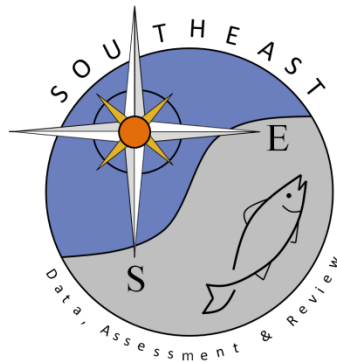# Standardized Catch Rates of Red Grouper (*Epinephelus morio*) from the Gulf of Mexico Recreational Charterboat and Private Boat Fisheries (MRFSS) 1986-2017

Skyler Sagarese and Adyan Rios

SEDAR61-WP-16

21 November 2018

Please cite this document as:


Sagarese, Skyler and Adyan Rios.  2018.  Standardized Catch Rates of Red Grouper (*Epinephelus morio*) from the Gulf of Mexico Recreational Charterboat and Private Boat Fisheries (MRFSS) 1986-2017. SEDAR61-WP-16. SEDAR, North Charleston, SC. 13 pp.

**Standardized Catch Rates of Red Grouper (*Epinephelus morio*) from the Gulf of Mexico Recreational Charterboat and Private Boat Fisheries (MRFSS) 1986-2017**

Skyler Sagarese and Adyan Rios
National Marine Fisheries Service, Southeast Fisheries Science Center
Sustainable Fisheries Division, 75 Virginia Beach Drive, Miami, FL 33149
Skyler.sagarese@noaa.gov; Adyan.Rios@NOAA.gov

## 1. Introduction

The recreational fishery in the Gulf of Mexico is surveyed by the Marine Recreational Fishery Statistics Survey (MRFSS) conducted by NOAA Fisheries, the Texas Marine Sport-Harvest Monitoring Program conducted by the Texas Parks and Wildlife Department (TPWD), and the Headboat Survey (HBS) conducted by NOAA Fisheries. MRFSS has monitored shore based, charterboat and private/rental boat angler fishing in the Gulf of Mexico since 1981. Publically available MRFSS data were used to construct an index of red grouper catch rates in the Gulf of Mexico. The index was constructed using Generalized Linear Mixed Models, and a delta-lognormal approach.

## 2. Materials and Methods

*Marine Recreational Fishery Statistics Survey*

MRFSS collects information on participation, effort, and species-specific catch. Data are collected to provide catch and effort estimates in two-month periods ("waves") for each recreational fishing mode (shore fishing, private/rental boat, charterboat, or headboat/charterboat combined) and for each area of fishing (inshore, state Territorial Seas, U.S. Exclusive Economic Zone), in each Gulf of Mexico state (except Texas). Total catch information is collected by MRFSS on fish landed whole and observed by interviewers ("Type A"), fish reported as killed by the fishers ("Type B1") and fish reported as released alive by the fishers ("Type B2").

Data from the MRFSS dockside interviews were used to characterize abundance trends of red grouper in the Gulf of Mexico. Information on effort included hours fished and number of anglers as reported to the interviewer. Catch that was not observed by the interviewer (B1 and B2) was adjusted upwards by the ratio of non-interviewed to interviewed anglers in each group of anglers. The catch per unit effort was calculated on an individual group basis and was equal to the number of fish caught divided by the effort, where effort was the product of the number of anglers and the total hours fished.

*Data Filtering Techniques*
The following data preparation and filtering techniques were applied to the MRFSS dataset:
1. Data in the Gulf of Mexico were limited to interviews that took place in west Florida (excluding Monroe County)
2. Only interviews associated with charterboat or private fishing modes were retained.
3. Data were limited to interviews that took place from noon to 5:59pm.
4. Interviews that reported shore-based fishing or fishing in inshore waters were excluded.
5. Interviews with possible error in effort information or in catch amount were excluded.
6. Data prior to 1986 were excluded.
7. Data were not adjusted to account for size limits or closed seasons.
8. The Stephens MacCall (2004) approach was used to restrict the dataset to anglers that likely encountered red grouper based on the trip's species composition.
9. Interviews that reached bag limits for red grouper and aggregate groupers were retained.

*Standardization*
       A delta-lognormal approach (Lo et al., 1992) was used to develop standardized catch rate indices. This method combines separate generalized linear modeling (GLM) analyses of the proportion of interviews that observed red grouper and the catch rates positive interviews to construct a single standardized index of abundance.  A forward stepwise approach based on AIC was used during the construction of each GLM. In addition to screening using AIC, factors were also screened and not added to the model if the reduction in deviance per degree of freedom was less than one percent. The following factors were examined as possible influences on the proportion of positive interviews, and the catch rates on positive interviews:

| Factor | DF | Details |
|---|---|---|
| Year | 32 | 1986-2017 |
| Time of Interview | 5 | 12-1pm, 2pm, 3pm, 4pm, 5-6pm |
| Season | 4 | Dec-Feb, Mar-May ,Jun-Aug, Sep-Nov |
| Reg. Season | 2 | Open, Closed |
| Region | 3 | SWFL, CWFL, NWFL |
| Area | 2 | <10 miles offshore, > 10 miles offshore |
| Mode | 2 | Private, Charterboat |
| Hours Fished* | 4 | 1-2, 3-4, 5-6, 7+ |
| Anglers* | 7 | 1, 2, 3, 4, 5, 6, 7+ |

*Trip type and number of anglers were only explored as factors for modeling success.

       The factors above were examined for the binomial model based on success, where success was defined as whether or not an interview caught red grouper. However, the binomial component of the delta lognormal did not model success. Instead, the binomial component modeled the proportion of positive interviews in each unique combination of variables associated with the fixed factors.

       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 final delta-lognormal model was fit using the SAS macro GLIMMIX and the SAS procedure PROC MIXED (SAS Institute Inc. 1997) following the procedures by Lo et al. (1992).

## 3. Results and Discussion

*Stephens and MacCall*

The minimum difference between the predicted and the observed number of interviews that reported red grouper occurred at the probability threshold of 0.36 (Figure 1a). Interviews with a predicted probability that was greater than the critical threshold probability were identified as interviews that targeted red grouper (Figure 2b). This method retained 12.4% of interviews, and 59.4% of interviews that reported red grouper. Prior to trip selection, there were 126,213 interviews and the proportion positive was 0.12, and after selection there were 15,655 interviews and the proportion positive was 0.58. Given these diagnostics, sufficient interviews were retained to develop a standardized index of abundance.

*Annual Abundance Indices*

Table 1 summarizes the standardized index and corresponding coefficients of variation, upper confidence limits, lower confidence limits, and nominal CPUE. Final deviance tables are included in Table 2. Tables 3-5, in appendix A, provide the number of observations, the number of positive observations, and the proportion of positive observations by year and factor.

The final models for the binomial and lognormal components were:

Proportion Positive = YEAR + REGION + AREA + ANGLERS + YEAR*REGION
ln(CPUE) = YEAR + REGION + MODE + REGION*MODE + YEAR*REGION

The standardized index, with 95% confidence intervals, is shown in figure 2. Diagnostics for each component of the GLM are provided in figures 3 and 4. The over-dispersion parameter for the binomial component was 1.49. Figure 5 provides a comparison of the MRFSS index that resulted from the current analysis to the MRFSS index that was used in the SEDAR 42 assessment.

*Comments on Adequacy for Assessment*

An important issue to point out is that for SEDAR61, the raw MRIP data were processed and used by the analysts to develop the index. Prior to the MRIP calibration, FSD staff preprocessed the recreational data and provided it for index development. Minor differences in how trips were filtered have led to slight variations in the index, most notably in the first five years of the index. For example, the large difference in 1988 is a result of the number of trips retained: only 48 trips in 1988 as opposed to 138 trips during SEDAR42. However, even with potential differences in data processing, the overall trend is generally similar to the index produced previously.

## 4. References

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.

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

## 5. Tables

**Table 1.** Number of total interviews and positive interviews, proportion of positive interviews (PPT), relative nominal CPUE, and abundance index statistics for the MRFSS index.

| YEAR | TRIPS | POSITIVE TRIPS | PPT | RELATIVE NOMINAL CPUE | RELATIVE INDEX | LOWER 95% CI | UPPER 95% CI | CV |
|---|---|---|---|---|---|---|---|---|
| 1986 | 132 | 104 | 0.788 | 1.1097 | 0.9155 | 0.5271 | 1.5901 | 0.2814 |
| 1987 | 140 | 91 | 0.650 | 0.7086 | 0.8588 | 0.4844 | 1.5226 | 0.2923 |
| 1988 | 48 | 34 | 0.708 | 1.4474 | 1.7574 | 0.8844 | 3.4922 | 0.3537 |
| 1989 | 124 | 92 | 0.742 | 1.6939 | 1.1544 | 0.6254 | 2.1309 | 0.3138 |
| 1990 | 109 | 81 | 0.743 | 1.9271 | 1.6897 | 0.9805 | 2.9119 | 0.2772 |
| 1991 | 124 | 68 | 0.548 | 1.5406 | 1.6115 | 0.8679 | 2.9921 | 0.3170 |
| 1992 | 326 | 203 | 0.623 | 1.2380 | 1.2747 | 0.7513 | 2.1627 | 0.2690 |
| 1993 | 304 | 172 | 0.566 | 0.9807 | 1.0266 | 0.5673 | 1.8576 | 0.3032 |
| 1994 | 347 | 179 | 0.516 | 0.8770 | 0.8697 | 0.4735 | 1.5973 | 0.3111 |
| 1995 | 355 | 179 | 0.504 | 0.9990 | 0.8428 | 0.4500 | 1.5782 | 0.3215 |
| 1996 | 350 | 143 | 0.409 | 0.6080 | 0.4655 | 0.2253 | 0.9617 | 0.3751 |
| 1997 | 318 | 113 | 0.355 | 0.6926 | 0.5510 | 0.2668 | 1.1379 | 0.3749 |
| 1998 | 622 | 313 | 0.503 | 0.7313 | 0.6964 | 0.3758 | 1.2902 | 0.3158 |
| 1999 | 952 | 513 | 0.539 | 0.9832 | 0.8329 | 0.4661 | 1.4885 | 0.2965 |
| 2000 | 698 | 352 | 0.504 | 0.7368 | 0.8053 | 0.4417 | 1.4681 | 0.3071 |
| 2001 | 813 | 398 | 0.490 | 0.5790 | 0.6549 | 0.3543 | 1.2104 | 0.3145 |
| 2002 | 860 | 436 | 0.507 | 0.6312 | 0.7432 | 0.4017 | 1.3751 | 0.3151 |
| 2003 | 962 | 556 | 0.578 | 0.7900 | 0.9254 | 0.5229 | 1.6377 | 0.2913 |
| 2004 | 1190 | 829 | 0.697 | 0.8695 | 1.1536 | 0.6924 | 1.9218 | 0.2594 |
| 2005 | 857 | 534 | 0.623 | 0.4759 | 0.7927 | 0.4472 | 1.4054 | 0.2923 |
| 2006 | 413 | 186 | 0.450 | 0.2646 | 0.4123 | 0.2012 | 0.8450 | 0.3706 |
| 2007 | 387 | 200 | 0.517 | 0.4773 | 0.6248 | 0.3381 | 1.1547 | 0.3145 |
| 2008 | 542 | 339 | 0.625 | 1.0123 | 1.2365 | 0.7531 | 2.0301 | 0.2518 |
| 2009 | 457 | 310 | 0.678 | 1.3090 | 1.4434 | 0.8840 | 2.3568 | 0.2489 |
| 2010 | 401 | 255 | 0.636 | 1.3000 | 1.2157 | 0.7210 | 2.0497 | 0.2657 |
| 2011 | 473 | 296 | 0.626 | 1.3830 | 1.3885 | 0.8276 | 2.3296 | 0.2631 |
| 2012 | 521 | 335 | 0.643 | 0.9964 | 1.0493 | 0.6244 | 1.7631 | 0.2639 |
| 2013 | 429 | 295 | 0.688 | 1.6296 | 1.5715 | 0.9405 | 2.6260 | 0.2610 |
| 2014 | 684 | 475 | 0.694 | 1.3591 | 1.2859 | 0.7732 | 2.1388 | 0.2585 |
| 2015 | 548 | 371 | 0.677 | 1.1625 | 0.9172 | 0.5274 | 1.5949 | 0.2820 |
| 2016 | 615 | 371 | 0.603 | 0.7468 | 0.5269 | 0.2854 | 0.9728 | 0.3140 |
| 2017 | 554 | 322 | 0.581 | 0.7400 | 0.7063 | 0.3968 | 1.2572 | 0.2944 |

**Table 2.** Final deviance tables for the Gulf of Mexico red grouper regressions from the MRFSS charterboat and private boat fisheries. 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 Model for Success (whether or not a trip landed red grouper)** | | | | | | | | |
| Null | 1 | 21256.8 | 15654 | 21256.8 | 21256.80 | - | -10628.4 | - |
| Region | 3 | 20328.9 | 15652 | 927.9 | 20329.00 | 4.35% | -10164.5 | 927.8 |
| Area | 2 | 19128.8 | 15651 | 1200.1 | 19128.80 | 5.90% | -9564.4 | 1200.2 |
| Year | 32 | 18601.7 | 15620 | 1727.2 | 18601.60 | 2.56% | -9300.8 | 527.2 |
| Anglers | 7 | 18199.1 | 15614 | 2129.8 | 18199.20 | 2.13% | -9099.6 | 402.4 |
| Region*Year | 63 | 17518.4 | 15552 | 1610.4 | 17518.40 | 3.36% | -8759.2 | 680.8 |
| **Lognormal Model for Catch Rates From Positive Trips** | | | | | | | | |
| Null | 1 | 14273.9 | 9144 | 14273.9 | 30024.00 | - | -15012.0 | - |
| Region | 3 | 11775.4 | 9142 | 2498.5 | 28264.20 | 17.49% | -14132.1 | 1759.8 |
| Year | 32 | 11321.2 | 9111 | 454.2 | 27904.60 | 3.53% | -13952.3 | 359.6 |
| Mode | 2 | 11031.7 | 9110 | 289.5 | 27667.60 | 2.55% | -13833.8 | 237.0 |
| Region*Mode | 3 | 10438.5 | 9108 | 593.2 | 27162.20 | 5.36% | -13581.1 | 505.4 |
| Year*Region | 63 | 10004.4 | 9046 | 434.1 | 26773.80 | 3.50% | -13386.9 | 388.4 |

## 6. Figures

(a)                                               (b)
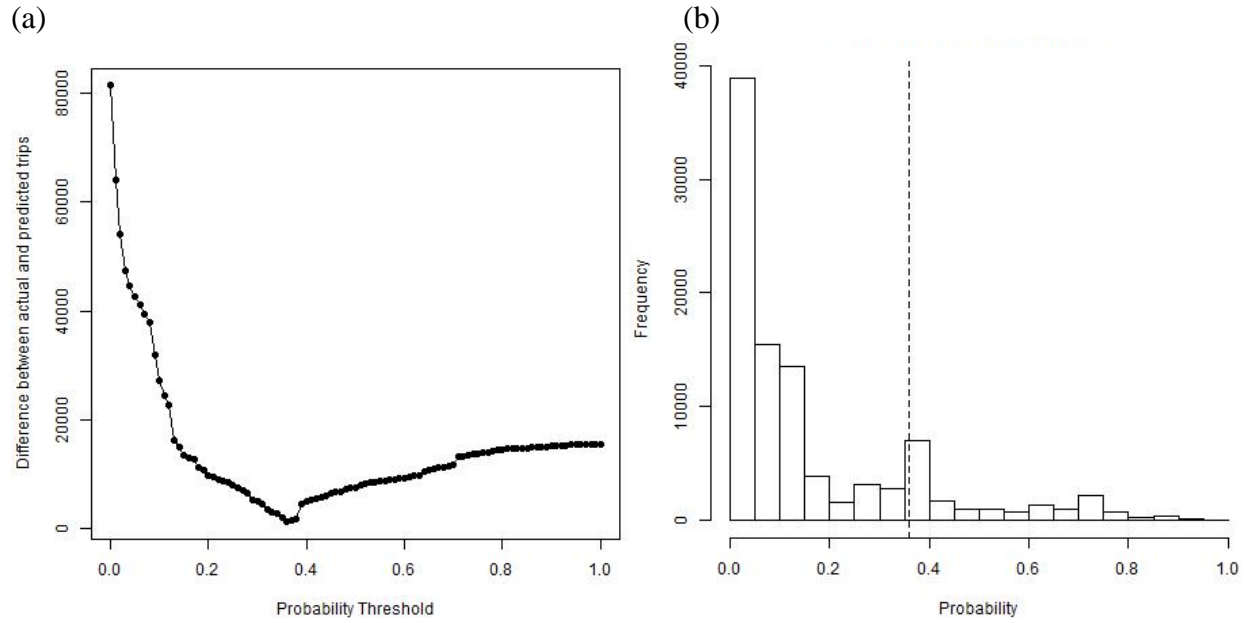


Figure 1: The difference between the number of records in which red grouper are observed and the number in which they are predicted to occur for each probability threshold (a). Histogram of probabilities generated by the species-based regression (b). The dashed vertical line indicates the critical value where false prediction is minimized.
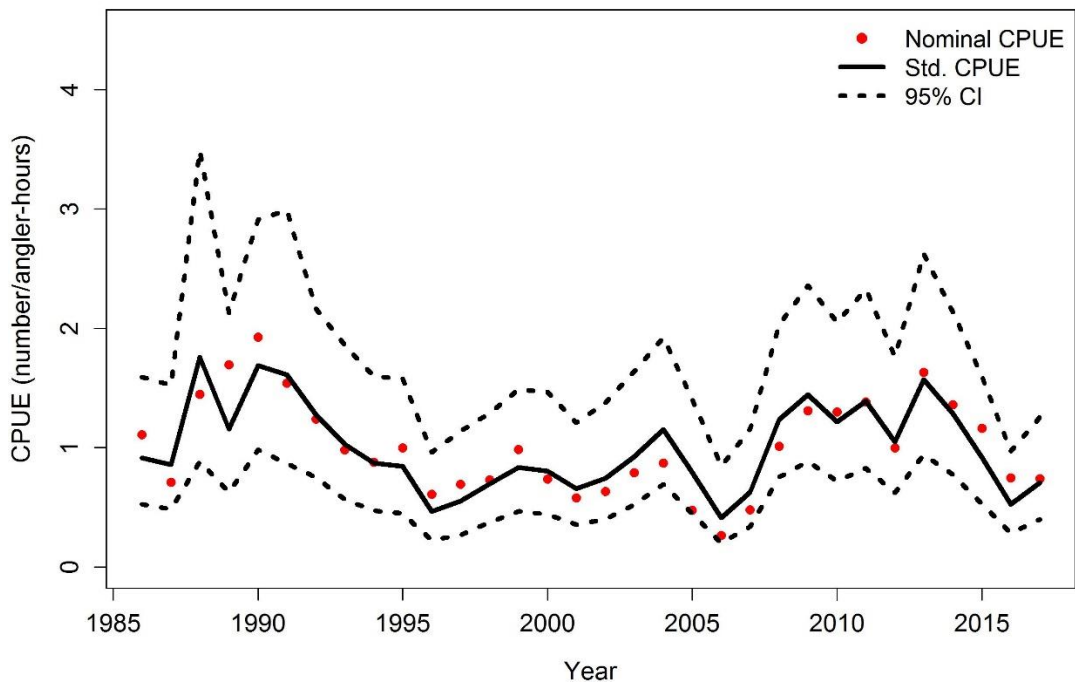


Figure 2: Standardized indices with 95% confidence intervals and nominal CPUE for the Gulf of Mexico red grouper MRFSS index.
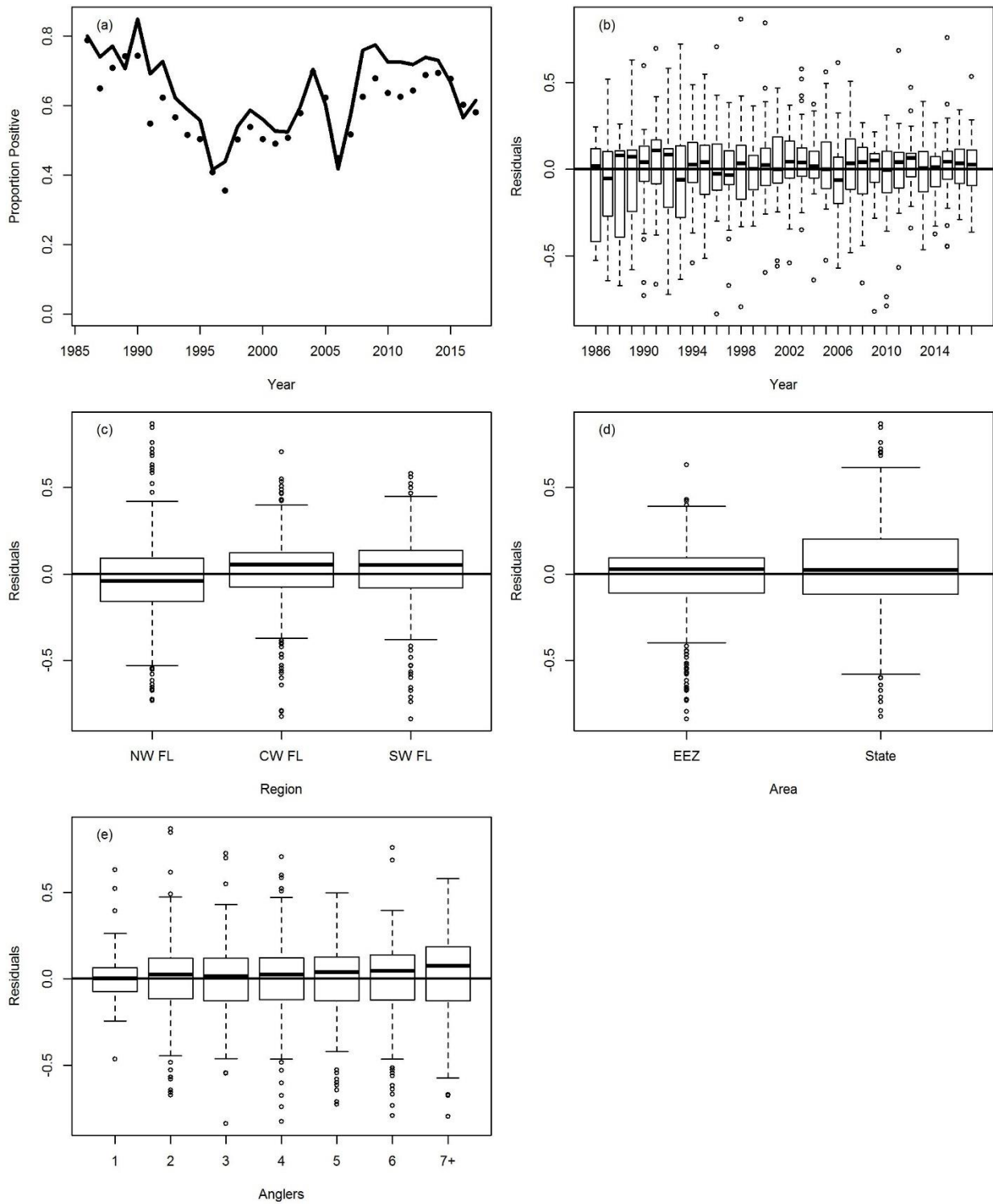
Figure 3. Diagnostic plots for the binomial model. Shown here are the predicted (solid line) and observed proportion of positive interviews by year (a), and the residuals from the binomial model by year (b), region (c), area (d), and number of anglers (e).
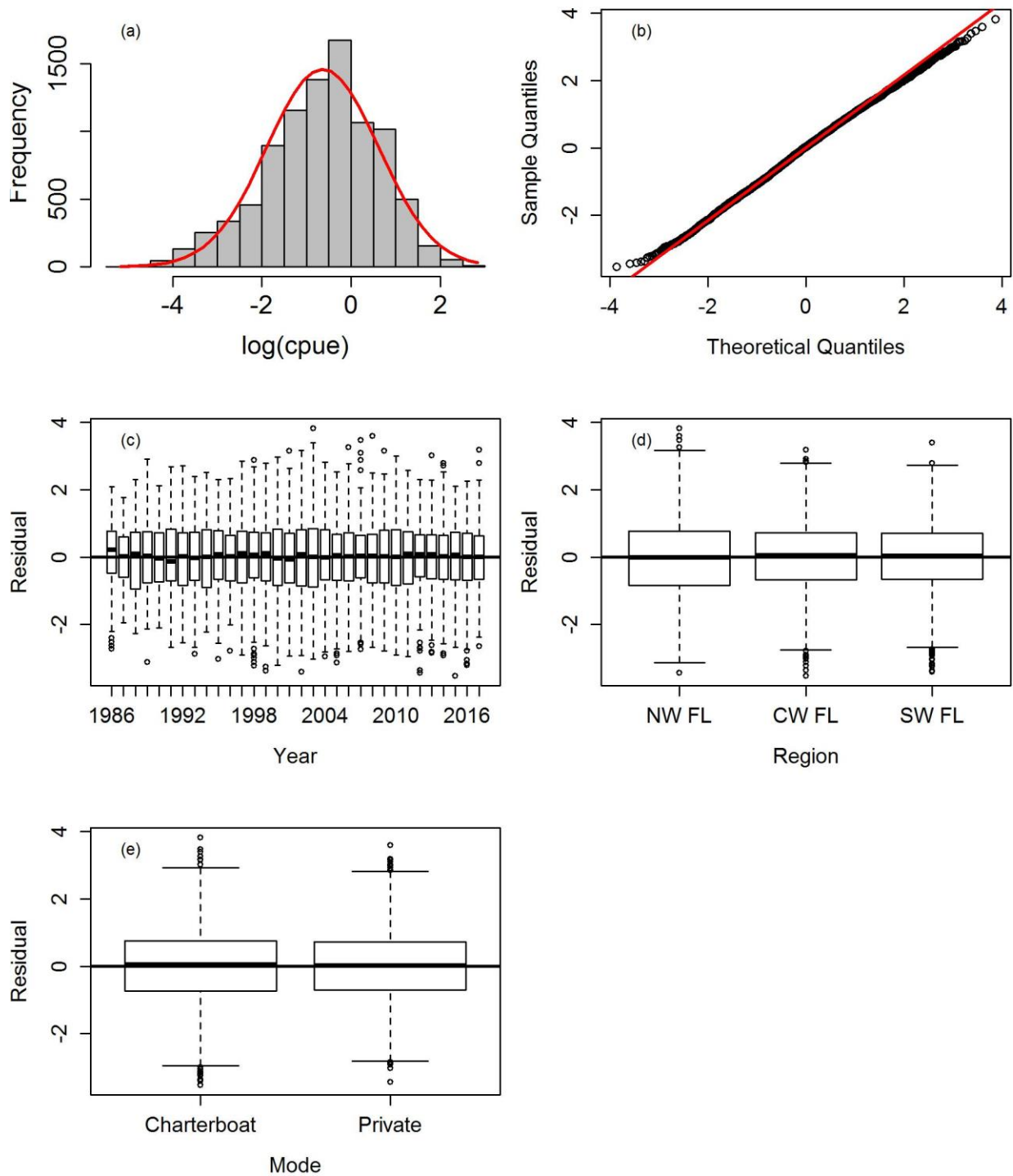
Figure 4. Diagnostic plots for the lognormal model of catch rates on positive interviews. Shown here are the frequency distribution of catch rates (a), the cumulative normalized residuals (b), and the distribution of residuals by year (c), region (d), and mode (e). The red lines represent the expected normal distribution.

Figure 5: Standardized MRFSS indices for Gulf of Mexico red grouper from this report and from the SEDAR 42 Assessment Report. Each index has a mean of 1 over the time series shown in the plot.

## 7. Appendix A

*Description of the analysis dataset after exclusions and other treatments*

Table 3: Number of interviews by factor and year.

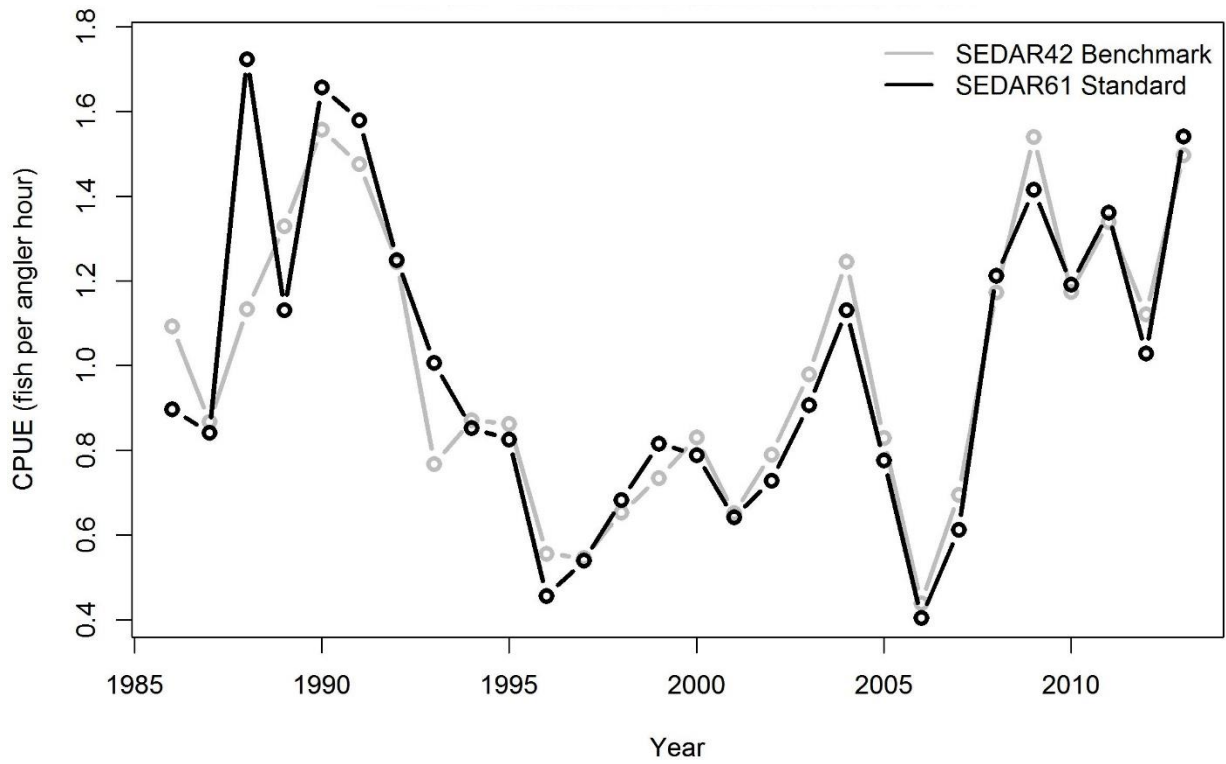| Year | Areas | | Regions | | | Mode | | Number of Anglers | | | | | | |
|------|------|-------|------|------|------|---------|---------|------|------|------|------|-----|------|------|
| | EEZ | State | NWFL | CWFL | SWFL | charter | private | 1 | 2 | 3 | 4 | 5 | 6 | 7+ |
| 1986 | 94 | 38 | 19 | 44 | 69 | 88 | 44 | 102 | 4 | NA | 6 | 8 | 11 | 1 |
| 1987 | 101 | 39 | 52 | 54 | 34 | 57 | 83 | 89 | 11 | 6 | 11 | 6 | 4 | 13 |
| 1988 | 42 | 6 | 18 | 24 | 6 | 13 | 35 | 33 | 5 | 4 | 1 | 3 | NA | 2 |
| 1989 | 94 | 30 | 21 | 49 | 54 | 36 | 88 | 65 | 11 | 15 | 16 | 6 | 7 | 4 |
| 1990 | 70 | 39 | 34 | 63 | 12 | 29 | 80 | 77 | 7 | 8 | 6 | 7 | 4 | NA |
| 1991 | 73 | 51 | 62 | 35 | 27 | 10 | 114 | 81 | 17 | 8 | 9 | 3 | 5 | 1 |
| 1992 | 178 | 148 | 108 | 109 | 109 | 33 | 293 | 224 | 34 | 22 | 15 | 9 | 13 | 9 |
| 1993 | 220 | 84 | 113 | 121 | 70 | 33 | 271 | 204 | 40 | 19 | 18 | 9 | 6 | 8 |
| 1994 | 240 | 107 | 139 | 84 | 124 | 32 | 315 | 257 | 22 | 26 | 18 | 13 | 5 | 6 |
| 1995 | 259 | 96 | 120 | 139 | 96 | 47 | 308 | 267 | 28 | 28 | 14 | 6 | 7 | 5 |
| 1996 | 260 | 90 | 112 | 109 | 129 | 22 | 328 | 286 | 25 | 9 | 15 | 5 | 4 | 6 |
| 1997 | 169 | 149 | 123 | 116 | 79 | 72 | 246 | 218 | 24 | 17 | 12 | 10 | 16 | 21 |
| 1998 | 393 | 229 | 209 | 272 | 141 | 237 | 385 | 346 | 46 | 37 | 49 | 50 | 47 | 47 |
| 1999 | 593 | 359 | 320 | 303 | 329 | 335 | 617 | 554 | 88 | 55 | 73 | 55 | 53 | 74 |
| 2000 | 493 | 205 | 315 | 239 | 144 | 302 | 396 | 362 | 49 | 52 | 63 | 40 | 66 | 66 |
| 2001 | 554 | 259 | 333 | 289 | 191 | 291 | 522 | 414 | 81 | 69 | 51 | 42 | 67 | 89 |
| 2002 | 595 | 265 | 395 | 257 | 208 | 318 | 542 | 428 | 83 | 58 | 58 | 50 | 84 | 99 |
| 2003 | 677 | 285 | 426 | 240 | 296 | 474 | 488 | 447 | 77 | 84 | 68 | 80 | 104 | 102 |
| 2004 | 902 | 288 | 526 | 307 | 357 | 640 | 550 | 492 | 101 | 90 | 113 | 89 | 157 | 148 |
| 2005 | 657 | 200 | 475 | 163 | 219 | 541 | 316 | 291 | 52 | 78 | 88 | 76 | 132 | 140 |
| 2006 | 319 | 94 | 270 | 69 | 74 | 218 | 195 | 134 | 43 | 34 | 32 | 33 | 64 | 73 |
| 2007 | 271 | 116 | 212 | 89 | 86 | 191 | 196 | 185 | 18 | 26 | 38 | 28 | 46 | 46 |
| 2008 | 294 | 248 | 256 | 168 | 118 | 191 | 351 | 270 | 50 | 39 | 54 | 38 | 43 | 48 |
| 2009 | 282 | 175 | 194 | 134 | 129 | 191 | 266 | 228 | 31 | 46 | 35 | 25 | 47 | 45 |
| 2010 | 248 | 153 | 170 | 143 | 88 | 160 | 241 | 197 | 30 | 31 | 36 | 30 | 36 | 41 |
| 2011 | 269 | 204 | 195 | 165 | 113 | 183 | 290 | 222 | 42 | 39 | 46 | 44 | 33 | 47 |
| 2012 | 319 | 202 | 193 | 193 | 135 | 252 | 269 | 230 | 45 | 45 | 63 | 33 | 50 | 55 |
| 2013 | 256 | 173 | 110 | 207 | 112 | 105 | 324 | 258 | 35 | 35 | 42 | 19 | 24 | 16 |
| 2014 | 405 | 279 | 151 | 315 | 218 | 226 | 458 | 358 | 69 | 68 | 66 | 48 | 53 | 22 |
| 2015 | 362 | 186 | 102 | 261 | 185 | 181 | 367 | 299 | 56 | 43 | 48 | 33 | 53 | 16 |
| 2016 | 383 | 232 | 126 | 301 | 188 | 245 | 370 | 313 | 54 | 47 | 65 | 47 | 62 | 27 |
| 2017 | 395 | 159 | 168 | 223 | 163 | 174 | 380 | 325 | 60 | 42 | 45 | 32 | 35 | 15 |
| All | 10467 | 5188 | 6067 | 5285 | 4303 | 5927 | 9728 | 8256 | 1338 | 1180 | 1274 | 977 | 1338 | 1292 |

Table 4: Number of positive interviews by factor and year.

| Year | Areas | | Regions | | | Mode | | Number of Anglers | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EEZ | State | NWFL | CWFL | SWFL | charter | private | 1 | 2 | 3 | 4 | 5 | 6 | 7+ |
| 1986 | 76 | 28 | 11 | 24 | 69 | 68 | 36 | 84 | 3 | NA | 2 | 3 | 11 | 1 |
| 1987 | 67 | 24 | 19 | 41 | 31 | 29 | 62 | 65 | 7 | 3 | 8 | 3 | 2 | 3 |
| 1988 | 31 | 3 | 9 | 19 | 6 | 10 | 24 | 25 | 3 | 2 | 1 | 3 | NA | 0 |
| 1989 | 75 | 17 | 8 | 44 | 40 | 23 | 69 | 47 | 11 | 11 | 12 | 5 | 3 | 3 |
| 1990 | 54 | 27 | 12 | 57 | 12 | 22 | 59 | 56 | 6 | 7 | 6 | 5 | 1 | NA |
| 1991 | 47 | 21 | 23 | 26 | 19 | 2 | 66 | 37 | 12 | 8 | 7 | 3 | 1 | 0 |
| 1992 | 135 | 68 | 47 | 81 | 75 | 21 | 182 | 125 | 27 | 20 | 14 | 6 | 7 | 4 |
| 1993 | 152 | 20 | 47 | 78 | 47 | 10 | 162 | 114 | 24 | 14 | 12 | 4 | 4 | 0 |
| 1994 | 143 | 36 | 47 | 50 | 82 | 15 | 164 | 127 | 13 | 15 | 11 | 7 | 3 | 3 |
| 1995 | 157 | 22 | 34 | 77 | 68 | 29 | 150 | 123 | 15 | 18 | 11 | 5 | 4 | 3 |
| 1996 | 130 | 13 | 21 | 34 | 88 | 7 | 136 | 115 | 11 | 3 | 9 | 3 | 1 | 1 |
| 1997 | 72 | 41 | 13 | 50 | 50 | 20 | 93 | 76 | 9 | 12 | 4 | 5 | 2 | 5 |
| 1998 | 216 | 97 | 59 | 168 | 86 | 112 | 201 | 177 | 27 | 22 | 28 | 30 | 23 | 6 |
| 1999 | 360 | 153 | 68 | 201 | 244 | 183 | 330 | 301 | 62 | 34 | 48 | 31 | 25 | 12 |
| 2000 | 274 | 78 | 104 | 155 | 93 | 156 | 196 | 182 | 31 | 29 | 35 | 22 | 36 | 17 |
| 2001 | 310 | 88 | 123 | 170 | 105 | 137 | 261 | 185 | 46 | 42 | 36 | 25 | 38 | 26 |
| 2002 | 367 | 69 | 198 | 153 | 85 | 197 | 239 | 177 | 43 | 36 | 39 | 31 | 56 | 54 |
| 2003 | 465 | 91 | 240 | 160 | 156 | 358 | 198 | 186 | 44 | 57 | 50 | 63 | 81 | 75 |
| 2004 | 697 | 132 | 360 | 216 | 253 | 502 | 327 | 289 | 71 | 68 | 84 | 69 | 125 | 123 |
| 2005 | 459 | 75 | 306 | 103 | 125 | 406 | 128 | 117 | 30 | 48 | 59 | 61 | 103 | 116 |
| 2006 | 168 | 18 | 128 | 25 | 33 | 121 | 65 | 38 | 17 | 16 | 20 | 15 | 38 | 42 |
| 2007 | 162 | 38 | 94 | 47 | 59 | 109 | 91 | 92 | 10 | 15 | 22 | 14 | 26 | 21 |
| 2008 | 206 | 133 | 113 | 138 | 88 | 121 | 218 | 173 | 27 | 28 | 32 | 25 | 32 | 22 |
| 2009 | 207 | 103 | 96 | 112 | 102 | 121 | 189 | 156 | 23 | 34 | 22 | 20 | 28 | 27 |
| 2010 | 185 | 70 | 77 | 114 | 64 | 98 | 157 | 127 | 22 | 17 | 26 | 16 | 25 | 22 |
| 2011 | 184 | 112 | 81 | 131 | 84 | 119 | 177 | 132 | 23 | 27 | 33 | 31 | 24 | 26 |
| 2012 | 224 | 111 | 75 | 155 | 105 | 165 | 170 | 132 | 33 | 30 | 49 | 21 | 39 | 31 |
| 2013 | 215 | 80 | 53 | 159 | 83 | 85 | 210 | 165 | 27 | 27 | 30 | 17 | 19 | 10 |
| 2014 | 325 | 150 | 56 | 240 | 179 | 182 | 293 | 219 | 51 | 55 | 52 | 37 | 48 | 13 |
| 2015 | 279 | 92 | 31 | 195 | 145 | 150 | 221 | 174 | 39 | 33 | 40 | 27 | 48 | 10 |
| 2016 | 272 | 99 | 22 | 221 | 128 | 181 | 190 | 156 | 32 | 33 | 47 | 37 | 52 | 14 |
| 2017 | 279 | 43 | 54 | 139 | 129 | 128 | 194 | 160 | 39 | 29 | 32 | 25 | 30 | 7 |
| All | 6993 | 2152 | 2629 | 3583 | 2933 | 3887 | 5258 | 4332 | 838 | 793 | 881 | 669 | 935 | 697 |

Table 5: Proportion of positive interviews by factor and year.

| Year | Areas | | Regions | | | Mode | | Number of Anglers | | | | | | |
|------|-------|-------|------|------|------|---------|---------|------|------|------|------|------|------|------|
| | EEZ | State | NWFL | CWFL | SWFL | charter | private | 1 | 2 | 3 | 4 | 5 | 6 | 7+ |
| 1986 | 0.81 | 0.74 | 0.58 | 0.55 | 1.00 | 0.77 | 0.82 | 0.82 | 0.75 | NA | 0.33 | 0.38 | 1.00 | 1.00 |
| 1987 | 0.66 | 0.62 | 0.37 | 0.76 | 0.91 | 0.51 | 0.75 | 0.73 | 0.64 | 0.50 | 0.73 | 0.50 | 0.50 | 0.23 |
| 1988 | 0.74 | 0.50 | 0.50 | 0.79 | 1.00 | 0.77 | 0.69 | 0.76 | 0.60 | 0.50 | 1.00 | 1.00 | NA | 0.00 |
| 1989 | 0.80 | 0.57 | 0.38 | 0.90 | 0.74 | 0.64 | 0.78 | 0.72 | 1.00 | 0.73 | 0.75 | 0.83 | 0.43 | 0.75 |
| 1990 | 0.77 | 0.69 | 0.35 | 0.90 | 1.00 | 0.76 | 0.74 | 0.73 | 0.86 | 0.88 | 1.00 | 0.71 | 0.25 | NA |
| 1991 | 0.64 | 0.41 | 0.37 | 0.74 | 0.70 | 0.20 | 0.58 | 0.46 | 0.71 | 1.00 | 0.78 | 1.00 | 0.20 | 0.00 |
| 1992 | 0.76 | 0.46 | 0.44 | 0.74 | 0.69 | 0.64 | 0.62 | 0.56 | 0.79 | 0.91 | 0.93 | 0.67 | 0.54 | 0.44 |
| 1993 | 0.69 | 0.24 | 0.42 | 0.64 | 0.67 | 0.30 | 0.60 | 0.56 | 0.60 | 0.74 | 0.67 | 0.44 | 0.67 | 0.00 |
| 1994 | 0.60 | 0.34 | 0.34 | 0.60 | 0.66 | 0.47 | 0.52 | 0.49 | 0.59 | 0.58 | 0.61 | 0.54 | 0.60 | 0.50 |
| 1995 | 0.61 | 0.23 | 0.28 | 0.55 | 0.71 | 0.62 | 0.49 | 0.46 | 0.54 | 0.64 | 0.79 | 0.83 | 0.57 | 0.60 |
| 1996 | 0.50 | 0.14 | 0.19 | 0.31 | 0.68 | 0.32 | 0.41 | 0.40 | 0.44 | 0.33 | 0.60 | 0.60 | 0.25 | 0.17 |
| 1997 | 0.43 | 0.28 | 0.11 | 0.43 | 0.63 | 0.28 | 0.38 | 0.35 | 0.38 | 0.71 | 0.33 | 0.50 | 0.12 | 0.24 |
| 1998 | 0.55 | 0.42 | 0.28 | 0.62 | 0.61 | 0.47 | 0.52 | 0.51 | 0.59 | 0.59 | 0.57 | 0.60 | 0.49 | 0.13 |
| 1999 | 0.61 | 0.43 | 0.21 | 0.66 | 0.74 | 0.55 | 0.53 | 0.54 | 0.70 | 0.62 | 0.66 | 0.56 | 0.47 | 0.16 |
| 2000 | 0.56 | 0.38 | 0.33 | 0.65 | 0.65 | 0.52 | 0.49 | 0.50 | 0.63 | 0.56 | 0.56 | 0.55 | 0.55 | 0.26 |
| 2001 | 0.56 | 0.34 | 0.37 | 0.59 | 0.55 | 0.47 | 0.50 | 0.45 | 0.57 | 0.61 | 0.71 | 0.60 | 0.57 | 0.29 |
| 2002 | 0.62 | 0.26 | 0.50 | 0.60 | 0.41 | 0.62 | 0.44 | 0.41 | 0.52 | 0.62 | 0.67 | 0.62 | 0.67 | 0.55 |
| 2003 | 0.69 | 0.32 | 0.56 | 0.67 | 0.53 | 0.76 | 0.41 | 0.42 | 0.57 | 0.68 | 0.74 | 0.79 | 0.78 | 0.74 |
| 2004 | 0.77 | 0.46 | 0.68 | 0.70 | 0.71 | 0.78 | 0.59 | 0.59 | 0.70 | 0.76 | 0.74 | 0.78 | 0.80 | 0.83 |
| 2005 | 0.70 | 0.38 | 0.64 | 0.63 | 0.57 | 0.75 | 0.41 | 0.40 | 0.58 | 0.62 | 0.67 | 0.80 | 0.78 | 0.83 |
| 2006 | 0.53 | 0.19 | 0.47 | 0.36 | 0.45 | 0.56 | 0.33 | 0.28 | 0.40 | 0.47 | 0.62 | 0.45 | 0.59 | 0.58 |
| 2007 | 0.60 | 0.33 | 0.44 | 0.53 | 0.69 | 0.57 | 0.46 | 0.50 | 0.56 | 0.58 | 0.58 | 0.50 | 0.57 | 0.46 |
| 2008 | 0.70 | 0.54 | 0.44 | 0.82 | 0.75 | 0.63 | 0.62 | 0.64 | 0.54 | 0.72 | 0.59 | 0.66 | 0.74 | 0.46 |
| 2009 | 0.73 | 0.59 | 0.49 | 0.84 | 0.79 | 0.63 | 0.71 | 0.68 | 0.74 | 0.74 | 0.63 | 0.80 | 0.60 | 0.60 |
| 2010 | 0.75 | 0.46 | 0.45 | 0.80 | 0.73 | 0.61 | 0.65 | 0.64 | 0.73 | 0.55 | 0.72 | 0.53 | 0.69 | 0.54 |
| 2011 | 0.68 | 0.55 | 0.42 | 0.79 | 0.74 | 0.65 | 0.61 | 0.59 | 0.55 | 0.69 | 0.72 | 0.70 | 0.73 | 0.55 |
| 2012 | 0.70 | 0.55 | 0.39 | 0.80 | 0.78 | 0.65 | 0.63 | 0.57 | 0.73 | 0.67 | 0.78 | 0.64 | 0.78 | 0.56 |
| 2013 | 0.84 | 0.46 | 0.48 | 0.77 | 0.74 | 0.81 | 0.65 | 0.64 | 0.77 | 0.77 | 0.71 | 0.89 | 0.79 | 0.62 |
| 2014 | 0.80 | 0.54 | 0.37 | 0.76 | 0.82 | 0.81 | 0.64 | 0.61 | 0.74 | 0.81 | 0.79 | 0.77 | 0.91 | 0.59 |
| 2015 | 0.77 | 0.49 | 0.30 | 0.75 | 0.78 | 0.83 | 0.60 | 0.58 | 0.70 | 0.77 | 0.83 | 0.82 | 0.91 | 0.62 |
| 2016 | 0.71 | 0.43 | 0.17 | 0.73 | 0.68 | 0.74 | 0.51 | 0.50 | 0.59 | 0.70 | 0.72 | 0.79 | 0.84 | 0.52 |
| 2017 | 0.71 | 0.27 | 0.32 | 0.62 | 0.79 | 0.74 | 0.51 | 0.49 | 0.65 | 0.69 | 0.71 | 0.78 | 0.86 | 0.47 |
| All | 0.67 | 0.41 | 0.43 | 0.68 | 0.68 | 0.66 | 0.54 | 0.52 | 0.63 | 0.67 | 0.69 | 0.68 | 0.70 | 0.54 |