0.05) until no factor reduced the percent deviance by the pre-specified level of 1%. Once a set of fixed factors was identified, first level interactions were examined. The significance of these interactions was

evaluated between nested models using the likelihood ratio test. Interactions were screened and were only retained if the model improvement was significant according to the likelihood ratio test ($p< 0.0001$). Significant YEAR*FACTOR interaction terms were modeled as random effects.

The variation in catch rates by vessel was examined using a "repeated measures" approach (Littell et al., 1998). The term 'repeated measures' refers to multiple measurements taken over time on the same experimental unit (i.e. vessel). Specifying the repeated measure "VESSEL" and the subject "VESSEL(YEAR)" allows PROC MIXED to model the covariance structure of the data. This is particularly important because catch rates may vary by vessel and because catch rates by a given vessel that are close in time can have a higher correlation than those far apart in time (Littell et al., 1998).

Results of the binomial (proportion positive) and lognormal (mean CPUE on successful trips) models were then multiplied to attain a single index of abundance based on the year effect. The final delta-lognormal model was fit using the SAS macro GLIMMIX (glmm800MaOB.sas: Russ Wolfinger, SAS Institute) and the SAS procedure PROC MIXED (SAS Institute Inc. 1997) following the procedures by Lo et al. (1992).

Results and Discussion

Species Associations - Stephens and MacCall (2004) Approach - Eastern U.S. Gulf of Mexico

The minimum difference between the predicted and the observed number of trips that reported Scamp and Yellowmouth Grouper occurred at the probability threshold of 0.19 (**Figure 2A**). Predicted trips showed a general increasing trend throughout the time series, were underestimated early in the time series and overestimated at the end of the time series (**Figure 2B**). Trips with a predicted probability greater than the critical threshold probability were considered as trips that targeted Scamp and Yellowmouth Grouper (**Figure 2C**). Nominal CPUE was relatively similar before and after applying the Stephens and MacCall (2004) approach, with the exception of the mid-1980s and the mid-2000s (**Figure 2D**). This method retained 7.2% of the total trips, and 26.4% of trips that reported Scamp and Yellowmouth Grouper. Prior to trip selection, there were 190,722 trips and the proportion positive was 0.07, and after selection there were 13,661 trips and the proportion positive was 0.25. **Table A1** in **Appendix A** provides the total trips after logbook filtering and applying the Stephens and MacCall (2004) approach per year.

The Stephens and MacCall (2004) trip subsetting approach identified 15 reef fish species which were captured with Scamp and Yellowmouth Grouper (**Table 2**; scientific names provided in **Table 1**). Red Porgy, Vermilion Snapper, Gray Snapper, Almaco Jack, and Littlehead Porgy were positively correlated to Scamp and Yellowmouth Grouper whereas White Grunt, Tomtate, Bank Sea Bass, and Sand Perch were negatively correlated.

Species Associations - Stephens and MacCall (2004) Approach - Western U.S. Gulf of Mexico

The minimum difference between the predicted and the observed number of trips that reported Scamp and Yellowmouth Grouper occurred at the probability threshold of 0.2 (**Figure 3A**). The

trends in predicted and observed trips were similar, with both gradually declining throughout the time series and increasing in recent years (**Figure 3B**). Trips with a predicted probability greater than the critical threshold probability were considered as trips that targeted Scamp and Yellowmouth Grouper (**Figure 3C**). Nominal CPUE was relatively similar before and after applying the Stephens and MacCall (2004) approach (**Figure 3D**). This method retained 6.5% of the total trips, and 36.4% of trips that reported Scamp and Yellowmouth Grouper. Prior to trip selection, there were 63,242 trips and the proportion positive was 0.06, and after selection there were 4,131 trips and the proportion positive was 0.35. **Table A2** in **Appendix A** provides the total trips after logbook filtering and applying the Stephens and MacCall (2004) approach per year.

The Stephens and MacCall (2004) trip subsetting approach identified 12 reef fish species which were captured with Scamp and Yellowmouth Grouper (**Table 3**; scientific names provided in **Table 1**). Vermilion Snapper, Red Porgy, Tomtate, Rock Hind, and Almaco Jack were positively correlated to Scamp and Yellowmouth Grouper whereas Atlantic Spadefish and Great Barracuda were negatively correlated.

Trends in Species Associations Between Regions for the Stephens and MacCall (2004) approach

Associations in the Western U.S. Gulf of Mexico were moderately similar to the Eastern U.S. Gulf of Mexico (correlation = 0.45; **Figure 4**).

The derived probability threshold and proportion positive before applying the Stephens and MacCall (2004) approach were similar across regions (**Figure 5**). However, the percent of trips retained and the proportion positive were higher in the Western U.S. Gulf of Mexico compared to the Eastern U.S. Gulf of Mexico (**Figure 5**).

Variable Selection

The following factors were treated as fixed effects and were examined as possible influences on the proportion of positive trips and on the catch rates of positive trips:

Name	DF	Details
Year	35	1986-2020
Season	4	Dec-Feb, Mar-May, Jun-Aug, Sep-Nov
Area	4	CenSWTX, NWFL_AL, NWTX_LA, SWFL
Trip Type*	3	Full day, Half day (0.5 day), Three quarter day (0.75 day)
Anglers*	7	7-10, 11-20, 21-30, 41-50, 51-60, 61+

*Only explored as factors for modeling success because these factors were confounded with effort for the CPUE response variable in the lognormal model.

Appendix B provides the number of total trips, position trips, and proportion positive of trips by year for each variable level tested.

Annual Abundance Indices

Final deviance tables are included in **Table 4**. The final models for the binomial (i.e., proportion positive) and lognormal (catch rate of positive trips) components were:

$$ProportionPositive = YEAR$$

$$ln(CPUE) = YEAR + AREA + SEASON + YEAR * AREA$$

For the binomial model, year was the only significant variable (**Table 4**).

Diagnostics for each component of the GLM are provided in **Figure 6** and **Figure 7**. The overdispersion parameter for the binomial component was undefined. The binomial model consistently estimated the proportion of positive trips (**Figure 6A**). The proportion positive ranged from 0.14 to 0.61, and has generally remained between 0.22 and 0.34. Residual analysis of the binomial model showed no obvious patterns in the residuals by year (**Figure 6B**).

The lognormal model results suggest a good fit to the data and indicated that the assumption of a lognormal distribution for positive catch rates was appropriate for the data (**Figure 7A-B**). Residual analysis of the lognormal model also showed no obvious patterns in the residuals by year (**Figure 7C**), area (**Figure 7D**) or season (**Figure 7E**).

Table 5 summarizes the standardized index, corresponding lower and upper 95% confidence limits, annual coefficients of variation, nominal CPUE, and number of trips. Nominal CPUE values fell within the 95% confidence interval of the standardized index, with the exception of the values in years 1987, 2003 and 2006 (**Figure 8**). Relative abundance remained above the time series mean in the first few years of the index, declined to below the time series mean during most of the 1990s and began to increase in the 2000s. However, the index showed a continuous decline from 2011 to the end of the time series. Relative abundance peaked in 1986, the first year of the time series, and was lowest in 2020, the last year of the time series (**Figure 8**).

Figure 9 provides a comparison of the SEDAR 68 Operational Track headboat index to the headboat index derived during the SEDAR 68 Research Track (Gulf and Caribbean Branch, 2020) for the U.S. Gulf of Mexico. The continuity index is very similar to the index developed during the SEDAR 68 Research Track, and all index values for the SEDAR 68 Operational Track remain within the confidence intervals of the SEDAR 68 Research Track index (**Figure 10**). Trip selection for the SEDAR 68 Operational Track identified two additional species compared to the SEDAR 68 Research Track for the Western U.S. Gulf of Mexico, while the coefficients were generally similar for the remaining species (**Figure 11**).

Comments on Adequacy for Assessment

The headboat index was recommended for use by the Index Working Group in the base SEDAR 68 Research Track assessment model. This decision was largely based on the long time series and large spatial coverage associated with the SRHS Survey, as this survey often represents the longest time series for Gulf of Mexico reef fish stocks. For Scamp, the lack of targeting by anglers suggests that this index may be reflective of abundance, which was a topic of discussion during the Data Workshop.

However, during the Review Workshop the Panel discussed the recent decline evident in the headboat index. Concerns were raised regarding the sharp decline following 2010 and whether that was reflective of a decline in the population or in the behavior of the fishery. Insights from the fishery suggest a recent change in how the fishery operates, with effort shifting to shorter trips and closer to shore in more recent years. Trip type (i.e., the duration of the trip) can be used as a proxy for where fishing occurred, but was not significant during index development and therefore was excluded from the standardization process. While the removal of this index will be evaluated in the jack-knife analysis conducted during the SEDAR 68 Operational Track assessment, additional efforts should evaluate whether this index truly reflects relative abundance, particularly since 2010. Further, additional research is needed to explore alternative trip selection approaches which may be more appropriate for the U.S. Gulf of Mexico and South Atlantic recreational fisheries.

References

Gulf and Caribbean Branch. 2020. Standardized Catch Rate Indices for Scamp (*Mycteroperca phenax*) and Yellowmouth Grouper (*Mycteroperca interstitialis*) during 1986-2017 by the U.S. Gulf of Mexico Headboat Recreational Fishery. SEDAR68-DW-18. SEDAR, North Charleston, SC. 42 pp.

Littell, R.C., P.R. Henry and C.B. Ammerman. 1998. Statistical analysis of repeated measures data using SAS procedures. J. Anim. Sci. 76:1216-1231.

Lo, N.C., L.D. Jacobson, and J.L. Squire. 1992. Indices of relative abundance from fish spotter data based on delta-lognormal models. Can. J. Fish. Aquat. Sci. 49: 2515-2526.

SAS Institute Inc. 1997, SAS/STAT Software: Changes and Enhancements through Release 6.12. Cary, NC: Sas Institute Inc., 1997. 1167 pp.

SEDAR (Southeast Data Assessment and Review). 2011. SEDAR22 Gulf of Mexico Yellowedge Grouper Stock Assessment Report. 423 pp.

Stephens, A., and A. MacCall. 2004. A multispecies approach to subsetting logbook data for purposes of estimating CPUE. Fish. Res. 70:299-310.

Tables

Table 1. Reef fish species listed on headboat logbook forms since 1986 in the U.S. Gulf of Mexico.

Common Name	Scientific Name
African Pompano	*Alectis ciliaris*
Almaco Jack	*Seriola rivoliana*
Angelfish	*Pomacanthidae*
Bank Sea Bass	*Centropristis ocyurus*
Great Barracuda	*Sphyraena barracuda*
Bigeye	*Priacanthus arenatus*
Blackfin Snapper	*Lutjanus buccanella*
Blue Runner	*Caranx crysos*
Bluefish	*Pomatomus saltatrix*
Blueline Tilefish	*Caulolatilus microps*
Bluestriped Grunt	*Haemulon sciurus*
Atlantic Bonito	*Sarda sarda*
Cobia	*Rachycentron canadum*
Cubera Snapper	*Lutjanus cyanopterus*
Dolphin	*Coryphaena hippurus*
Gag	*Mycteroperca microlepis*
Gray Snapper	*Lutjanus griseus*
Gray Triggerfish	*Balistes capriscus*
Graysby	*Epinephelus cruentatus*
Greater Amberjack	*Seriola dumerili*
Hogfish	*Lachnolaimus maximus*
Jolthead Porgy	*Calamus bajonado*
King Mackerel	*Scomberomorus cavalla*
Knobbed Porgy	*Calamus nodosus*
Lane Snapper	*Lutjanus synagris*
Littlehead Porgy	*Calamus proridens*
Mutton Snapper	*Lutjanus analis*

Table 1 Continued. Reef fish species listed on headboat logbook forms since 1986 in the U.S. Gulf of Mexico.

Common Name	Scientific Name
Queen Triggerfish	*Balistes vetula*
Rainbow Runner	*Elagatis bipinnulata*
Red Grouper	*Epinephelus morio*
Red Hind	*Epinephelus guttatus*
Red Porgy	*Pagrus pagrus*
Red Snapper	*Lutjanus campechanus*
Rock Hind	*Epinephelus adscensionis*
Sand Perch	*Diplectrum formosum*
Sand Tilefish	*Malacanthus plumieri*
Scamp	*Mycteroperca phenax*
Silk Snapper	*Lutjanus vivanus*
Atlantic Spadefish	*Chaetodipterus faber*
Spanish Mackerel	*Scomberomorus maculatus*
Spottail Pinfish	*Diplodus holbrooki*
Spottail Porgy	*Sparidae*
Squirrelfish	*Holocentrus adscensionis*
Tomtate	*Haemulon aurolineatum*
Vermilion Snapper	*Rhomboplites aurorubens*
White Grunt	*Haemulon plumieri*
Whitebone Porgy	*Calamus leucosteus*
Yellowfin Grouper	*Mycteroperca venenosa*
Yellowmouth Grouper	*Mycteroperca interstitialis*

Table 2. Association coefficients of other species with Scamp and Yellowmouth Grouper for the Eastern U.S. Gulf of Mexico. Positive numbers indicate a positive correlation.

Coefficient	Common Name
0.871	Red Porgy
0.833	Vermilion Snapper
0.574	Gray Snapper
0.563	Almaco Jack
0.529	Littlehead Porgy
0.480	Jolthead Porgy
0.260	Knobbed Porgy
0.101	Blue Runner
0.065	Whitebone Porgy
0.056	Lane Snapper
0.001	Hogfish
-0.190	Sand Perch
-0.200	Bank Sea Bass
-0.469	Tomtate
-0.746	White Grunt

Table 3. Association coefficients of other species with Scamp and Yellowmouth Grouper for the Western U.S. Gulf of Mexico. Positive numbers indicate a positive correlation.

Coefficient	Common Name
1.992	Vermilion Snapper
1.282	Red Porgy
0.901	Tomtate
0.840	Rock Hind
0.622	Almaco Jack
0.451	Whitebone Porgy
0.419	Lane Snapper
0.403	African Pompano
0.232	Blue Runner
0.140	Gray Snapper
-0.037	Great Barracuda
-0.208	Atlantic Spadefish

Table 4. Deviance tables for the regression models for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico. The table shows the order of the factors as they were sequentially added to each model. Fit diagnostics listed for each factor were the diagnostics from a model that included that factor and all of the factors listed above it in the tables below.

Factor	DF	Deviance	Residual DF	Residual Deviance	AIC	Deviance Reduced	Log likelihood	Likelihood Ratio Test
Binomial								
Null	1	20,847	17,791	20,847	20,847	-	-10,423	-
Year	35	20,152	17,757	695	20,152	3.15%	-10,076	695.2
Lognormal								
Null	1	2,753	4,850	2,753	11,019	-	-5,509	-
Area	4	2,465	4,847	287	10,484	10.39%	-5,242	535
Year	35	2,268	4,813	197	10,078	7.37%	-5,039	405.6
Season	4	2,168	4,810	99	9,860	4.34%	-4,930	218
Area*Year	92	2,026	4,719	142	9,532	4.75%	-4,766	328.6

Table 5. Numbers (N) of total and positive trips, proportion of positive trips (PPT), relative nominal CPUE, and standardized abundance index statistics for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	N	Positive N	PPT	Relative Nominal CPUE	Relative Index	Lower 95% CI	Upper 95% CI	CV
1986	229	139	0.607	1.965	2.185	1.663	2.872	0.137
1987	307	142	0.463	1.080	1.457	1.100	1.931	0.141
1988	352	160	0.455	1.321	1.559	1.202	2.023	0.131
1989	338	84	0.249	0.703	0.869	0.661	1.142	0.137
1990	368	121	0.329	0.977	1.197	0.916	1.564	0.134
1991	379	97	0.256	0.769	1.007	0.766	1.323	0.137
1992	447	101	0.226	0.610	0.734	0.561	0.962	0.135
1993	402	94	0.234	0.685	0.736	0.563	0.961	0.134
1994	500	158	0.316	0.966	0.950	0.732	1.232	0.131
1995	470	159	0.338	1.024	1.288	0.986	1.683	0.134
1996	379	97	0.256	0.837	0.882	0.669	1.163	0.139
1997	439	106	0.241	0.773	0.770	0.565	1.049	0.156
1998	336	101	0.301	0.854	1.000	0.750	1.332	0.144
1999	270	50	0.185	0.716	0.718	0.522	0.988	0.161
2000	391	95	0.243	0.673	0.824	0.613	1.107	0.149
2001	503	91	0.181	0.738	0.724	0.530	0.990	0.157
2002	466	123	0.264	1.263	1.039	0.783	1.377	0.142
2003	464	103	0.222	1.279	0.847	0.624	1.148	0.153
2004	305	115	0.377	1.521	1.370	1.040	1.803	0.138
2005	353	135	0.382	1.480	1.309	0.992	1.726	0.139
2006	327	81	0.248	1.305	0.947	0.689	1.302	0.160
2007	343	128	0.373	1.680	1.584	1.159	2.164	0.157
2008	602	214	0.355	1.596	1.464	1.100	1.950	0.144
2009	701	197	0.281	1.126	0.953	0.719	1.262	0.141
2010	277	62	0.224	0.836	0.722	0.516	1.009	0.169
2011	417	218	0.523	2.095	1.848	1.378	2.480	0.148
2012	650	226	0.348	1.277	1.112	0.853	1.449	0.133
2013	741	183	0.247	0.705	0.707	0.513	0.974	0.161

Table 5 Continued. Numbers (N) of total and positive trips, proportion of positive trips (PPT), relative nominal CPUE, and standardized abundance index statistics for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	N	Positive N	PPT	Relative Nominal CPUE	Relative Index	Lower 95% CI	Upper 95% CI	CV
2014	849	204	0.240	0.672	0.741	0.557	0.984	0.143
2015	903	264	0.292	0.788	0.831	0.626	1.103	0.142
2016	1,038	194	0.187	0.483	0.494	0.375	0.651	0.139
2017	821	150	0.183	0.468	0.488	0.358	0.665	0.156
2018	809	179	0.221	0.638	0.602	0.448	0.810	0.149
2019	912	178	0.195	0.616	0.597	0.452	0.789	0.140
2020	704	102	0.145	0.479	0.446	0.333	0.596	0.146

Figures

Recreational Fishery - Open Days Per Year

	Red Snapper	Gray Triggerfish	Red Grouper	Greater Amberjack	Gag
1981	365	365	365	365	365
1982	365	365	365	365	365
1983	365	365	365	365	365
1984	366	366	366	366	366
1985	365	365	365	365	365
1986	365	365	365	365	365
1987	365	365	365	365	365
1988	366	366	366	366	366
1989	365	365	365	365	365
1990	365	365	365	365	365
1991	365	365	365	365	365
1992	366	366	366	366	366
1993	365	365	365	365	365
1994	365	365	365	365	365
1995	365	365	365	365	365
1996	366	366	366	366	366
1997	330	365	365	365	365
1998	272	365	365	365	365
1999	240	365	365	365	365
2000	194	366	366	366	366
2001	194	365	365	365	365
2002	194	365	365	365	365
2003	194	365	365	365	365
2004	194	366	366	366	366
2005	194	365	304	365	304
2006	194	365	365	365	337
2007	194	365	337	365	337
2008	65	366	337	366	337
2009	75	365	337	297	306
2010	77	365	306	365	306
2011	48	365	306	304	63
2012	46	162	306	304	122
2013	42	226	306	365	156
2014	9	120	276	236	156
2015	44	37	280	269	156
2016	46	152	366	152	156
2017	49	0	365	82	214
2018	51	108	365	209	213
2019	62	71	365	122	213
2020	62	118	365	122	213

Figure 1. Species removed from the Stephens and MacCall (2004) trip selection approach for defining Scamp and Yellowmouth Grouper trips due to seasonal or complete closures. Note that the Red Snapper days open from 2015 onward refer to the federal for-hire recreational fishery.

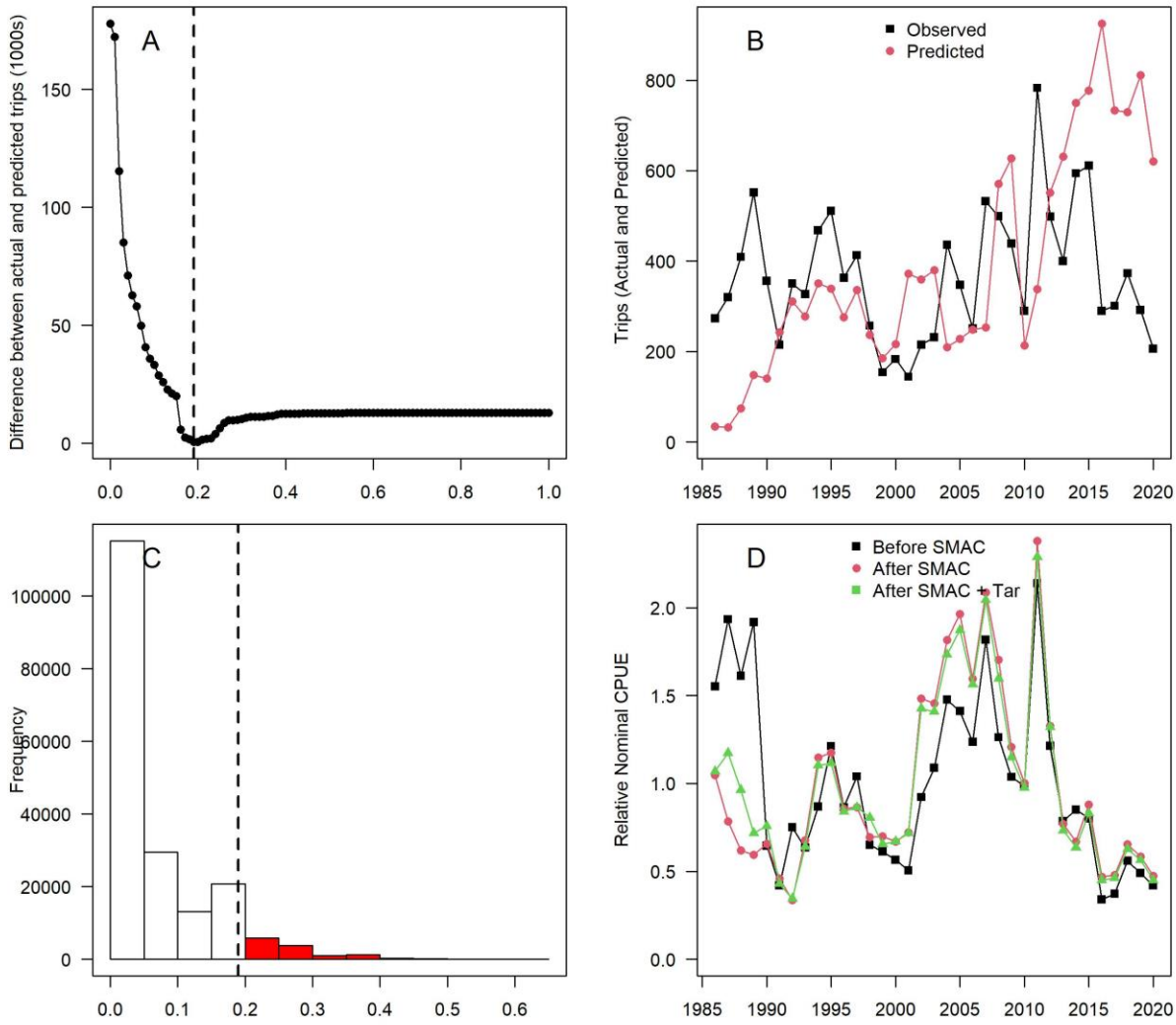

Figure 2. Stephens and MacCall (2004) trip selection diagnostics for the Eastern U.S. Gulf of Mexico. (A) The difference between the number of records in which Scamp and Yellowmouth Grouper are observed and the number in which they are predicted to occur for each probability threshold; (B) The number of actual and predicted trips; (C) Histogram of probabilities generated by the species-based regression (trips that targeted Scamp and Yellowmouth Grouper given in red); and (D) Nominal CPUE before ("Before SMAC") and after ("After SMAC") Stephens and MacCall (2004) trip selection ("After SMAC + Tar" = also includes all trips where the target species was caught). The dashed vertical line indicates the critical value where false prediction is minimized.

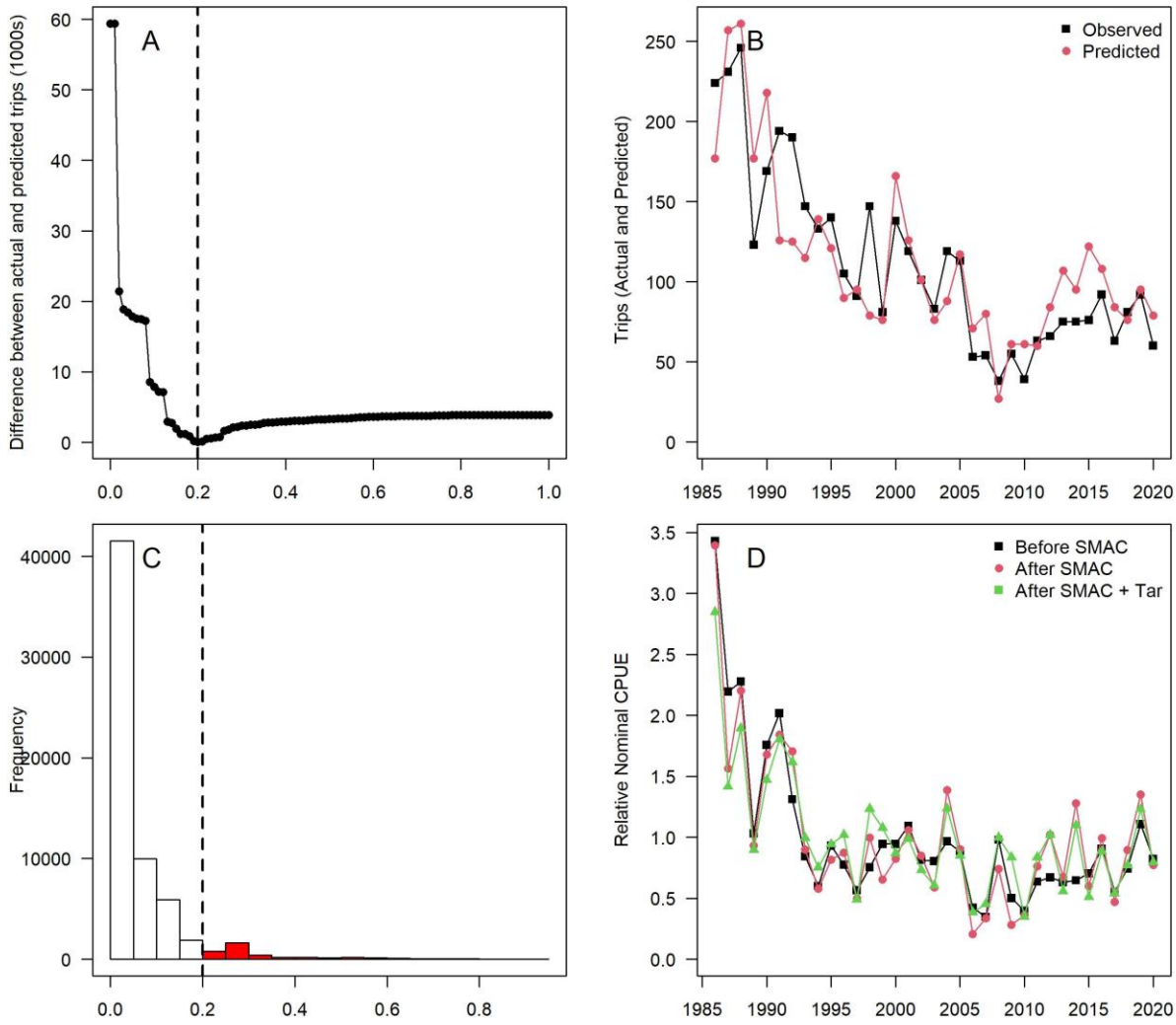

Figure 3. Stephens and MacCall diagnostics for the Western U.S. Gulf of Mexico. (A) The difference between the number of records in which Scamp and Yellowmouth Grouper are observed and the number in which they are predicted to occur for each probability threshold; (B) The number of actual and predicted trips; (C) Histogram of probabilities generated by the species-based regression (trips that targeted Scamp and Yellowmouth Grouper given in red); and (D) Nominal CPUE before ("Before SMAC") and after ("After SMAC") Stephens and MacCall (2004) trip selection ("After SMAC + Tar" = also includes all trips where the target species was caught). The dashed vertical line indicates the critical value where false prediction is minimized.

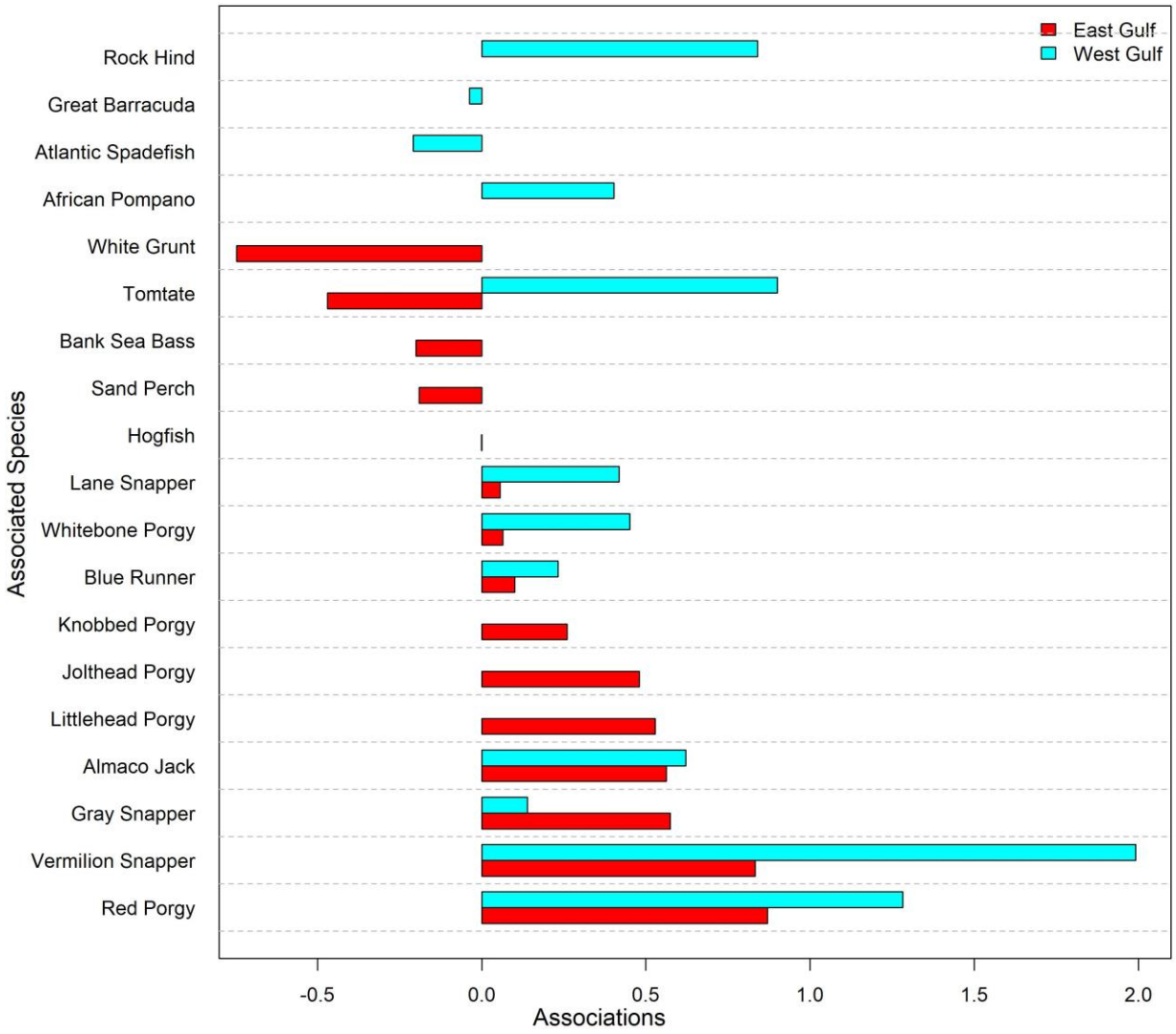

Figure 4. Association coefficients of other species with Scamp and Yellowmouth Grouper across regions in the U.S. Gulf of Mexico. Positive numbers indicate a positive correlation.

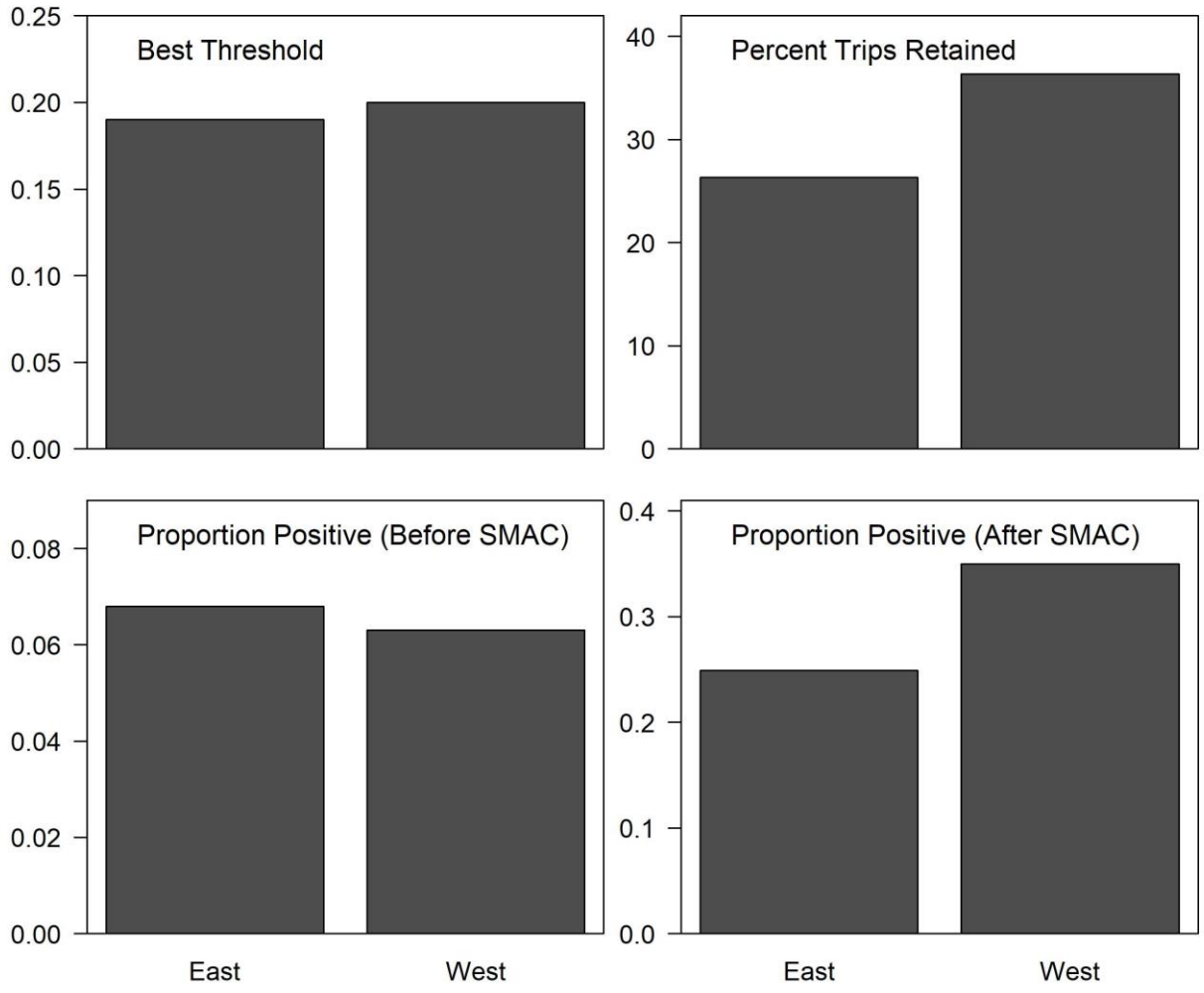

Figure 5. Stephens and MacCall (2004) statistics across regions for associations with Scamp and Yellowmouth Grouper.

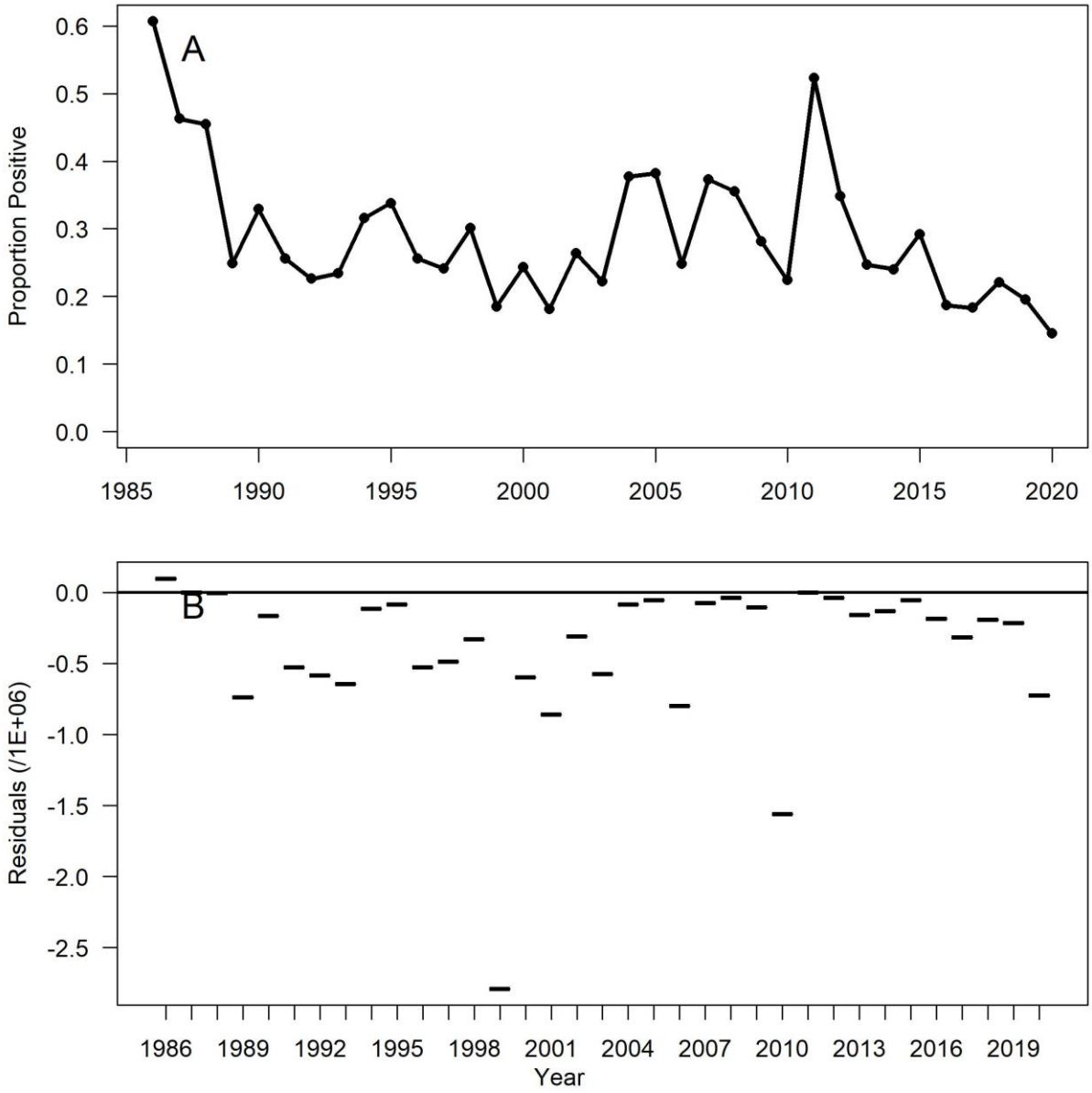

Figure 6. Diagnostic plots for the binomial model for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico. Shown here are the predicted (solid line) and observed proportion of positive trips by year (A) and the residuals from the binomial model by year (B). Note that the observed proportions are below the predicted proportions in (A) and the y-axis values are very small in (B).

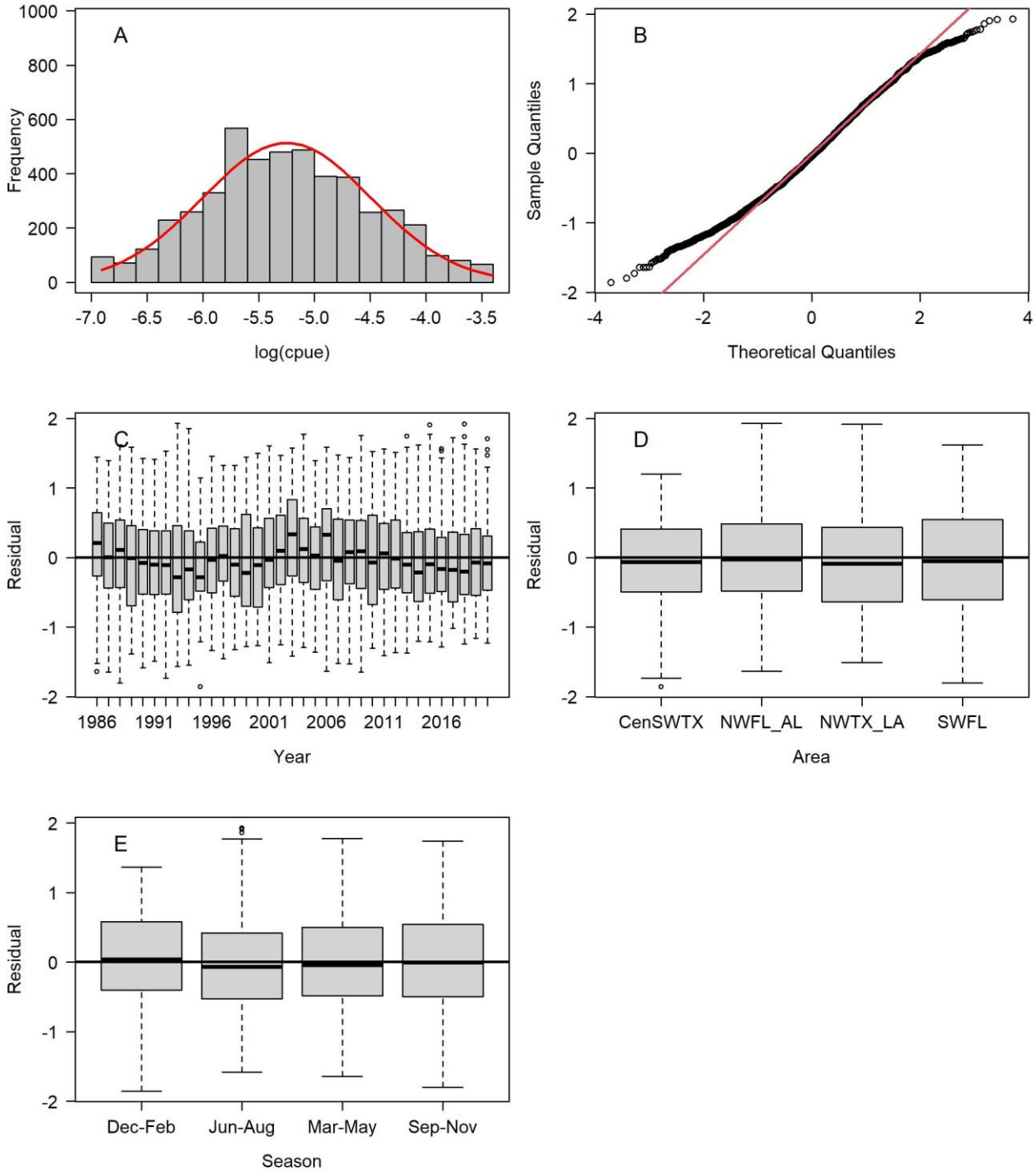

Figure 7. Diagnostic plots for the lognormal model of catch rates on positive trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico. Shown here are the frequency distribution of catch rates (A), the cumulative normalized residuals (B), and the distribution of residuals by year (C), area (D) and season (E). The red lines represent the expected normal distribution.

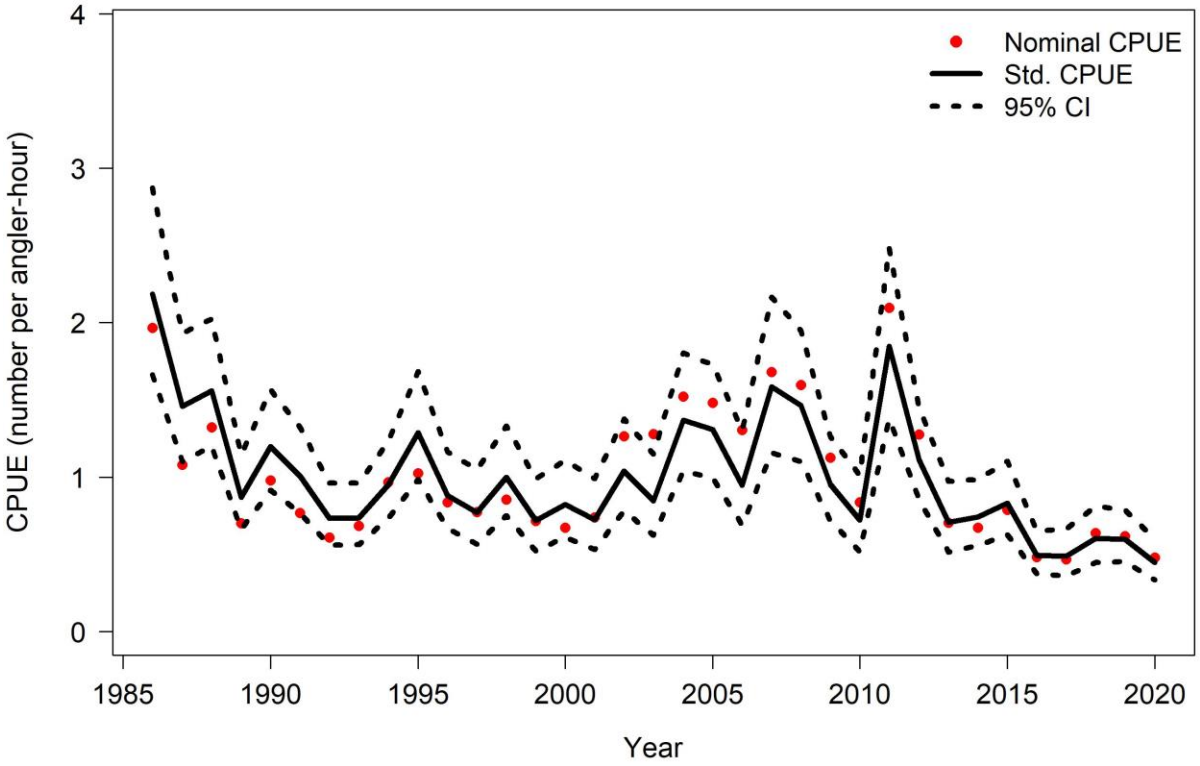

Figure 8. Standardized index with 95% confidence intervals, and nominal CPUE for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico. The index was scaled to the mean value of the entire time series.

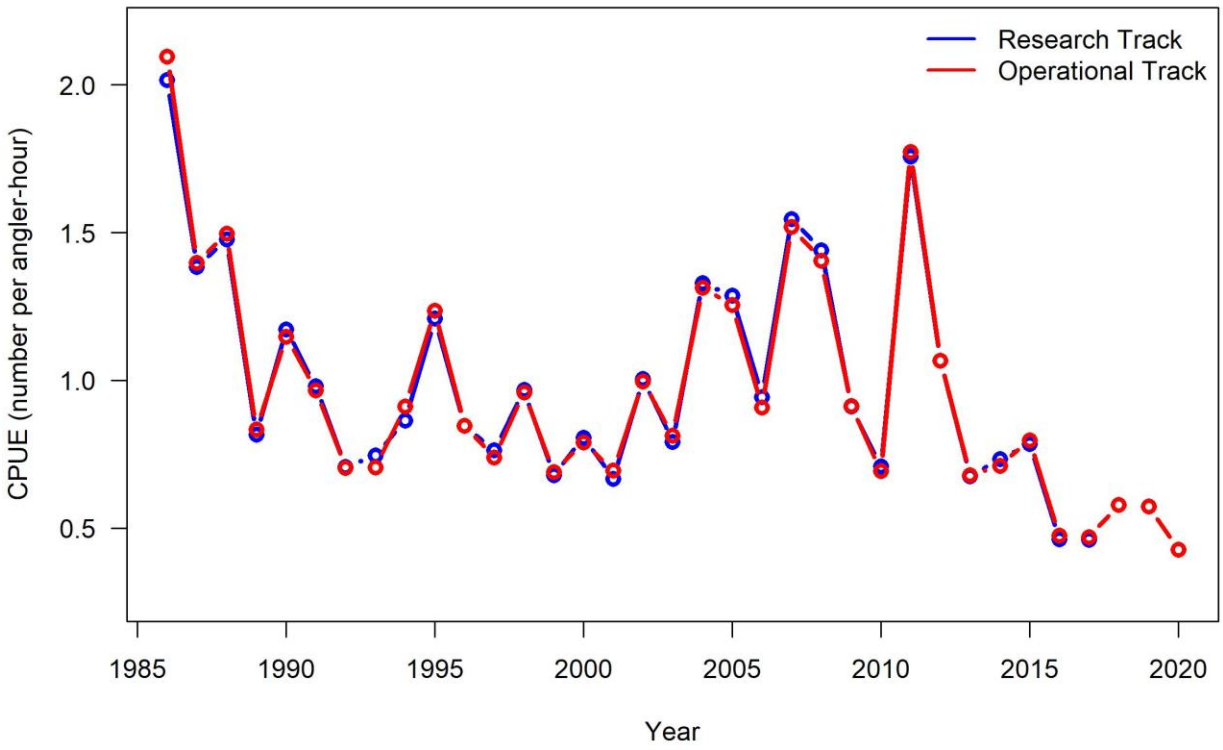

Figure 9. Standardized index for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico for SEDAR 68 Operational Track compared to the index provided during SEDAR 68 Research Track. For comparison, both indices have been normalized by their respective means.

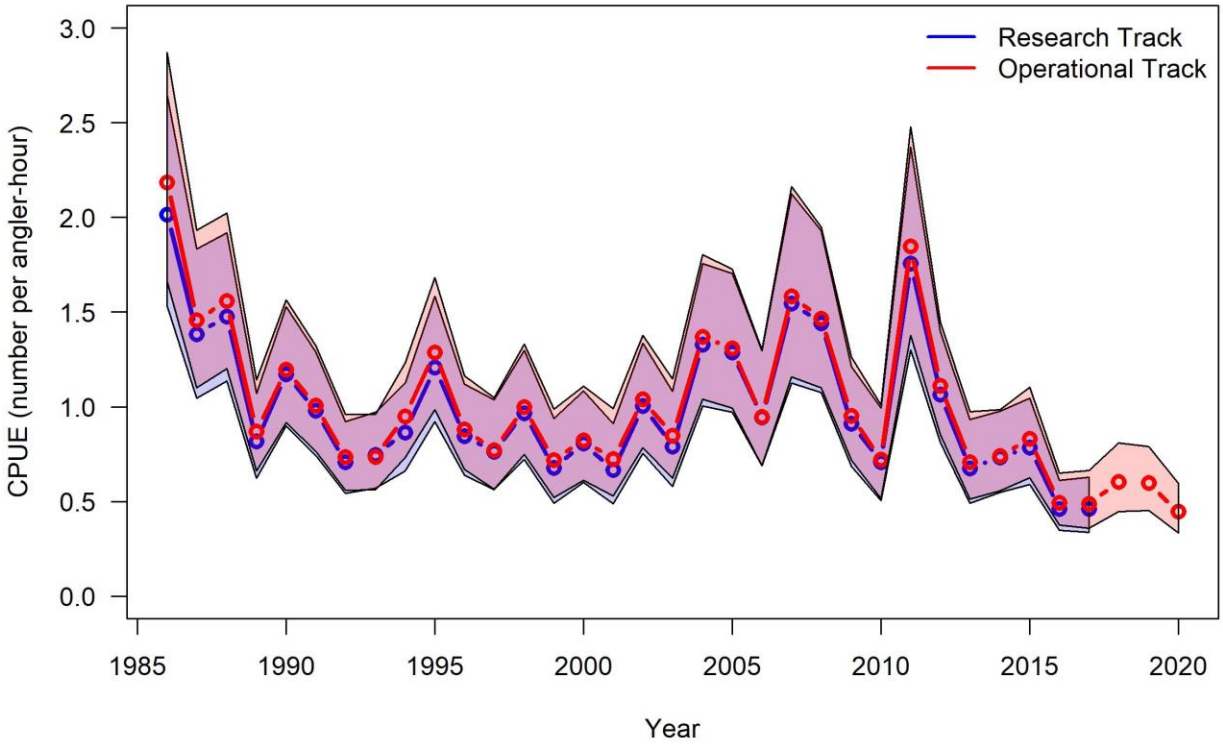

Figure 10. Comparison of indices for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico for the SEDAR 68 Operational Track compared to the index provided during the SEDAR 68 Research Track with confidence intervals.

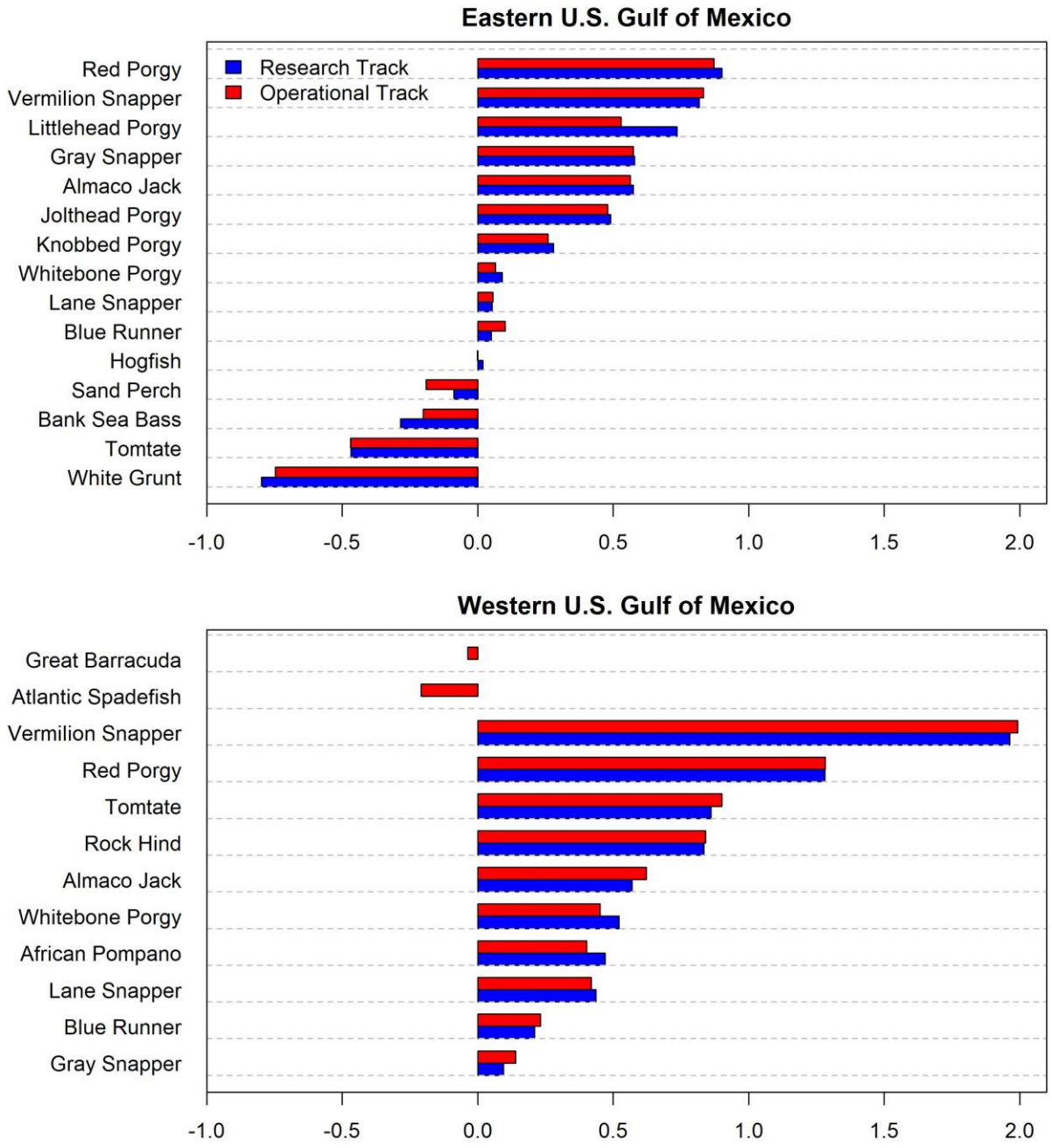

Figure 11. Comparison of coefficients obtained from the Stephens and MacCall (2004) trip selection approach for the SEDAR 68 Operational Track and the previous SEDAR 68 Research Track assessment in the Eastern U.S. Gulf of Mexico and Western U.S. Gulf of Mexico.

Appendix A

Table A1. Total trips, positive trips (Pos), and proportion of positive trips (PPos) before (Total) and after trip selection (Stephens and MacCall, SMAC) for Scamp and Yellowmouth Grouper for the Eastern U.S. Gulf of Mexico. SMAC+ includes all trips where the target species was caught. The percent of trips retained is also provided.

Year	Trips Tot	Pos Tot	PPos Tot	Trips SMAC	Pos SMAC	PPos SMAC	Trips SMAC+	Pos SMAC+	PPos SMAC+	Trips Retained
1986	2,641	276	0.105	34	9	0.265	38	13	0.342	1.4
1987	2,470	320	0.130	32	8	0.250	38	14	0.368	1.5
1988	3,887	416	0.107	74	17	0.230	82	25	0.305	2.1
1989	4,575	553	0.121	148	33	0.223	152	37	0.243	3.3
1990	7,874	359	0.046	140	30	0.214	143	33	0.231	1.8
1991	6,937	215	0.031	243	32	0.132	243	32	0.132	3.5
1992	7,292	350	0.048	311	42	0.135	314	45	0.143	4.3
1993	7,577	328	0.043	278	51	0.183	280	53	0.189	3.7
1994	7,041	468	0.066	351	117	0.333	353	119	0.337	5.0
1995	5,747	511	0.089	339	127	0.375	340	128	0.376	5.9
1996	5,545	363	0.065	276	65	0.236	282	71	0.252	5.1
1997	5,507	413	0.075	336	81	0.241	342	87	0.254	6.2
1998	4,764	257	0.054	237	58	0.245	246	67	0.272	5.2
1999	3,246	154	0.047	185	28	0.151	185	28	0.151	5.7
2000	4,254	195	0.046	216	41	0.190	219	44	0.201	5.1
2001	4,045	144	0.036	372	56	0.151	374	58	0.155	9.2
2002	4,038	215	0.053	359	96	0.267	363	100	0.275	9.0
2003	4,080	232	0.057	380	85	0.224	385	90	0.234	9.4
2004	4,545	436	0.096	209	78	0.373	212	81	0.382	4.7
2005	3,941	347	0.088	228	89	0.390	231	92	0.398	5.9
2006	3,600	251	0.070	248	65	0.262	252	69	0.274	7.0
2007	4,139	532	0.129	253	109	0.431	261	117	0.448	6.3
2008	5,462	500	0.092	571	206	0.361	571	206	0.361	10.5
2009	6,206	439	0.071	627	173	0.276	631	177	0.281	10.2
2010	4,136	290	0.070	213	48	0.225	215	50	0.233	5.2
2011	5,416	783	0.145	338	173	0.512	355	190	0.535	6.6

Table A1 Continued. Total trips, positive trips (Pos), and proportion of positive trips (PPos) before (Total) and after trip selection (Stephens and MacCall, SMAC) for Scamp and Yellowmouth Grouper for the Eastern U.S. Gulf of Mexico. SMAC+ includes all trips where the target species was caught. The percent of trips retained is also provided.

Year	Trips Tot	Pos Tot	PPos Tot	Trips SMAC	Pos SMAC	PPos SMAC	Trips SMAC+	Pos SMAC+	PPos SMAC+	Trips Retained
2012	5,374	499	0.093	551	183	0.332	561	193	0.344	10.4
2013	5,732	400	0.070	631	145	0.230	633	147	0.232	11.0
2014	6,968	594	0.085	750	155	0.207	752	157	0.209	10.8
2015	7,429	612	0.082	777	231	0.297	780	234	0.300	10.5
2016	7,748	290	0.037	925	150	0.162	927	152	0.164	12.0
2017	7,732	301	0.039	733	126	0.172	734	127	0.173	9.5
2018	7,543	374	0.050	730	148	0.203	732	150	0.205	9.7
2019	7,347	293	0.040	811	137	0.169	814	140	0.172	11.1
2020	5,884	206	0.035	620	77	0.124	621	78	0.126	10.6

Table A2. Total trips, positive trips (Pos), and proportion of positive trips (PPos) before (Total) and after trip selection (Stephens and MacCall, SMAC) for Scamp and Yellowmouth Grouper for the Western U.S. Gulf of Mexico. SMAC+ includes all trips where the target species was caught. The percent of trips retained is also provided.

Year	Trips Total	Pos Total	PPos Total	Trips SMAC	Pos SMAC	PPos SMAC	Trips SMAC+	Pos SMAC+	PPos SMAC+	Trips Retained
1986	1,429	229	0.160	177	112	0.633	191	126	0.660	13.4
1987	1,748	239	0.137	257	116	0.451	269	128	0.476	15.4
1988	1,897	251	0.132	261	126	0.483	270	135	0.500	14.2
1989	1,822	124	0.068	177	38	0.215	186	47	0.253	10.2
1990	1,914	171	0.089	218	81	0.372	225	88	0.391	11.8
1991	1,639	194	0.118	126	55	0.437	136	65	0.478	8.3
1992	2,331	195	0.084	125	48	0.384	133	56	0.421	5.7
1993	2,532	149	0.059	115	34	0.296	122	41	0.336	4.8
1994	2,945	140	0.048	139	31	0.223	147	39	0.265	5.0
1995	2,699	144	0.053	121	22	0.182	130	31	0.238	4.8
1996	2,381	112	0.047	90	19	0.211	97	26	0.268	4.1
1997	2,259	95	0.042	95	17	0.179	97	19	0.196	4.3

Table A2 Continued. Total trips, positive trips (Pos), and proportion of positive trips (PPos) before (Total) and after trip selection (Stephens and MacCall, SMAC) for Scamp and Yellowmouth Grouper for the Western U.S. Gulf of Mexico. SMAC+ includes all trips where the target species was caught. The percent of trips retained is also provided.

Year	Trips Total	Pos Total	PPos Total	Trips SMAC	Pos SMAC	PPos SMAC	Trips SMAC+	Pos SMAC+	PPos SMAC+	Trips Retained
1998	2,510	149	0.059	79	23	0.291	90	34	0.378	3.6
1999	1,416	85	0.060	76	13	0.171	85	22	0.259	6.0
2000	1,872	138	0.074	166	45	0.271	172	51	0.297	9.2
2001	1,816	125	0.069	126	30	0.238	129	33	0.256	7.1
2002	1,978	102	0.052	101	21	0.208	103	23	0.223	5.2
2003	1,781	84	0.047	76	10	0.132	79	13	0.165	4.4
2004	1,836	125	0.068	88	29	0.330	93	34	0.366	5.1
2005	1,736	121	0.070	117	38	0.325	122	43	0.352	7.0
2006	2,011	57	0.028	71	8	0.113	75	12	0.160	3.7
2007	1,970	56	0.028	80	9	0.112	82	11	0.134	4.2
2008	753	38	0.050	27	4	0.148	31	8	0.258	4.1
2009	1,691	57	0.034	61	11	0.180	70	20	0.286	4.1
2010	1,250	40	0.032	61	11	0.180	62	12	0.194	5.0
2011	1,241	66	0.053	60	26	0.433	62	28	0.452	5.0
2012	1,512	70	0.046	84	28	0.333	89	33	0.371	5.9
2013	1,553	78	0.050	107	35	0.327	108	36	0.333	7.0
2014	1,597	77	0.048	95	45	0.474	97	47	0.485	6.1
2015	1,626	78	0.048	122	29	0.238	123	30	0.244	7.6
2016	1,619	92	0.057	108	39	0.361	111	42	0.378	6.9
2017	1,504	63	0.042	84	20	0.238	87	23	0.264	5.8
2018	1,530	81	0.053	76	28	0.368	77	29	0.377	5.0
2019	1,471	92	0.063	95	35	0.368	98	38	0.388	6.7
2020	1,373	63	0.046	79	20	0.253	83	24	0.289	6.0

Appendix B

Table B1. Number of trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	CenSWTX	NWTX_LA	NWFL_AL	SWFL	0.5day	0.75day	Fullday	Dec-Feb
1986	31	160	20	18	4	11	214	7
1987	21	248	30	8	3	5	299	29
1988	37	233	71	11	7	23	322	46
1989	18	168	145	7	22	32	284	24
1990	48	177	116	27	17	46	305	21
1991	42	94	229	14	32	95	252	20
1992	58	75	291	23	12	114	321	14
1993	47	75	259	21	13	66	323	28
1994	66	81	343	10	43	113	344	32
1995	52	78	335	5	85	82	303	28
1996	39	58	271	11	50	92	237	15
1997	46	51	341	1	75	96	268	7
1998	32	58	245	1	13	137	186	25
1999	14	71	183	2	32	81	157	19
2000	24	148	215	4	20	114	257	12
2001	25	104	367	7	32	231	240	35
2002	56	47	359	4	47	251	168	19
2003	26	53	385	4	50	241	173	9
2004	23	70	208	2	22	142	141	14
2005	40	82	229	1	9	153	191	21
2006	16	59	252	4	39	169	119	13
2007	31	51	260	3	46	183	114	18
2008	20	11	567	1	69	395	138	26
2009	22	48	628	2	119	433	149	35
2010	14	48	214	5	9	144	124	7
2011	13	49	353	2	36	261	120	11
2012	35	54	556	7	48	434	168	24
2013	37	71	631	6	97	246	398	27
2014	23	74	745	9	120	324	405	53

Table B1 Continued. Number of trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	CenSWTX	NWTX_LA	NWFL_AL	SWFL	0.5day	0.75day	Fullday	Dec-Feb
2015	34	89	774	7	119	326	458	61
2016	23	88	918	7	142	365	531	70
2017	14	73	727	14	90	306	425	49
2018	13	64	725	6	105	322	382	34
2019	47	51	800	18	170	372	370	44
2020	40	43	615	8	87	284	333	48
Total	1,127	3,004	13,407	280	1,884	6,689	9,219	945

Table B1 Continued. Number of trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	Mar-May	Jun-Aug	Sep-Nov	7-10	11-20	21-30	31-40	41-50	51-60	61+
1986	49	117	56	16	49	51	32	40	17	24
1987	82	129	67	11	37	61	43	50	53	52
1988	107	135	64	15	66	66	60	45	36	64
1989	79	145	90	10	46	53	63	49	42	75
1990	74	201	72	27	47	68	73	52	58	43
1991	66	212	81	14	38	78	68	68	61	52
1992	107	178	148	4	57	115	101	68	60	42
1993	96	188	90	11	57	82	95	63	50	44
1994	102	239	127	24	76	117	104	76	54	49
1995	119	257	66	23	74	104	97	55	94	23
1996	86	219	59	14	75	90	73	62	39	26
1997	96	243	93	12	90	136	71	56	31	43
1998	93	186	32	14	44	101	77	43	38	19
1999	115	132	4	16	43	61	52	35	33	30
2000	98	188	93	18	51	85	76	42	42	77
2001	155	239	74	29	114	122	107	38	43	50
2002	99	275	73	16	99	116	124	36	36	39
2003	126	239	90	17	67	114	141	48	37	40

Table B1 Continued. Number of trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	Mar-May	Jun-Aug	Sep-Nov	7-10	11-20	21-30	31-40	41-50	51-60	61+
2004	81	166	44	8	54	70	81	25	23	44
2005	117	177	38	12	61	72	110	31	31	36
2006	75	172	67	7	46	69	97	25	28	55
2007	93	183	49	7	31	75	138	24	22	46
2008	128	370	78	9	57	150	257	76	24	29
2009	136	413	117	10	74	158	282	95	31	51
2010	72	114	84	5	27	74	76	28	27	40
2011	59	283	64	4	29	61	155	61	33	74
2012	114	336	176	11	61	150	198	88	68	74
2013	123	435	156	13	65	153	261	74	84	91
2014	155	499	142	4	41	146	327	137	89	105
2015	198	474	170	7	49	169	320	118	108	132
2016	208	620	140	4	64	210	319	148	107	186
2017	189	441	142	8	92	138	266	106	89	122
2018	168	463	144	14	87	145	273	91	95	104
2019	223	480	165	27	106	196	273	106	70	134
2020	108	399	149	27	98	154	192	103	58	72
Total	3,996	9,547	3,304	468	2,172	3,810	5,082	2,262	1,811	2,187

Table B2. Number of positive trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	CenSWTX	NWTX_LA	NWFL_AL	SWFL	0.5day	0.75day	Fullday	Dec-Feb
1986	23	103	6	7	1	6	132	3
1987	16	112	6	8	3	3	136	22
1988	23	112	15	10	1	6	153	20
1989	9	38	32	5	1	5	78	10
1990	24	64	25	8	6	11	104	9
1991	22	43	29	3	2	19	76	7
1992	29	27	39	6	1	14	86	7

Table B2 Continued. Number of positive trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	CenSWTX	NWTX_LA	NWFL_AL	SWFL	0.5day	0.75day	Fullday	Dec-Feb
1993	14	27	48	5	0	10	84	12
1994	17	22	111	8	14	21	123	13
1995	17	14	124	4	55	16	88	9
1996	9	17	65	6	6	22	69	3
1997	6	13	87	0	27	22	57	3
1998	9	25	67	0	1	42	58	8
1999	6	16	28	0	2	13	35	6
2000	5	46	43	1	0	17	78	2
2001	5	28	58	0	4	44	43	9
2002	8	15	98	2	2	76	45	8
2003	5	8	90	2	7	66	30	8
2004	7	27	79	0	3	51	61	6
2005	11	32	92	0	2	48	85	9
2006	2	10	69	3	2	42	37	3
2007	2	9	117	1	10	76	42	8
2008	4	4	203	1	9	156	49	14
2009	9	11	176	0	15	141	41	10
2010	1	11	49	1	1	27	34	2
2011	3	25	190	0	17	147	54	7
2012	15	18	192	2	13	158	55	6
2013	3	33	147	4	21	47	115	2
2014	9	38	155	1	19	54	131	9
2015	4	26	230	0	31	76	157	18
2016	13	29	151	2	19	29	146	14
2017	3	20	127	2	6	29	115	7
2018	2	27	148	1	12	39	128	5
2019	15	23	138	7	7	72	99	6
2020	11	13	77	8	8	32	62	6
Total	361	1,086	3,311	108	328	1,637	2,886	291

Table B2 Continued. Number of positive trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	Mar-May	Jun-Aug	Sep-Nov	7-10	11-20	21-30	31-40	41-50	51-60	61+
1986	26	67	43	9	34	38	21	23	6	8
1987	40	48	32	4	18	33	21	16	24	26
1988	48	67	25	7	31	38	21	21	9	33
1989	21	35	18	1	16	14	14	8	12	19
1990	17	61	34	3	17	22	26	23	20	10
1991	22	53	15	7	11	21	11	15	17	15
1992	24	45	25	2	13	22	24	13	14	13
1993	20	44	18	1	12	20	15	18	12	16
1994	33	76	36	5	20	31	38	21	25	18
1995	35	103	12	5	17	27	32	17	57	4
1996	30	48	16	6	17	23	17	19	6	9
1997	25	56	22	4	21	34	15	12	5	15
1998	40	45	8	6	9	24	25	15	15	7
1999	20	23	1	6	11	11	7	5	9	1
2000	24	46	23	6	8	22	18	11	16	14
2001	27	38	17	6	26	18	17	6	6	12
2002	29	59	27	4	40	32	29	6	7	5
2003	29	36	30	7	23	34	21	6	6	6
2004	23	68	18	0	23	33	34	10	7	8
2005	51	63	12	3	24	31	36	12	14	15
2006	26	37	15	2	22	12	30	4	6	5
2007	41	73	6	4	11	27	62	7	5	12
2008	52	118	30	5	22	58	96	21	4	8
2009	33	109	45	3	23	55	84	17	7	8
2010	12	22	26	0	8	18	15	7	7	7
2011	30	148	33	0	17	33	86	33	18	31
2012	40	120	60	4	19	50	89	22	25	17
2013	20	116	45	2	15	42	60	16	18	30
2014	35	116	44	2	12	33	73	22	20	42

Table B2 Continued. Number of positive trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	Mar-May	Jun-Aug	Sep-Nov	7-10	11-20	21-30	31-40	41-50	51-60	61+
2015	54	149	43	2	9	47	88	45	33	40
2016	32	110	38	2	18	48	56	18	18	34
2017	32	78	33	1	19	26	45	10	20	29
2018	25	117	32	1	11	34	59	19	29	26
2019	51	87	34	5	28	35	51	17	7	35
2020	13	49	34	5	25	22	29	6	5	10
Total	1,080	2,530	950	130	650	1,068	1,365	541	509	588

Table B3. Proportion positive of trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	CenSWTX	NWTX_LA	NWFL_AL	SWFL	0.5day	0.75day	Fullday	Dec-Feb
1986	0.742	0.644	0.300	0.389	0.250	0.545	0.617	0.429
1987	0.762	0.452	0.200	1.000	1.000	0.600	0.455	0.759
1988	0.622	0.481	0.211	0.909	0.143	0.261	0.475	0.435
1989	0.500	0.226	0.221	0.714	0.046	0.156	0.275	0.417
1990	0.500	0.362	0.216	0.296	0.353	0.239	0.341	0.429
1991	0.524	0.457	0.127	0.214	0.062	0.200	0.302	0.350
1992	0.500	0.360	0.134	0.261	0.083	0.123	0.268	0.500
1993	0.298	0.360	0.185	0.238	0.000	0.152	0.260	0.429
1994	0.258	0.272	0.324	0.800	0.326	0.186	0.358	0.406
1995	0.327	0.180	0.370	0.800	0.647	0.195	0.290	0.321
1996	0.231	0.293	0.240	0.545	0.120	0.239	0.291	0.200
1997	0.130	0.255	0.255	0.000	0.360	0.229	0.213	0.429
1998	0.281	0.431	0.274	0.000	0.077	0.307	0.312	0.320
1999	0.429	0.225	0.153	0.000	0.062	0.160	0.223	0.316
2000	0.208	0.311	0.200	0.250	0.000	0.149	0.304	0.167
2001	0.200	0.269	0.158	0.000	0.125	0.190	0.179	0.257
2002	0.143	0.319	0.273	0.500	0.043	0.303	0.268	0.421
2003	0.192	0.151	0.234	0.500	0.140	0.274	0.173	0.889

Table B3 Continued. Proportion positive of trips for Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	CenSWTX	NWTX_LA	NWFL_AL	SWFL	0.5day	0.75day	Fullday	Dec-Feb
2004	0.304	0.386	0.380	0.000	0.136	0.359	0.433	0.429
2005	0.275	0.390	0.402	0.000	0.222	0.314	0.445	0.429
2006	0.125	0.170	0.274	0.750	0.051	0.248	0.311	0.231
2007	0.064	0.176	0.450	0.333	0.217	0.415	0.368	0.444
2008	0.200	0.364	0.358	1.000	0.130	0.395	0.355	0.538
2009	0.409	0.229	0.280	0.000	0.126	0.326	0.275	0.286
2010	0.071	0.229	0.229	0.200	0.111	0.188	0.274	0.286
2011	0.231	0.510	0.538	0.000	0.472	0.563	0.450	0.636
2012	0.429	0.333	0.345	0.286	0.271	0.364	0.327	0.250
2013	0.081	0.465	0.233	0.667	0.216	0.191	0.289	0.074
2014	0.391	0.513	0.208	0.111	0.158	0.167	0.324	0.170
2015	0.118	0.292	0.297	0.000	0.260	0.233	0.343	0.295
2016	0.565	0.330	0.164	0.286	0.134	0.080	0.275	0.200
2017	0.214	0.274	0.175	0.143	0.067	0.095	0.271	0.143
2018	0.154	0.422	0.204	0.167	0.114	0.121	0.335	0.147
2019	0.319	0.451	0.172	0.389	0.041	0.194	0.268	0.136
2020	0.275	0.302	0.125	1.000	0.092	0.113	0.186	0.125
Total	0.320	0.362	0.247	0.386	0.174	0.245	0.313	0.308

Table B3 Continued. Proportion positive of trips with Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	Mar-May	Jun-Aug	Sep-Nov	7-10	11-20	21-30	31-40	41-50	51-60	61+
1986	0.531	0.573	0.768	0.562	0.694	0.745	0.656	0.575	0.353	0.333
1987	0.488	0.372	0.478	0.364	0.486	0.541	0.488	0.320	0.453	0.500
1988	0.449	0.496	0.391	0.467	0.470	0.576	0.350	0.467	0.250	0.516
1989	0.266	0.241	0.200	0.100	0.348	0.264	0.222	0.163	0.286	0.253
1990	0.230	0.304	0.472	0.111	0.362	0.324	0.356	0.442	0.345	0.233
1991	0.333	0.250	0.185	0.500	0.290	0.269	0.162	0.221	0.279	0.288
1992	0.224	0.253	0.169	0.500	0.228	0.191	0.238	0.191	0.233	0.310

Table B3 Continued. Proportion positive of trips with Scamp and Yellowmouth Grouper in the U.S. Gulf of Mexico.

Year	Mar-May	Jun-Aug	Sep-Nov	7-10	11-20	21-30	31-40	41-50	51-60	61+
1993	0.208	0.234	0.200	0.091	0.210	0.244	0.158	0.286	0.240	0.364
1994	0.324	0.318	0.284	0.208	0.263	0.265	0.365	0.276	0.463	0.367
1995	0.294	0.401	0.182	0.217	0.230	0.260	0.330	0.309	0.606	0.174
1996	0.349	0.219	0.271	0.429	0.227	0.256	0.233	0.306	0.154	0.346
1997	0.260	0.230	0.237	0.333	0.233	0.250	0.211	0.214	0.161	0.349
1998	0.430	0.242	0.250	0.429	0.204	0.238	0.325	0.349	0.395	0.368
1999	0.174	0.174	0.250	0.375	0.256	0.180	0.135	0.143	0.273	0.033
2000	0.245	0.245	0.247	0.333	0.157	0.259	0.237	0.262	0.381	0.182
2001	0.174	0.159	0.230	0.207	0.228	0.148	0.159	0.158	0.140	0.240
2002	0.293	0.214	0.370	0.250	0.404	0.276	0.234	0.167	0.194	0.128
2003	0.230	0.151	0.333	0.412	0.343	0.298	0.149	0.125	0.162	0.150
2004	0.284	0.410	0.409	0.000	0.426	0.471	0.420	0.400	0.304	0.182
2005	0.436	0.356	0.316	0.250	0.393	0.431	0.327	0.387	0.452	0.417
2006	0.347	0.215	0.224	0.286	0.478	0.174	0.309	0.160	0.214	0.091
2007	0.441	0.399	0.122	0.571	0.355	0.360	0.449	0.292	0.227	0.261
2008	0.406	0.319	0.385	0.556	0.386	0.387	0.374	0.276	0.167	0.276
2009	0.243	0.264	0.385	0.300	0.311	0.348	0.298	0.179	0.226	0.157
2010	0.167	0.193	0.310	0.000	0.296	0.243	0.197	0.250	0.259	0.175
2011	0.508	0.523	0.516	0.000	0.586	0.541	0.555	0.541	0.545	0.419
2012	0.351	0.357	0.341	0.364	0.312	0.333	0.450	0.250	0.368	0.230
2013	0.163	0.267	0.288	0.154	0.231	0.274	0.230	0.216	0.214	0.330
2014	0.226	0.232	0.310	0.500	0.293	0.226	0.223	0.161	0.225	0.400
2015	0.273	0.314	0.253	0.286	0.184	0.278	0.275	0.381	0.306	0.303
2016	0.154	0.177	0.271	0.500	0.281	0.229	0.176	0.122	0.168	0.183
2017	0.169	0.177	0.232	0.125	0.206	0.188	0.169	0.094	0.225	0.238
2018	0.149	0.253	0.222	0.071	0.126	0.234	0.216	0.209	0.305	0.250
2019	0.229	0.181	0.206	0.185	0.264	0.179	0.187	0.160	0.100	0.261
2020	0.120	0.123	0.228	0.185	0.255	0.143	0.151	0.058	0.086	0.139
Total	0.270	0.265	0.288	0.278	0.299	0.280	0.269	0.239	0.281	0.269