Standardized Catch Rates of Yellowtail Snapper (*Ocyurus chrysurus*) from the Marine Recreational Information Program (MRIP) in Southeast Florida and the Florida Keys, 1981-2017

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Introduction

Yellowtail Snapper are caught by recreational anglers primarily in south Florida from Palm Beach County on the east coast to Monroe County on the west coast. The Marine Recreational Fisheries Statistics Survey (MRFSS) was initiated in 1981 to collect catch, effort, and participation estimates from the recreational sector. MRFSS consists of a telephone survey of fishing effort and an access point angler intercept survey (APAIS) of angler catch. Intercepts are conducted at public marine fishing access points (boat ramps, piers, beaches, marinas, etc.) to collect individual catch data including number of each species caught, number discarded, length, and weight. Access points are selected by a proportional random selection process in order to sample high activity sites most often. From these intercept data, total catch (fish kept or released) per trip estimates can be made for each species encountered. These catch rates can provide an indication of population trends over time and are combined with the effort estimates from the telephone survey to produce total catch and harvest estimates. In 1991, MRFSS made several improvements to the survey and one of which was the linking together of separate intercepts of anglers that fished on the same trip and recording the total number of anglers in the party. In 2008, the Marine Recreational Information Program (MRIP) officially replaced MRFSS as a more precise and accurate method for estimating recreational catch and effort. In 2013 the APAIS was implemented to remove bias from the sampling process and in 2015 the Fishing Effort Survey (FES, a mail survey) was launched to improve estimates for those fishing via the private boat and shore effort modes. In 2018, the MRIP data were re-calibrated to account for the transition away from the Coastal Household Telephone Survey (CHTS) towards the new FES.

Methods

Area Descriptions

Three standardized MRIP total catch rate indices were generated.

1. A catch rate index for Southeast Florida (SE_FL) – Counties: Palm Beach, Broward, Miami-Dade
2. A catch rate index for the Florida Keys (FL_Keys) – Monroe County
3. A catch rate index for combined Florida Keys and Southeast Florida

The standardized index was generated by adding the trip catches together only after all forthcoming filtering and clustering steps had been applied to each area-specific dataset.

New Variables

Additional features (variables) were created using existing variables within the dataset. The new features were *area* and *avidity*. The MRIP variable area_x was collapsed into two areas, inshore and offshore, and represents the angler's judgment on the area where most of their fishing effort was spent. Avidity was defined as the number of days fished within the last 2 months and was represented categorically with 7 levels (lower number is inclusive in group): 0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30+.

Data Preparation and Filtering

To generate a standardized MRIP total catch rate, angler interviews made during wave 2, 1981 through wave 6, 2017 for each area where the fishing mode was either private/rental or charter boat were selected. Catches of anglers on the same boat trip were collapsed into a single catch sample per boat trip because angler catch on the same boat were more likely the same or similar. MRIP Type 6 fishing party code identifier was used to collapse catch for years 1991 to 2017 and MRIP Type 4 fishing group identifier to collapse catch for years prior to 1991. All inland trips were excluded.

Furthermore, only trips that were directly or indirectly targeting Yellowtail Snapper were retained in the analysis. Trips that targeted Yellowtail Snapper were identified as those that caught Yellowtail Snapper or any other species that were shown, via statistical methodology described below, to co-occur with Yellowtail Snapper even if Yellowtail Snapper was not caught on the specific trip.

Species Clustering

The suite of co-occurring species (hereafter, species clusters) was identified using hierarchical clustering analysis described by Shertzer and Williams (2008). Hierarchical cluster analysis was performed with average linkage on the Bray-Curtis similarity measure calculated on presence/absence of catch data for each species (i.e. total catch [kept+released] of a species per trip). The number of clusters against the average distance between clusters was visualized and a piecewise regression with one breakpoint was used to determine the inflection point of the plot (Figures 1 and 2). The inflection point was chosen as that with the lowest residual mean square error.

Six clusters were identified for SE_FL using this method with Yellowtail Snapper clustering with Blue Runner, Gray Snapper, Gray Triggerfish, Grunts, Lane Snapper, Mutton snapper, Red Grouper, Sand Tilefish and White Grunt (Figure 3). Five clusters were identified for the Keys area with Yellowtail Snapper clustering with Black Grouper, Blue Runner, Bluestriped Grunt, Gag Grouper, Gray Snapper, Grunts, Hogfish, Lane Snapper, Mutton Snapper, Red Grouper, and White Grunt (Figure 4).

Trips were removed if at least one of the species in the cluster was not caught. Importantly, the clustering algorithm was not run for the combined single area trip data. Rather, the catch rate index produced for the single area model was developed by combining the trip data selected from the two areas. Finally, trips were removed if hours fished, number of contributors, or days fished in previous wave (avidity) were not available. After all filtering, 10,969 trips remained for SE_FL and 16,468 trips in the Florida Keys.

Standardization

CPUE, the number of Yellowtail Snapper caught per trip (A+B1+B2), was modeled using the delta-glm approach (Dick 2004; Lo et al. 1992; Maunder and Punt 2004). This approach calculates an index as the product of the indices from binomial (probability of catching the selected species) and positive (trips that caught at least one Yellowtail Snapper) sub-models. Positive CPUE of Yellowtail Snapper was modeled as a lognormal distribution.

Seven explanatory variables were evaluated for both the positive and binomial models. These included:

Year – factor with levels 1981 to 2017
Contributors – The number of contributors to the combined trip catches (total catch of the entire trip); factor with seven levels (1- 7+)
Mode – fishing mode; factor with two levels (charter boat or private/rental boat)
Area – area fished; factor, two levels (inshore [state waters], offshore [federal waters])
Wave – survey period; factor with six levels (1 – 6)
Hours fished – hours fished; factor, seven levels (0-2, 2-4, 4-6, 6-8, 8-10, 10-12, 12+)
Avidity – number of days fished in the past two months; factor with seven levels (0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-60)

The **stats::glm** package and function were used to produce positive and binomial sub-models. For both the positive and binomial sub-models, explanatory variables were selected using stepwise forward selection based on AIC. The goal of stepwise selection is to produce a model (overall model) that contains the optimal combination of explanatory variables (which explain a significant amount of variation in the response variable) while also being most parsimonious. Stepwise forward selection starts with a null model that is specified by the practitioner. At the first step, each covariate is added to a null model so that there are *n* unique models (*n* = number of covariates). The lowest AIC of the unique models is compared to that of the null model; if it is lower than the AIC of the null model by at least two points the unique model becomes the new base model (Burnham and Anderson 2002, p. 70). This process repeats itself until no additional covariate sufficiently reduces the AIC. Finally, each variable was evaluated in terms of its total percent reduction in deviance (in relation to the null model). If the variables did not reduce deviance by at least 0.5% they were excluded from the final model.

Index Generation and Evaluation

The least squared means for the year factor from each model were multiplied together with a bias correction applied to the positive CPUE to account for transformation of the response variable from log space back to CPUE.

Results

Nominal catch rates were lower in SE_FL than in the FL_Keys (Figures 5, 6) and were generally consistent across levels of categorical variables (Figures 5, 6, 7). Nominal catch rate in both regions was highest for the 10-12 and 12+ hours fished category as well as for the offshore fishing area (Figures 5, 6, 7). Nominal catch rate varies by contributor level and fishing mode

most notably in the SE_FL region (Figure 5). Nominal catch rate appears generally consistent among avidity levels with a few notable peaks in catch rate for higher avidity levels in the earlier portion of the time series for both regions (Figures 5, 6).

The final positive and binomial sub-models were:

SE_FL

Pos: log(catch) = year + contributors + hoursfished (Table 1)

Bin: catch = year + contributors (Table 2)

FL_Keys

Pos: log(catch) = year + contributors + area (Table 3)

Bin: catch = year + contributors (Table 4)

Single Area (Continuity)

Pos: log(catch) = year + contributors + area (Table 5)

Bin: catch = year + contributors (Table 6)

To evaluate residuals of the binomial model randomization was introduced to produce continuous normal residuals using the 'qres.binom' function of the 'statmod' package in R. Randomized quantile residuals for the binomial sub-model were normally distributed and showed no pattern across predictor variables (Figures 8, 9, 10). Residuals from the positive sub-model were also normal with no pattern across predictor variables (Figures 11, 12, 13). Diagnostic plots of the positive sub-model indicate that residuals are normally distributed and exhibit no pattern, variance is homoscedastic, and there are no influential outliers in the dataset. The observed annual mean CPUE and modeled CPUE are provided in Tables 7, 8, and 9 and plotted in Figures 14 - 16. Additionally, the number of trips by year for each covariate and region are provided in Tables 10 A - C and 12 A – C, while Tables 11 A - C and 13 A - C present the number of positive trips (i.e. caught at least one Yellowtail Snapper) by year per covariate and region.

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Tables

Table 1. Deviance table for the final positive sub-model for the SE_FL area model.

Factor	Df	Resid. Df	Resid. Dev	Deviance	% Deviance Reduced
NULL	1	2798	2505.189	2505.189	-
year	36	2762	2411.903	93.28686	2.47
cntrbtrs	6	2756	2365.522	46.38101	1.67
hrsf	6	2750	2345.146	20.37606	0.62

Table 2. Deviance table for the final binomial sub-model for the SE_FL area model.

Factor	Df	Resid. Df	Resid. Dev	Deviance	% Deviance Reduced
NULL	1	10968	12459.64	12459.64	-
year	36	10932	12337.9	121.7458	0.65
cntrbtrs	6	10926	12078.29	259.6082	2.04

Table 3. Deviance table for the final positive sub-model for the FL_Keys area model.

Factor	Df	Resid. Df	Resid. Dev	Deviance	% Deviance Reduced
NULL	1	4005	5387.372	5387.372	-
year	36	3969	5244.866	142.5058	1.76
cntrbtrs	6	3963	5129.313	115.5533	2.02
area	1	3962	5083.225	46.08789	0.84

Table 4. Deviance table for the final binomial sub-model for the FL_Keys area model

Factor	Df	Resid. Df	Resid. Dev	Deviance	% Deviance Reduced
NULL	1	16467	18273.16	18273.16	-
year	36	16431	17973.73	299.4369	1.42
cntrbtrs	6	16425	17707.56	266.1715	1.42

Table 5. Deviance table for the final positive sub-model for the single area (continuity) model.

Factor	Df	Resid. Df	Resid. Dev	Deviance	% Deviance Reduced
NULL	1	6804	8508.913	8508.913	-
year	36	6768	8372.053	136.8609	1.09
cntrbtrs	6	6762	8107.271	264.782	3.04
area	1	6761	7964.673	142.5979	1.67

Table 6. Deviance table for the final binomial sub-model for the single area (continuity) model.

Factor	Df	Resid. Df	Resid. Dev	Deviance	% Deviance Reduced
NULL	1	27436	30737.81	30737.81	-
year	36	27400	30446.47	291.34	0.82
cntrbtrs	6	27394	29983.78	462.6887	1.49

Table 7. Nominal mean CPUE and final modeled index for the SE_FL area model.

Year	Nominal CPUE	N	Proportion Positive	Index	Index CV
1981	1.68	55	0.29	1.43	0.32
1982	0.87	99	0.19	0.90	0.33
1983	0.71	88	0.22	0.86	0.30
1984	0.50	93	0.26	0.79	0.33
1985	1.26	94	0.19	0.92	0.23
1986	0.78	177	0.24	1.11	0.22
1987	0.68	202	0.23	0.86	0.22
1988	0.68	210	0.25	0.93	0.25
1989	0.39	204	0.16	0.55	0.21
1990	0.90	176	0.36	1.49	0.19
1991	0.83	233	0.26	1.17	0.16
1992	1.21	410	0.33	1.74	0.16
1993	1.62	295	0.35	1.75	0.20
1994	0.82	211	0.27	1.08	0.22
1995	1.35	205	0.24	1.71	0.23
1996	1.04	178	0.24	1.34	0.26
1997	0.74	187	0.17	1.15	0.25
1998	0.84	218	0.17	0.75	0.17
1999	1.09	417	0.24	1.07	0.19
2000	1.14	335	0.23	1.19	0.18
2001	1.74	360	0.23	1.33	0.17
2002	0.68	525	0.19	0.64	0.18
2003	0.87	484	0.19	0.76	0.17
2004	1.53	474	0.26	1.43	0.16
2005	1.38	491	0.27	1.25	0.15
2006	1.50	534	0.28	1.51	0.15
2007	1.80	490	0.29	1.61	0.16
2008	1.04	449	0.26	1.02	0.17
2009	1.31	373	0.30	1.31	0.18
2010	0.85	344	0.26	0.95	0.21
2011	1.11	228	0.27	1.03	0.18
2012	0.76	382	0.23	0.9	0.19
2013	1.23	332	0.23	1.28	0.16
2014	1.32	460	0.27	1.38	0.16
2015	1.66	412	0.34	1.89	0.18
2016	1.33	307	0.29	1.30	0.21
2017	0.88	237	0.23	1.02	0.36

Table 8. Nominal mean CPUE and final modeled index for the Keys area model.

Year	Nominal CPUE	N	Proportion Positive	Index	Index CV
1981	5.97	70	0.39	4.17	0.17
1982	4.99	146	0.41	4.29	0.32
1983	1.74	55	0.27	1.93	0.24
1984	2.46	85	0.42	3.46	0.34
1985	1.64	35	0.40	2.19	0.21
1986	2.24	136	0.28	2.40	0.15
1987	2.94	296	0.28	2.31	0.18
1988	3.84	179	0.36	3.71	0.18
1989	4.45	160	0.35	4.67	0.15
1990	3.73	186	0.44	3.22	0.15
1991	6.01	221	0.32	5.58	0.12
1992	2.42	478	0.28	3.02	0.12
1993	2.60	435	0.27	2.60	0.13
1994	1.54	447	0.24	1.84	0.18
1995	1.65	278	0.20	1.72	0.16
1996	1.15	403	0.21	1.20	0.16
1997	1.19	465	0.17	1.09	0.15
1998	1.34	596	0.16	0.95	0.13
1999	1.64	882	0.16	1.41	0.12
2000	2.36	763	0.23	1.64	0.13
2001	2.61	737	0.18	1.57	0.11
2002	2.40	855	0.24	1.54	0.12
2003	1.76	875	0.19	1.40	0.13
2004	2.41	594	0.22	1.60	0.13
2005	2.92	502	0.27	1.94	0.14
2006	1.96	455	0.24	1.49	0.12
2007	2.41	613	0.24	1.89	0.11
2008	2.16	769	0.25	1.78	0.15
2009	1.49	456	0.20	1.33	0.13
2010	2.29	552	0.24	1.87	0.15
2011	1.90	463	0.21	1.52	0.12
2012	2.28	577	0.26	1.71	0.13
2013	2.66	469	0.28	2.44	0.11
2014	2.43	649	0.27	2.16	0.11
2015	2.28	679	0.27	2.02	0.12
2016	2.16	497	0.31	1.94	0.12
2017	3.22	410	0.37	2.62	0.26

Table 9. Nominal mean CPUE and final modeled index for the single area model.

Year	Nominal CPUE	N	Proportion Positive	Index	Index CV
1981	4.08	125	0.34	2.94	0.15
1982	3.33	245	0.32	2.97	0.22
1983	1.11	143	0.24	1.27	0.18
1984	1.44	178	0.34	2.10	0.23
1985	1.36	129	0.25	1.46	0.15
1986	1.42	313	0.26	1.80	0.12
1987	2.02	498	0.26	1.73	0.13
1988	2.13	389	0.30	2.14	0.14
1989	2.17	364	0.24	2.20	0.12
1990	2.35	362	0.40	2.63	0.11
1991	3.35	454	0.29	2.99	0.08
1992	1.86	888	0.30	2.59	0.09
1993	2.20	730	0.30	2.40	0.10
1994	1.31	658	0.25	1.70	0.13
1995	1.52	483	0.22	1.83	0.12
1996	1.12	581	0.22	1.30	0.13
1997	1.06	652	0.17	1.17	0.12
1998	1.21	814	0.17	0.92	0.09
1999	1.46	1299	0.18	1.30	0.09
2000	1.99	1098	0.23	1.56	0.10
2001	2.33	1097	0.20	1.48	0.09
2002	1.74	1380	0.22	1.21	0.09
2003	1.44	1359	0.19	1.22	0.09
2004	2.02	1068	0.24	1.64	0.09
2005	2.16	993	0.27	1.71	0.09
2006	1.71	989	0.26	1.64	0.08
2007	2.14	1103	0.26	1.93	0.08
2008	1.75	1218	0.25	1.55	0.10
2009	1.40	829	0.24	1.43	0.10
2010	1.73	896	0.25	1.56	0.11
2011	1.64	691	0.23	1.38	0.09
2012	1.67	959	0.25	1.43	0.10
2013	2.07	801	0.26	2.07	0.08
2014	1.97	1109	0.27	1.95	0.08
2015	2.05	1091	0.29	2.13	0.09
2016	1.84	804	0.30	1.79	0.10
2017	2.36	647	0.32	2.12	0.21

Table 10A. Number of trips by year and factor (area, hours fished) for SE_FL.

	Area		Hours Fished						
Year	inshore	offshore	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 -12	12 - 100
1981	25	30	4	10	27	9	2	2	1
1982	75	24	9	27	34	20	7	1	1
1983	54	34	7	29	32	15	4	1	NA
1984	70	23	5	34	26	20	7	1	NA
1985	70	24	3	28	36	14	6	7	NA
1986	114	63	10	54	68	39	5	NA	1
1987	124	78	16	60	80	31	9	3	3
1988	119	91	6	64	93	38	5	NA	4
1989	127	77	2	55	104	30	7	3	3
1990	134	42	10	50	89	17	6	NA	4
1991	162	71	8	60	93	58	11	2	1
1992	292	118	19	117	179	74	14	4	3
1993	216	79	19	75	110	62	22	6	1
1994	135	76	9	66	78	42	13	1	2
1995	120	85	8	63	89	26	12	4	3
1996	93	85	6	46	81	36	7	2	NA
1997	107	80	9	53	68	40	14	NA	3
1998	123	95	15	52	91	46	8	4	2
1999	269	148	28	117	170	63	30	8	1
2000	218	117	10	69	166	58	20	8	4
2001	205	155	26	83	161	57	25	4	4
2002	357	168	25	191	189	91	25	3	1
2003	325	159	24	186	164	70	35	3	2
2004	324	150	26	183	156	82	19	3	5
2005	326	165	27	211	151	80	16	6	NA
2006	396	138	21	228	182	72	23	8	NA
2007	377	113	30	193	173	65	16	11	2
2008	331	118	22	181	160	61	17	5	3
2009	318	55	23	139	141	60	9	1	NA
2010	291	53	9	156	130	38	11	NA	NA
2011	192	36	13	87	78	35	12	2	1
2012	279	103	13	159	136	56	14	3	1
2013	235	97	25	120	110	52	20	2	3
2014	319	141	36	148	156	81	29	7	3
2015	297	115	13	160	146	66	18	5	4
2016	204	103	8	139	87	53	15	5	NA
2017	173	64	14	94	85	30	13	NA	1

Table 10B. Number of trips by year and factor (contributors, avidity) for SE_FL.

	Contributors							Avidity						
Year	1	2	3	4	5	6	7+	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 60
1981	35	7	6	4	3	NA	NA	41	7	4	2	NA	NA	1
1982	67	21	7	3	1	NA	NA	39	21	12	5	12	3	7
1983	68	14	4	2	NA	NA	NA	39	26	9	8	3	NA	3
1984	72	12	5	4	NA	NA	NA	57	17	4	7	5	1	2
1985	77	9	4	3	1	NA	NA	43	27	9	6	6	2	1
1986	170	2	4	1	NA	NA	NA	91	42	10	19	7	NA	8
1987	167	18	7	7	2	NA	1	104	59	16	13	6	NA	4
1988	193	5	5	7	NA	NA	NA	104	52	11	22	9	3	9
1989	196	3	3	1	1	NA	NA	92	54	22	17	9	1	9
1990	172	1	2	1	NA	NA	NA	81	59	12	8	6	NA	10
1991	226	4	2	NA	1	NA	NA	120	64	12	14	13	2	8
1992	385	15	9	1	NA	NA	NA	215	127	25	20	16	2	5
1993	266	18	9	1	1	NA	NA	142	84	18	27	14	3	7
1994	185	12	9	3	2	NA	NA	104	69	11	12	9	1	5
1995	180	14	11	NA	NA	NA	NA	99	70	8	14	6	1	7
1996	141	22	10	4	1	NA	NA	100	44	16	10	5	2	1
1997	163	14	8	1	NA	1	NA	96	52	14	10	7	1	7
1998	164	26	13	6	4	5	NA	114	60	19	12	7	1	5
1999	315	47	32	17	3	3	NA	204	127	30	25	18	4	9
2000	263	31	17	7	10	7	NA	179	93	15	22	13	2	11
2001	263	28	18	21	10	19	1	210	89	23	23	6	3	6
2002	343	36	39	36	20	43	8	303	127	25	31	15	10	14
2003	349	27	23	26	19	27	13	298	114	21	25	18	NA	8
2004	375	23	19	14	15	22	6	305	109	20	22	9	NA	9
2005	357	27	36	15	13	25	18	322	93	29	18	21	2	6
2006	387	54	35	18	13	9	18	276	146	38	34	19	3	18
2007	350	40	33	20	10	14	23	294	116	26	18	14	3	19
2008	286	72	38	20	15	9	9	259	128	2	31	22	2	5
2009	241	43	39	17	14	13	6	206	122	11	17	8	NA	9
2010	231	36	20	14	11	19	13	161	103	7	42	18	NA	13
2011	153	19	16	12	11	7	10	141	61	1	17	6	NA	2
2012	287	38	25	13	8	6	5	242	83	25	10	14	4	4
2013	230	40	31	12	6	5	8	202	74	21	23	5	5	2
2014	328	39	39	20	15	8	11	298	89	29	22	13	NA	9
2015	287	48	30	16	8	11	12	264	90	27	12	8	4	7
2016	192	33	30	17	9	11	15	212	66	10	8	4	2	5
2017	182	20	15	6	5	4	5	154	49	20	4	6	NA	4

Table 10C. Number of trips by year and factor (mode, wave) for SE_FL.

	Mode		Wave					
Year	5	7	1	2	3	4	5	6
1981	NA	55	NA	9	11	12	13	10
1982	NA	99	5	3	4	20	47	20
1983	NA	88	13	3	9	28	11	24
1984	NA	93	20	10	8	8	2	45
1985	NA	94	23	13	19	20	12	7
1986	7	170	49	13	24	19	19	53
1987	1	201	42	62	26	33	14	25
1988	10	200	12	10	19	67	49	53
1989	14	190	33	19	18	52	51	31
1990	7	169	13	18	24	43	51	27
1991	8	225	28	25	45	76	30	29
1992	13	397	32	85	77	95	76	45
1993	3	292	78	23	32	57	77	28
1994	3	208	58	20	47	49	5	32
1995	3	202	54	13	44	59	16	19
1996	7	171	37	28	32	35	16	30
1997	10	177	43	20	42	31	20	31
1998	23	195	18	17	21	67	23	72
1999	38	379	110	76	74	93	31	33
2000	45	290	83	29	49	63	48	63
2001	93	267	47	47	53	72	89	52
2002	161	364	61	72	101	154	79	58
2003	132	352	75	88	101	77	68	75
2004	84	390	84	59	82	79	59	111
2005	119	372	85	66	87	114	65	74
2006	71	463	87	95	79	77	125	71
2007	66	424	77	59	96	91	69	98
2008	57	392	50	53	110	95	62	79
2009	69	304	75	37	74	85	57	45
2010	74	270	36	50	78	82	53	45
2011	39	189	37	31	38	43	46	33
2012	86	296	81	44	85	66	49	57
2013	41	291	71	21	67	62	81	30
2014	94	366	60	36	150	125	46	43
2015	95	317	31	93	115	88	59	26
2016	86	221	33	47	92	73	16	46
2017	43	194	30	21	55	57	22	52

Table 11A. Number of positive trips by year and factor (area, hours fished) for SE_FL.

	Area		Hours Fished						
Year	inshore	offshore	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 -12	12 - 100
1981	8	8	NA	2	7	5	1	NA	1
1982	8	11	1	4	4	8	2	NA	NA
1983	5	14	1	7	7	2	1	1	NA
1984	18	6	1	6	7	6	3	1	NA
1985	8	10	NA	6	7	NA	NA	5	NA
1986	30	13	1	10	17	15	NA	NA	NA
1987	28	19	2	13	17	8	4	1	2
1988	27	25	NA	12	23	13	3	NA	1
1989	21	12	1	10	12	6	NA	2	2
1990	55	8	3	15	33	6	3	NA	3
1991	38	23	1	16	24	15	4	NA	1
1992	96	39	4	32	66	26	4	1	2
1993	69	33	5	22	38	26	9	2	NA
1994	39	17	1	12	23	15	5	NA	NA
1995	21	28	1	16	20	6	3	2	1
1996	22	21	3	13	19	6	2	NA	NA
1997	18	13	2	10	10	5	3	NA	1
1998	19	19	NA	12	12	12	2	NA	NA
1999	65	37	4	23	44	21	6	4	NA
2000	47	30	1	19	33	15	4	2	3
2001	40	44	5	20	39	14	4	1	1
2002	65	34	2	45	36	9	7	NA	NA
2003	69	23	NA	34	35	12	11	NA	NA
2004	87	38	2	42	49	21	8	NA	3
2005	92	39	7	56	38	25	3	2	NA
2006	105	44	1	66	49	24	7	2	NA
2007	100	40	5	58	45	20	5	7	NA
2008	94	22	5	53	37	15	4	2	NA
2009	97	14	9	50	36	14	2	NA	NA
2010	80	10	2	45	36	5	2	NA	NA
2011	53	8	2	24	17	11	6	1	NA
2012	64	23	4	40	28	12	2	1	NA
2013	58	20	4	27	23	12	9	1	2
2014	90	34	11	43	40	21	8	NA	1
2015	111	29	1	59	50	16	9	2	3
2016	62	28	1	45	22	13	7	2	NA
2017	38	16	1	25	16	7	5	NA	NA

Table 11B. Number of positive trips by year and factor (contributors, avidity) for SE_FL.

	Contributors							Avidity						
Year	1	2	3	4	5	6	7+	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 60
1981	7	3	3	3	NA	NA	NA	11	3	NA	2	NA	NA	NA
1982	10	6	3	NA	NA	NA	NA	6	3	5	1	NA	1	3
1983	13	2	3	1	NA	NA	NA	3	10	5	1	NA	NA	NA
1984	17	4	1	2	NA	NA	NA	13	5	1	2	2	NA	1
1985	17	1	NA	NA	NA	NA	NA	8	2	2	NA	5	1	NA
1986	41	2	NA	NA	NA	NA	NA	24	10	1	5	1	NA	2
1987	36	5	2	3	1	NA	NA	19	14	9	2	2	NA	1
1988	42	2	3	5	NA	NA	NA	26	13	3	8	1	NA	1
1989	29	1	1	1	1	NA	NA	11	7	4	6	1	1	3
1990	62	1	NA	NA	NA	NA	NA	25	26	2	5	2	NA	3
1991	60	NA	1	NA	NA	NA	NA	25	22	6	5	2	NA	1
1992	128	5	2	NA	NA	NA	NA	72	38	9	8	6	NA	2
1993	90	9	2	NA	1	NA	NA	52	23	9	12	4	NA	2
1994	49	5	2	NA	NA	NA	NA	28	15	4	3	5	NA	1
1995	38	7	4	NA	NA	NA	NA	22	20	2	1	1	1	2
1996	29	11	3	NA	NA	NA	NA	20	12	4	5	NA	1	1
1997	29	2	NA	NA	NA	NA	NA	19	8	1	2	NA	NA	1
1998	23	4	5	NA	2	4	NA	22	12	1	1	NA	NA	2
1999	75	7	11	7	2	NA	NA	52	29	6	6	6	1	2
2000	53	13	5	3	2	1	NA	36	24	5	5	4	1	2
2001	54	3	4	7	5	10	1	55	15	6	5	2	1	NA
2002	46	6	8	11	7	18	3	57	22	6	6	5	1	2
2003	55	6	5	3	7	12	4	58	20	3	4	5	NA	2
2004	87	10	8	5	8	5	2	87	23	3	6	4	NA	2
2005	77	10	19	4	5	12	4	80	25	11	3	8	1	3
2006	91	17	19	10	3	3	6	70	38	13	11	9	1	7
2007	85	13	14	7	3	7	11	79	30	11	5	7	2	6
2008	64	18	12	9	6	4	3	71	30	1	8	3	1	2
2009	45	17	16	9	11	10	3	53	42	6	5	2	NA	3
2010	58	7	6	2	3	11	3	41	28	2	10	5	NA	4
2011	19	8	9	7	9	5	4	42	16	NA	2	1	NA	NA
2012	57	9	9	5	4	2	1	53	20	9	1	3	NA	1
2013	42	13	11	3	3	3	3	47	18	5	6	1	1	NA
2014	71	12	11	7	10	5	8	77	32	6	4	3	NA	2
2015	83	24	9	7	4	7	6	92	26	11	3	4	NA	4
2016	37	13	8	8	6	8	10	64	16	5	2	NA	1	2
2017	34	5	5	4	3	NA	3	34	12	7	NA	NA	NA	1

Table 11C. Number of positive trips by year and factor (mode, wave) for SE_FL.

	Mode		Wave					
Year	5	7	1	2	3	4	5	6
1981	NA	16	NA	3	3	2	6	2
1982	NA	19	1	3	2	3	6	4
1983	NA	19	3	NA	1	3	7	5
1984	NA	24	3	3	2	2	2	12
1985	NA	18	NA	2	1	12	3	NA
1986	NA	43	5	6	7	4	6	15
1987	1	46	7	11	9	8	7	5
1988	7	45	2	1	7	15	11	16
1989	2	31	4	3	3	9	6	8
1990	3	60	3	16	10	15	13	6
1991	2	59	2	6	16	20	7	10
1992	4	131	9	25	23	35	30	13
1993	1	101	28	9	7	16	32	10
1994	NA	56	13	3	11	13	2	14
1995	NA	49	15	3	9	12	2	8
1996	NA	43	8	7	9	9	4	6
1997	NA	31	7	4	4	4	6	6
1998	7	31	1	5	2	7	4	19
1999	11	91	22	16	19	21	12	12
2000	8	69	17	3	14	16	15	12
2001	27	57	12	8	9	18	25	12
2002	46	53	9	11	24	30	17	8
2003	37	55	12	21	20	9	14	16
2004	23	102	23	8	19	20	20	35
2005	35	96	19	16	28	34	13	21
2006	24	125	17	22	25	23	40	22
2007	25	115	19	16	33	23	21	28
2008	21	95	15	7	32	27	19	16
2009	32	79	11	9	29	27	21	14
2010	21	69	7	10	28	22	15	8
2011	21	40	5	4	11	13	15	13
2012	25	62	20	10	19	16	9	13
2013	16	62	13	3	22	15	18	7
2014	33	91	19	6	38	38	10	13
2015	36	104	10	35	40	21	25	9
2016	35	55	9	16	22	24	4	15
2017	13	41	8	4	9	15	6	12

Table 12A. Number of trips by year and factor (area, hours fished) for FL_Keys.

	Area		Hours Fished						
Year	inshore	offshore	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 -12	12 - 100
1981	45	25	2	22	21	18	3	3	1
1982	141	5	6	31	50	46	12	1	NA
1983	55	NA	6	27	14	5	2	1	NA
1984	76	9	3	28	26	19	7	NA	2
1985	35	NA	1	9	16	8	1	NA	NA
1986	109	27	9	15	47	46	15	3	1
1987	232	64	28	81	102	66	12	3	4
1988	145	34	9	68	45	48	7	1	1
1989	114	46	19	48	43	39	7	4	NA
1990	148	38	11	57	53	33	29	1	2
1991	166	55	10	37	74	42	48	4	6
1992	337	141	33	143	192	82	20	5	3
1993	355	80	23	151	153	88	17	2	1
1994	353	94	46	146	143	91	18	1	2
1995	185	93	15	77	102	69	14	1	NA
1996	159	244	10	73	158	119	36	5	2
1997	301	164	10	73	199	155	28	NA	NA
1998	288	308	18	103	227	175	72	NA	1
1999	207	675	24	206	337	263	52	NA	NA
2000	149	614	14	173	229	304	43	NA	NA
2001	93	644	12	215	195	252	57	5	1
2002	96	759	13	219	265	285	69	4	NA
2003	162	713	17	179	304	255	115	4	1
2004	122	472	11	178	185	183	36	1	NA
2005	66	436	10	177	134	147	34	NA	NA
2006	60	395	8	192	137	93	13	1	11
2007	113	500	19	236	199	136	23	NA	NA
2008	149	620	18	289	294	145	22	1	NA
2009	99	357	8	171	157	98	21	NA	1
2010	107	445	12	234	170	121	14	1	NA
2011	106	357	5	196	137	112	13	NA	NA
2012	185	392	22	241	181	110	20	2	1
2013	207	262	44	209	138	69	9	NA	NA
2014	323	326	49	245	228	107	16	4	NA
2015	399	280	44	252	248	108	26	1	NA
2016	229	268	24	189	186	81	13	3	1
2017	208	202	29	153	147	63	18	NA	NA

Table 12B. Number of trips by year and factor (contributors, avidity) for FL_Keys.

	Contributors							Avidity						
Year	1	2	3	4	5	6	7+	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 60
1981	40	14	6	8	2	NA	NA	29	19	6	6	5	NA	5
1982	101	16	8	13	6	1	1	59	42	13	18	2	2	10
1983	42	5	3	4	1	NA	NA	30	7	8	4	3	1	2
1984	74	3	5	1	1	1	NA	45	27	4	3	3	NA	3
1985	26	3	2	3	1	NA	NA	21	4	3	3	2	1	1
1986	78	20	21	11	5	1	NA	75	30	15	8	3	3	2
1987	162	55	37	24	11	4	3	165	57	34	13	7	7	13
1988	124	22	12	15	3	3	NA	109	34	12	7	6	4	7
1989	116	24	9	7	3	1	NA	79	27	24	5	10	NA	15
1990	117	30	18	14	5	2	NA	131	27	14	3	2	1	8
1991	99	45	38	20	11	8	NA	133	46	23	3	10	NA	6
1992	406	26	18	13	8	6	1	304	74	41	16	17	8	18
1993	316	53	35	22	7	2	NA	250	55	51	27	24	8	20
1994	304	64	41	26	9	2	1	266	73	31	34	20	9	14
1995	163	41	36	22	7	8	1	159	41	19	16	20	7	16
1996	220	66	37	46	18	13	3	225	71	51	11	29	2	14
1997	196	84	66	58	28	28	5	285	69	37	33	22	2	17
1998	252	91	75	91	54	33	NA	448	82	32	10	15	1	8
1999	553	88	69	96	43	33	NA	728	67	34	16	16	4	17
2000	322	132	89	114	55	51	NA	649	54	20	16	9	1	14
2001	214	116	123	161	69	54	NA	656	43	18	9	6	NA	5
2002	374	128	112	121	68	52	NA	744	59	16	11	13	2	10
2003	487	132	79	90	38	49	NA	713	78	46	10	9	4	15
2004	289	92	51	86	38	37	1	505	36	23	9	7	NA	14
2005	232	70	40	83	42	35	NA	432	33	14	10	5	2	6
2006	242	53	59	53	26	22	NA	385	32	11	9	10	NA	8
2007	379	57	63	59	28	26	1	499	67	17	10	13	NA	7
2008	459	105	66	67	38	34	NA	653	45	33	11	14	5	8
2009	274	52	41	47	22	20	NA	391	23	15	7	8	7	5
2010	289	74	50	72	30	29	8	480	29	13	12	7	NA	11
2011	204	69	49	59	41	32	9	413	30	3	5	5	1	6
2012	314	66	60	70	31	27	9	491	38	9	20	14	1	4
2013	245	89	51	37	23	20	4	358	43	28	20	6	1	13
2014	377	106	61	60	26	14	5	433	94	47	18	25	6	26
2015	368	127	69	62	27	19	7	427	113	44	33	24	7	31
2016	261	80	63	49	28	13	3	302	89	34	25	17	4	26
2017	215	81	46	33	17	13	5	283	53	20	10	17	4	23

Table 12C. Number of trips by year and factor (mode, wave) for FL_Keys.

	Mode		Wave					
Year	5 (CH)	7 (PR)	1	2	3	4	5	6
1981	NA	70	NA	3	3	24	28	12
1982	NA	146	11	30	27	55	11	12
1983	NA	55	NA	13	15	27	NA	NA
1984	NA	85	13	7	NA	12	18	35
1985	NA	35	12	6	7	NA	4	6
1986	42	94	11	14	27	NA	25	59
1987	45	251	112	75	32	53	22	2
1988	59	120	20	14	1	48	41	55
1989	39	121	67	45	19	22	5	2
1990	66	120	9	73	11	37	11	45
1991	64	157	75	36	33	28	34	15
1992	146	332	66	75	64	95	87	91
1993	103	332	87	76	48	98	62	64
1994	102	345	104	77	85	78	49	54
1995	86	192	71	55	47	41	39	25
1996	132	271	57	49	62	68	79	88
1997	203	262	97	62	45	57	89	115
1998	413	183	133	98	63	55	9	238
1999	704	178	329	235	44	78	64	132
2000	666	97	288	138	107	46	54	130
2001	673	64	286	280	40	37	29	65
2002	778	77	201	194	53	88	101	218
2003	728	147	260	228	122	89	25	151
2004	502	92	238	140	47	47	20	102
2005	470	32	154	159	60	56	1	72
2006	364	91	156	138	44	32	13	72
2007	478	135	127	138	48	59	113	128
2008	640	129	205	203	102	63	33	163
2009	383	73	102	104	62	33	61	94
2010	490	62	130	125	84	68	36	109
2011	426	37	157	93	57	47	31	78
2012	455	122	153	117	76	98	30	103
2013	269	200	158	48	67	51	62	83
2014	265	384	83	108	182	119	74	83
2015	260	419	117	167	152	121	82	40
2016	214	283	75	99	121	82	52	68
2017	167	243	100	67	58	82	23	80

Table 13A. Number of positive trips by year and factor (area, hours fished) for FL_Keys.

	Area		Hours Fished						
Year	inshore	offshore	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 -12	12 - 100
1981	17	10	1	7	8	9	1	NA	1
1982	58	2	3	15	21	17	4	NA	NA
1983	15	NA	NA	5	7	2	NA	1	NA
1984	33	3	NA	9	14	6	5	NA	2
1985	14	NA	NA	3	7	3	1	NA	NA
1986	32	6	1	1	16	16	4	NA	NA
1987	63	19	3	17	33	18	6	2	3
1988	55	10	2	26	16	17	4	NA	NA
1989	45	11	4	18	18	10	2	4	NA
1990	58	24	4	30	24	10	11	1	2
1991	55	16	2	13	26	13	14	NA	3
1992	98	36	5	33	70	14	9	1	2
1993	102	17	6	46	37	26	4	NA	NA
1994	90	19	8	36	35	25	3	1	1
1995	36	19	3	16	17	18	1	NA	NA
1996	37	47	3	13	33	25	9	NA	1
1997	51	28	3	14	28	29	5	NA	NA
1998	42	55	2	12	44	28	11	NA	NA
1999	34	103	4	22	47	56	8	NA	NA
2000	27	148	6	32	59	70	8	NA	NA
2001	17	116	2	30	37	54	8	1	1
2002	21	180	6	54	58	64	17	2	NA
2003	29	133	5	29	68	43	16	1	NA
2004	20	109	NA	29	49	44	7	NA	NA
2005	17	117	5	50	32	33	14	NA	NA
2006	15	96	2	41	31	24	8	1	4
2007	19	128	7	62	43	32	3	NA	NA
2008	39	153	5	69	74	37	7	NA	NA
2009	24	66	2	27	35	21	5	NA	NA
2010	19	112	2	55	37	33	4	NA	NA
2011	14	84	1	42	34	18	3	NA	NA
2012	41	108	5	70	45	25	3	1	NA
2013	48	85	11	59	38	22	3	NA	NA
2014	65	111	10	80	60	21	4	1	NA
2015	67	113	7	72	63	34	4	NA	NA
2016	48	107	5	67	61	20	2	NA	NA
2017	50	100	6	49	54	34	7	NA	NA

Table 13B. Number of positive trips by year and factor (contributors, avidity) for FL_Keys.

	Contributors							Avidity						
Year	1	2	3	4	5	6	7+	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 60
1981	10	7	2	6	2	NA	NA	10	9	3	2	1	NA	2
1982	37	11	3	5	3	1	NA	26	12	7	4	1	2	8
1983	8	2	2	3	NA	NA	NA	6	3	5	NA	1	NA	NA
1984	28	3	3	1	1	NA	NA	19	11	1	3	1	NA	1
1985	11	1	1	NA	1	NA	NA	9	1	NA	1	2	1	NA
1986	20	5	6	5	2	NA	NA	24	8	3	1	NA	1	1
1987	34	17	13	9	7	1	1	44	24	5	2	1	3	3
1988	41	11	5	6	1	1	NA	36	15	5	5	1	2	1
1989	36	12	4	2	1	1	NA	23	6	10	4	4	NA	9
1990	48	14	10	6	3	1	NA	56	13	7	1	NA	1	4
1991	32	16	11	6	3	3	NA	45	17	5	2	2	NA	NA
1992	114	6	6	1	2	4	1	78	22	15	5	4	4	6
1993	79	18	13	8	1	NA	NA	71	20	12	7	3	1	5
1994	77	18	9	4	NA	1	NA	62	20	10	5	3	5	4
1995	39	10	3	2	NA	1	NA	27	7	7	4	4	2	4
1996	47	15	8	10	2	2	NA	40	18	13	3	9	NA	1
1997	34	16	13	6	4	5	1	51	14	5	4	2	NA	3
1998	38	19	13	15	8	4	NA	75	11	6	1	3	NA	1
1999	61	16	18	23	11	8	NA	104	11	8	4	6	1	3
2000	47	32	25	37	16	18	NA	141	16	3	5	1	1	8
2001	22	23	26	40	15	7	NA	114	8	7	1	2	NA	1
2002	53	40	31	38	23	16	NA	170	19	3	4	4	NA	1
2003	55	27	22	36	13	9	NA	121	22	12	1	2	1	3
2004	33	23	17	29	15	12	NA	106	11	5	2	2	NA	3
2005	38	22	13	33	18	10	NA	116	8	3	4	NA	NA	3
2006	47	16	20	14	10	4	NA	85	15	2	4	3	NA	2
2007	78	17	21	19	4	8	NA	117	16	9	1	3	NA	1
2008	83	37	25	21	13	13	NA	160	14	11	2	1	NA	4
2009	49	14	12	10	1	4	NA	72	6	5	3	1	NA	3
2010	43	27	12	18	16	12	3	115	7	4	2	1	NA	2
2011	32	21	11	14	9	9	2	85	8	NA	1	3	NA	1
2012	58	19	21	31	7	10	3	123	9	2	6	7	1	1
2013	68	29	15	6	5	7	3	95	12	14	9	1	NA	2
2014	87	32	19	27	6	4	1	130	21	12	2	5	2	4
2015	76	33	23	25	12	7	4	127	20	11	8	4	1	9
2016	57	26	27	26	11	6	2	96	21	12	6	6	3	11
2017	70	22	23	13	10	8	4	103	21	7	5	6	3	5

Table 13C. Number of positive trips by year and factor (mode, wave) for FL_Keys.

	Mode		Wave					
Year	5 (CH)	7 (PR)	1	2	3	4	5	6
1981	NA	27	NA	1	2	6	8	10
1982	NA	60	4	8	17	11	8	12
1983	NA	15	NA	8	1	6	NA	NA
1984	NA	36	7	4	NA	3	6	16
1985	NA	14	5	NA	4	NA	1	4
1986	10	28	3	3	3	NA	8	21
1987	19	63	22	30	10	17	3	NA
1988	23	42	7	3	NA	14	16	25
1989	10	46	29	18	5	3	1	NA
1990	33	49	2	46	6	15	2	11
1991	20	51	29	10	10	6	12	4
1992	49	85	22	17	19	22	27	27
1993	24	95	28	18	19	18	17	19
1994	20	89	26	30	14	14	12	13
1995	14	41	11	13	5	8	12	6
1996	18	66	5	8	16	16	16	23
1997	33	46	13	14	9	7	17	19
1998	67	30	21	16	10	9	3	38
1999	98	39	37	37	10	12	15	26
2000	147	28	53	46	15	9	21	31
2001	118	15	27	65	4	7	13	17
2002	177	24	45	56	10	11	24	55
2003	130	32	40	39	20	15	9	39
2004	109	20	37	34	12	10	6	30
2005	130	4	31	57	23	6	NA	17
2006	82	29	31	34	12	7	6	21
2007	111	36	29	33	14	18	21	32
2008	155	37	60	50	24	16	14	28
2009	70	20	16	16	23	5	13	17
2010	116	15	25	24	29	22	13	18
2011	88	10	33	31	10	8	3	13
2012	120	29	35	25	23	25	9	32
2013	73	60	40	13	22	20	19	19
2014	92	84	20	32	48	37	14	25
2015	90	90	31	51	40	28	15	15
2016	79	76	20	37	48	25	11	14
2017	65	85	42	26	22	22	7	31

Figures

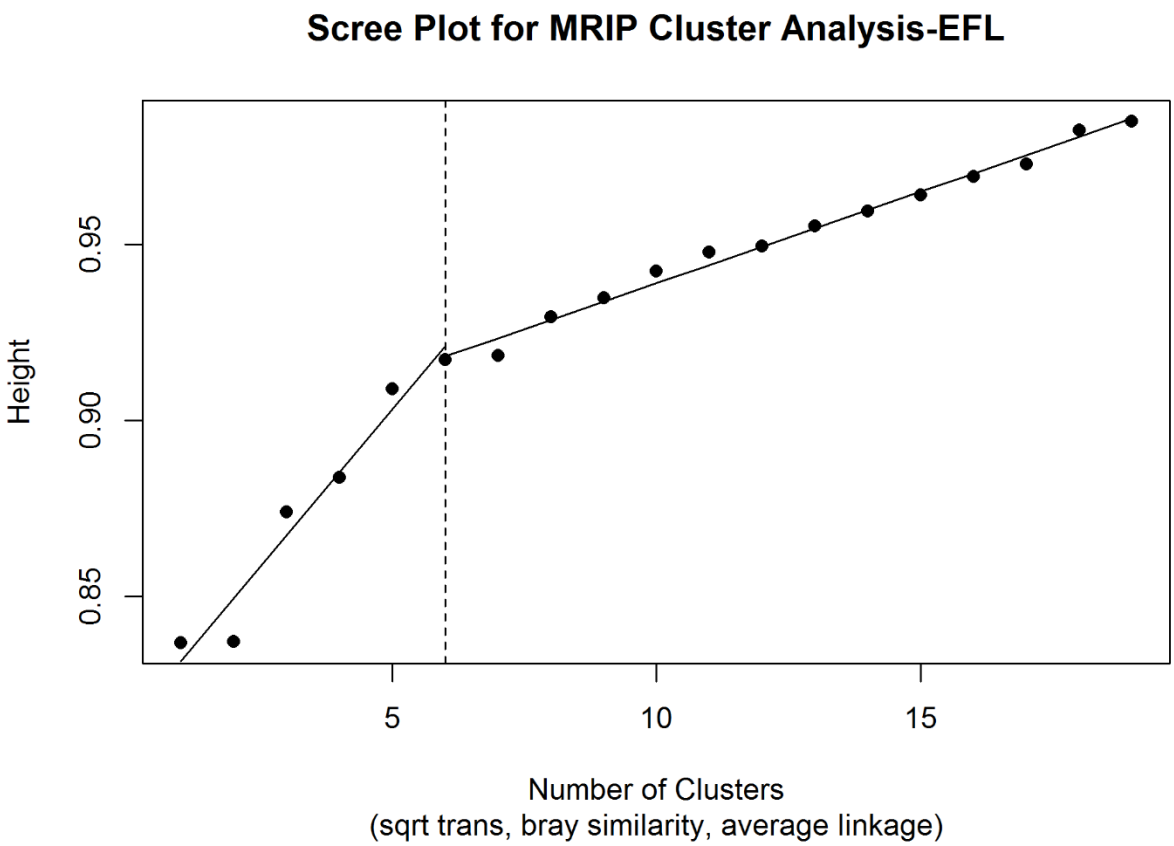

Figure 1. Plot of number of clusters against height from the hierarchical cluster analysis for the southeast Florida area model, where height is the average dissimilarity among species in a cluster with 1 being most similar. Included are the piecewise regression lines (solid line) using a breakpoint (dashed vertical line) that minimized the residual mean square error.

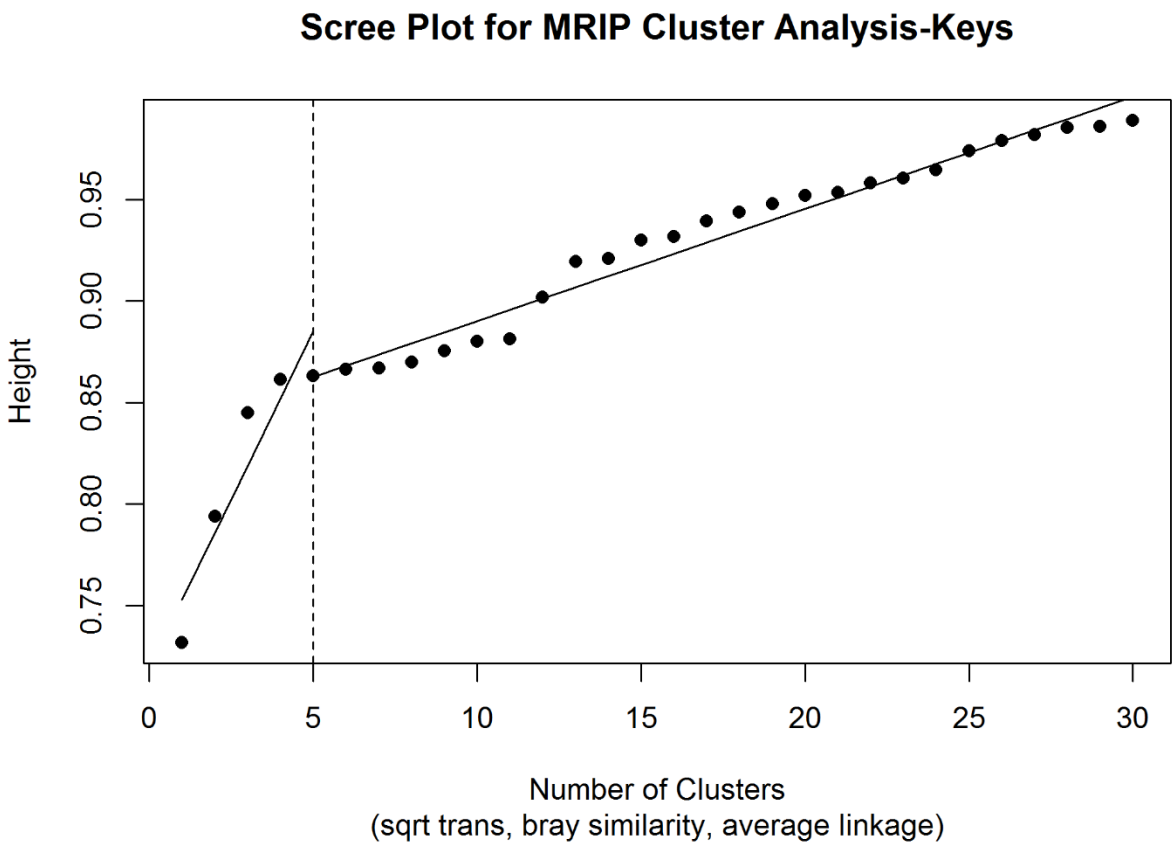

Figure 2. Plot of number of clusters against height from the hierarchical cluster analysis for the Keys area model, where height is the average dissimilarity among species in a cluster with 1 being most similar. Included are the piecewise regression lines (solid line) using a breakpoint (dashed vertical line) that minimized the residual mean square error.

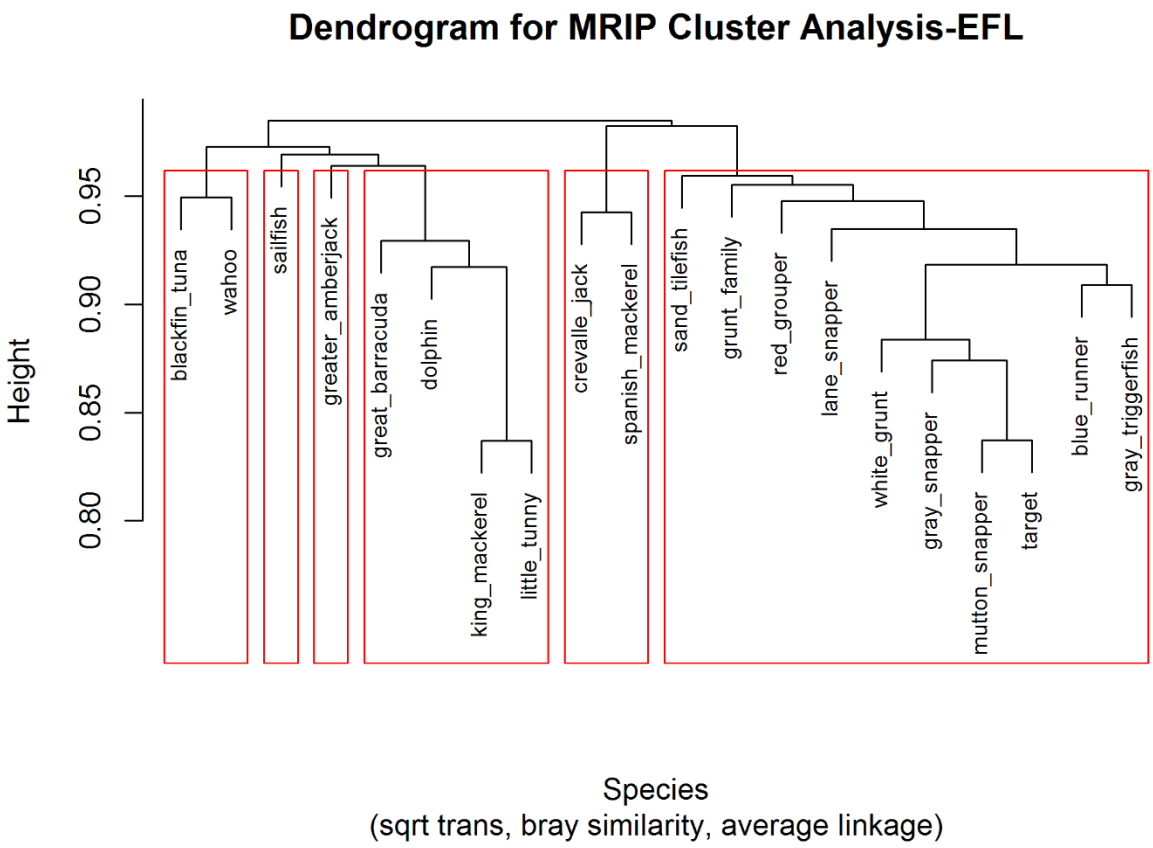

Figure 3. Dendrogram from hierarchical cluster analysis of species in the MRIP dataset for the southeast Florida area model. Height measures the average dissimilarity among species within a branch with a value of 1 being most similar. Yellowtail Snapper is represented as ‘target’ in this plot.

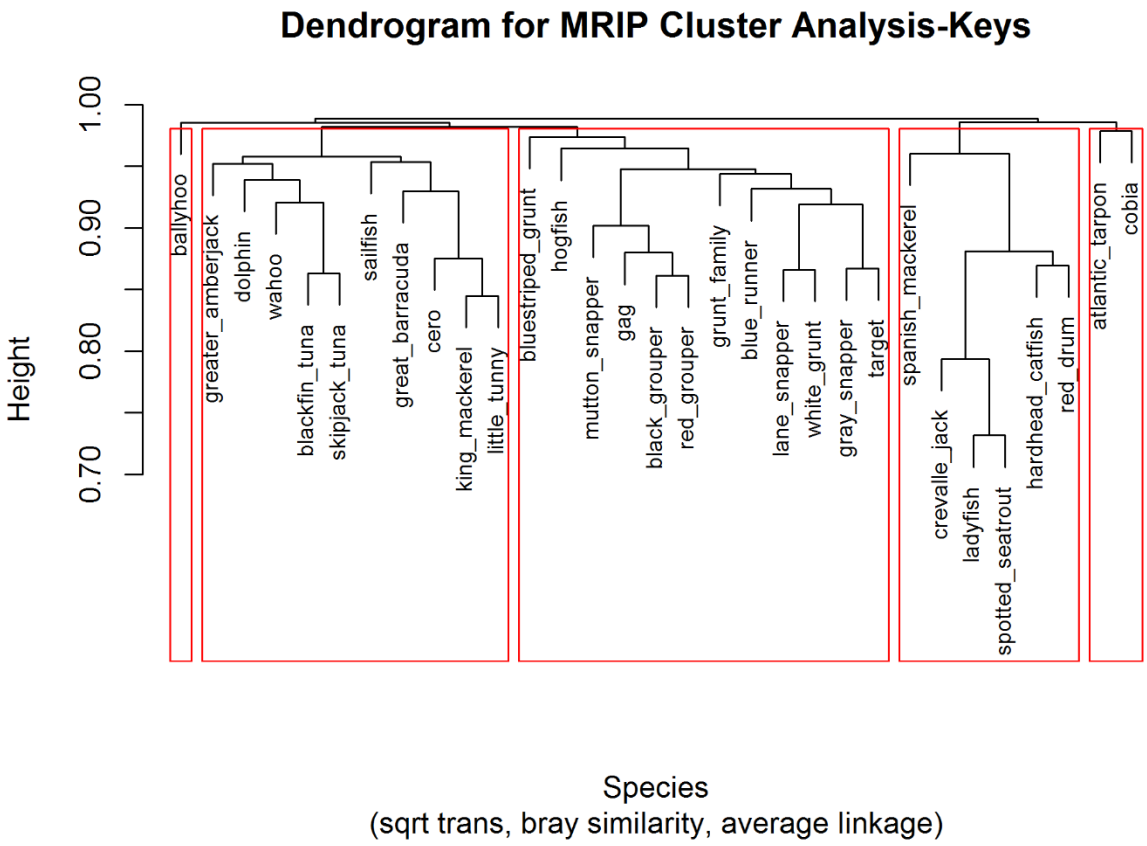

Figure 4. Dendrogram from hierarchical cluster analysis of species in the MRIP data for the Keys area model. Height measures the average dissimilarity among species within a branch with a value of 1 being most similar. Yellowtail Snapper is represented as ‘target’ in this plot.

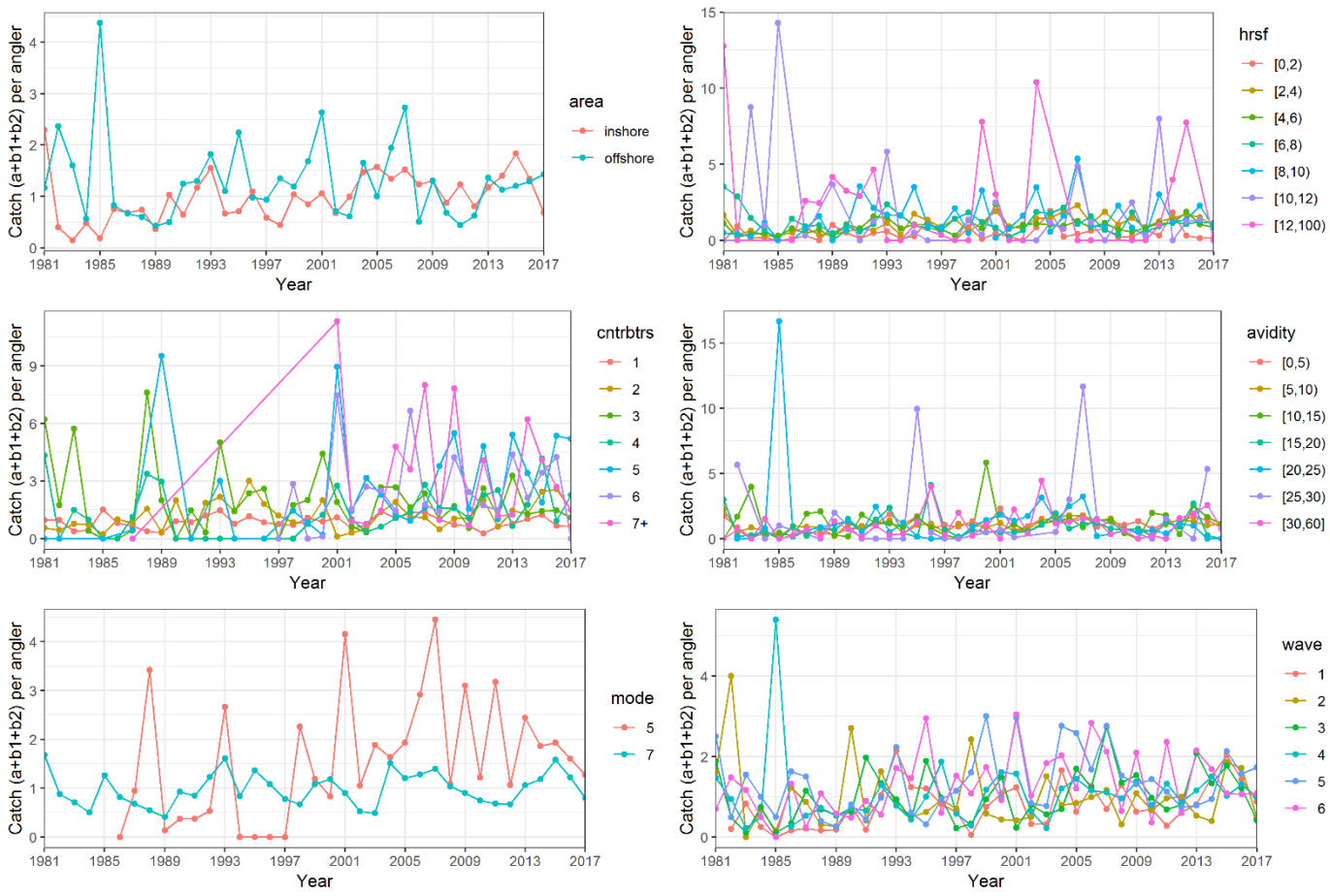

Figure 5. Interaction plots of year and each predictor variable on CPUE for the SE_FL area model.

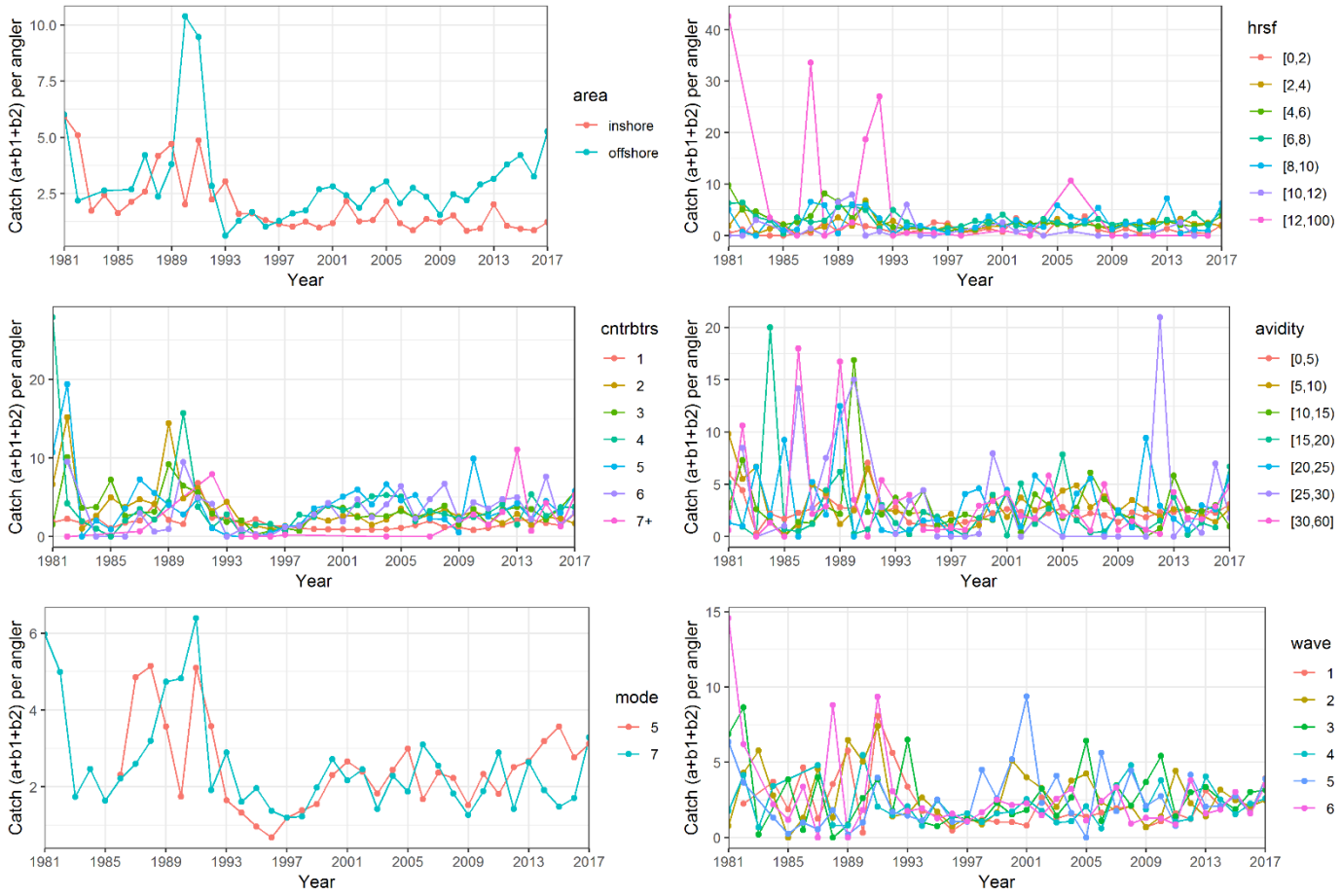

Figure 6. Interaction plots of year and each predictor variable on CPUE for the FL_Keys area model.

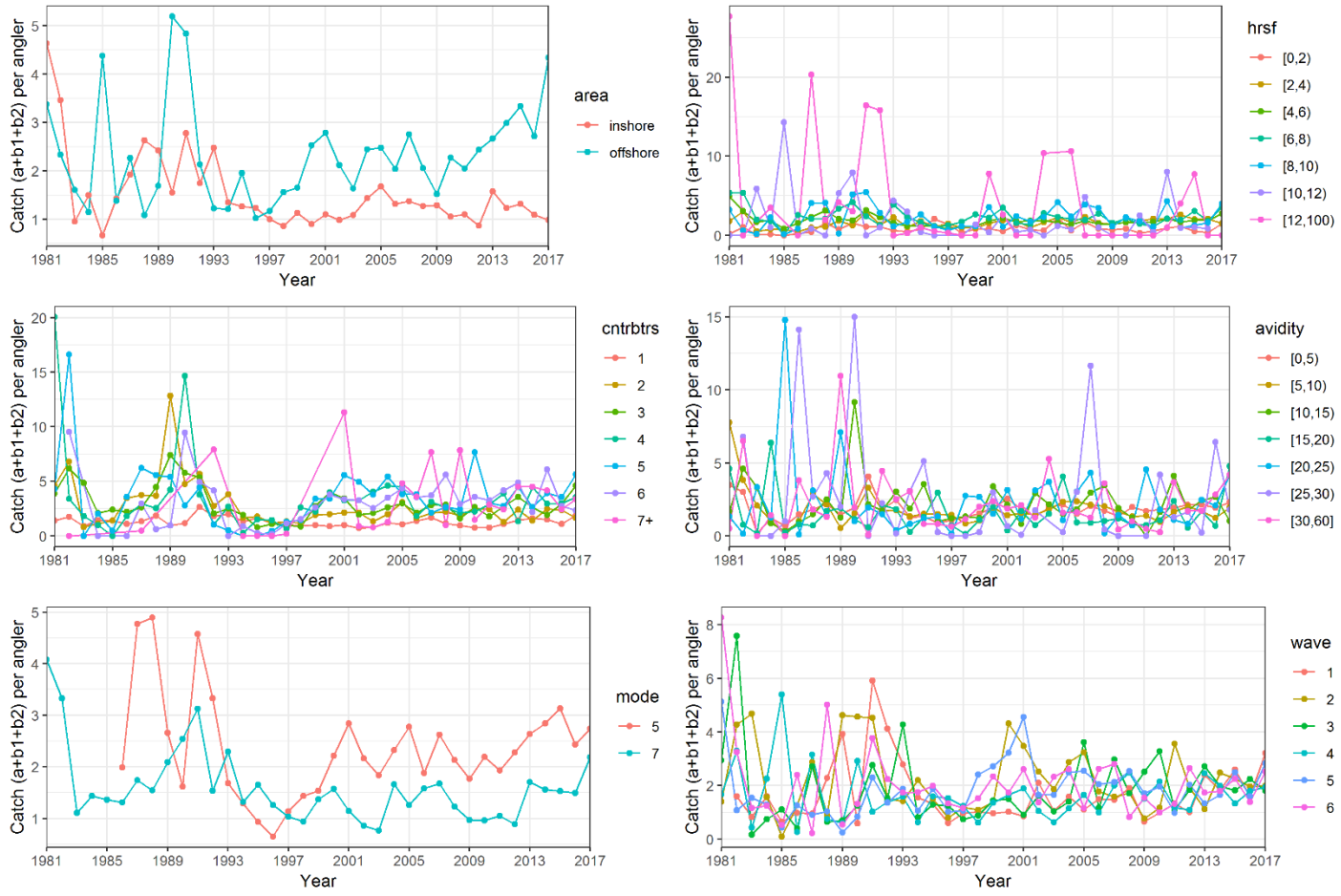

Figure 7. Interaction plots of year and each predictor variable on CPUE for the continuity model.

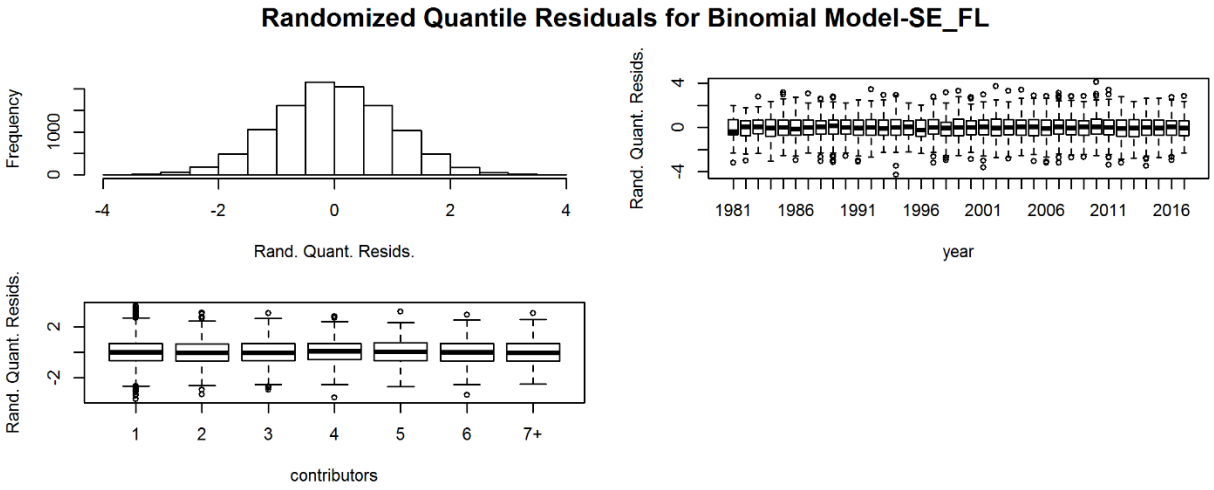

Figure 8. Standardized residuals for the binomial sub-model for the SE_FL area model.

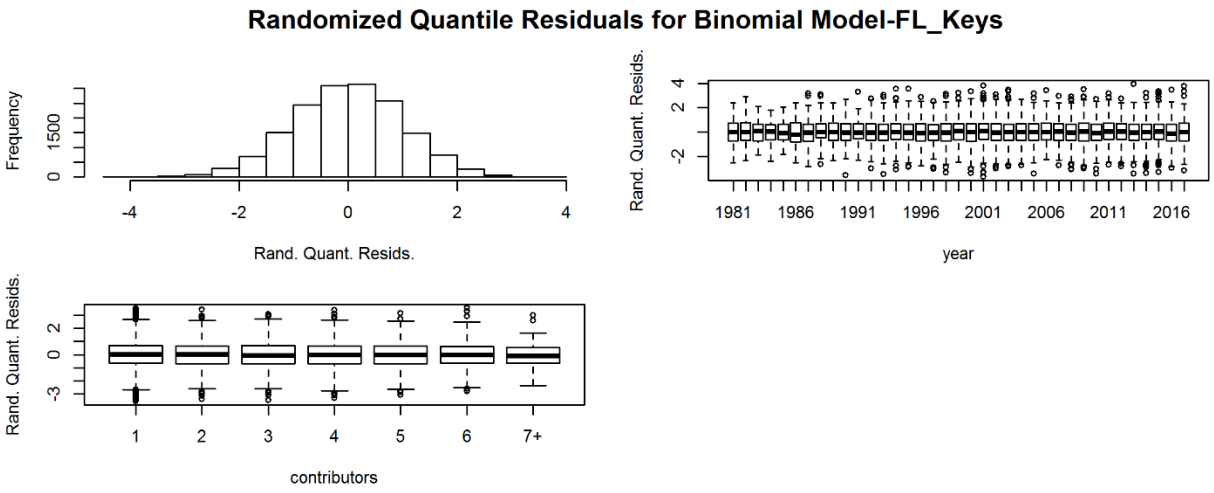

Figure 9. Standardized residuals for the binomial sub-model for the Keys area model.

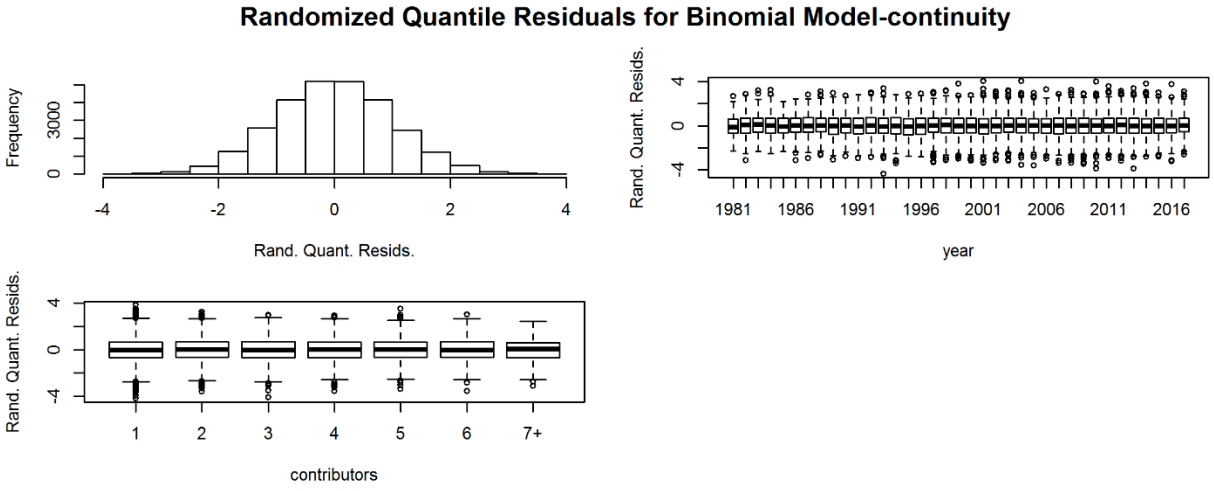

Figure 10. Standardized residuals for the binomial sub-model for the single area model.

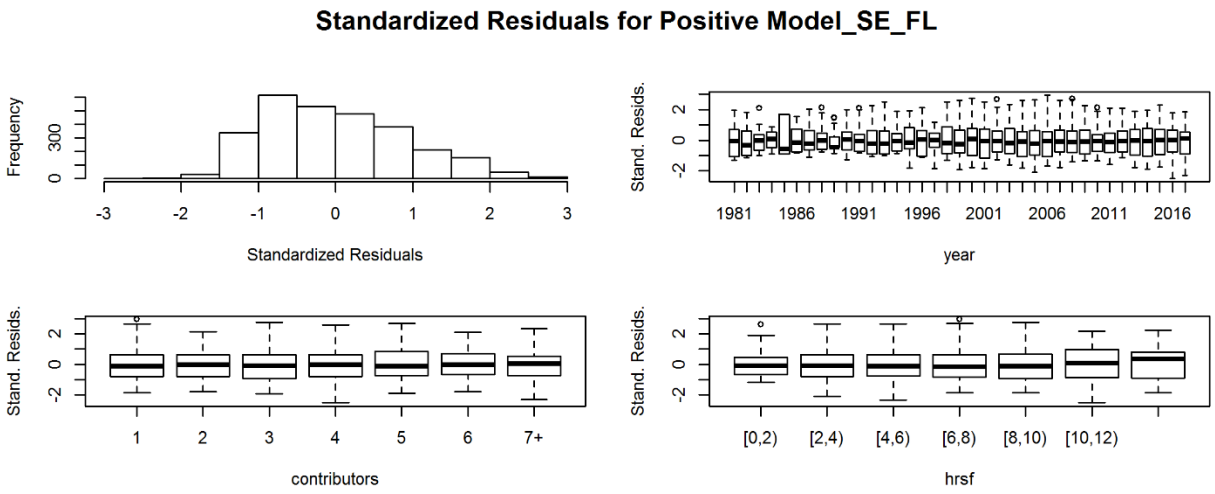

Figure 11. Standardized residuals for the positive sub-model for the SE_FL area model.

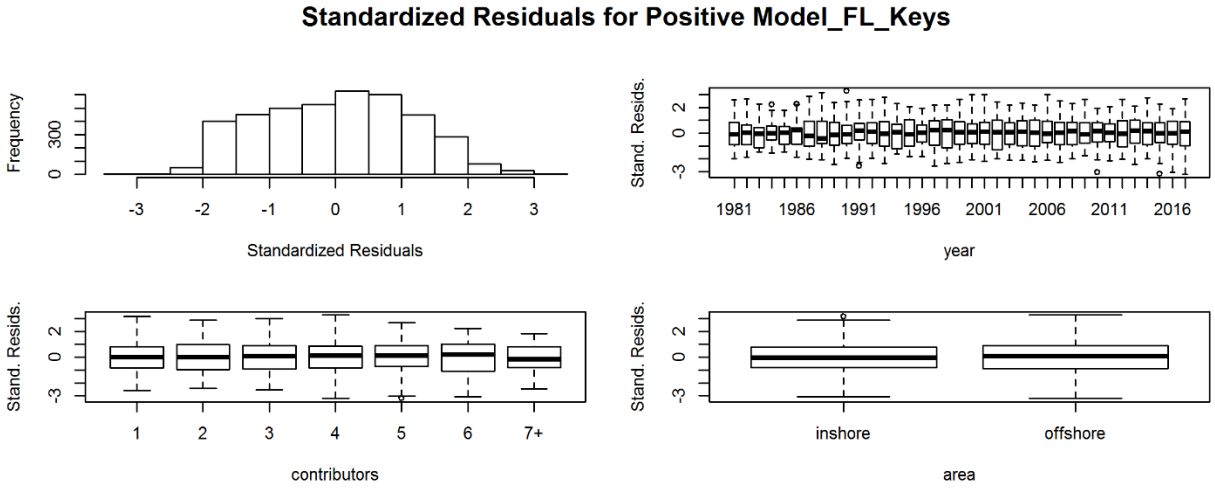

Figure 12. Standardized residuals for the positive sub-model for the Keys area model.

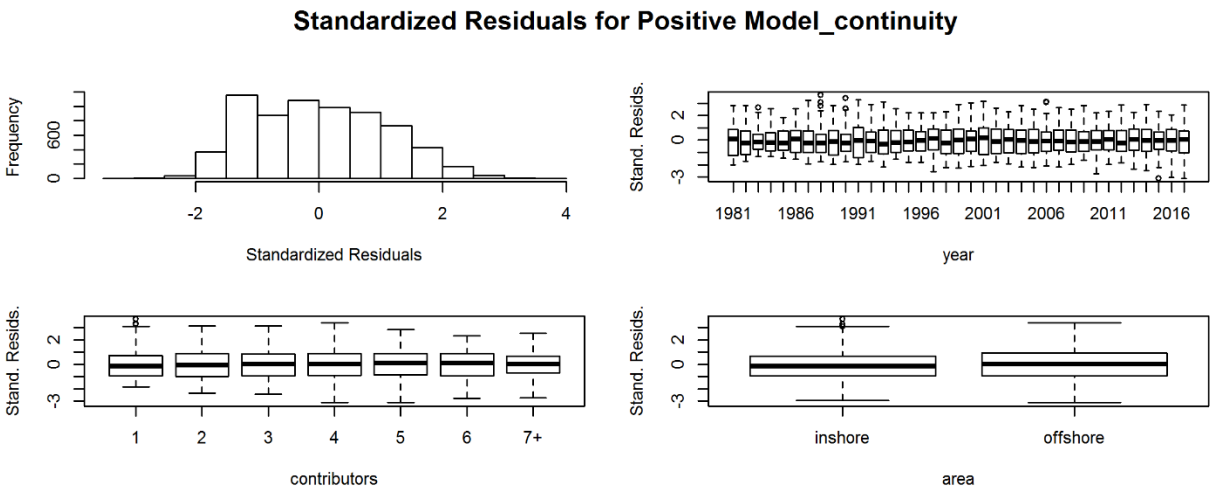

Figure 13. Standardized residuals for the positive sub-model for the single area model.

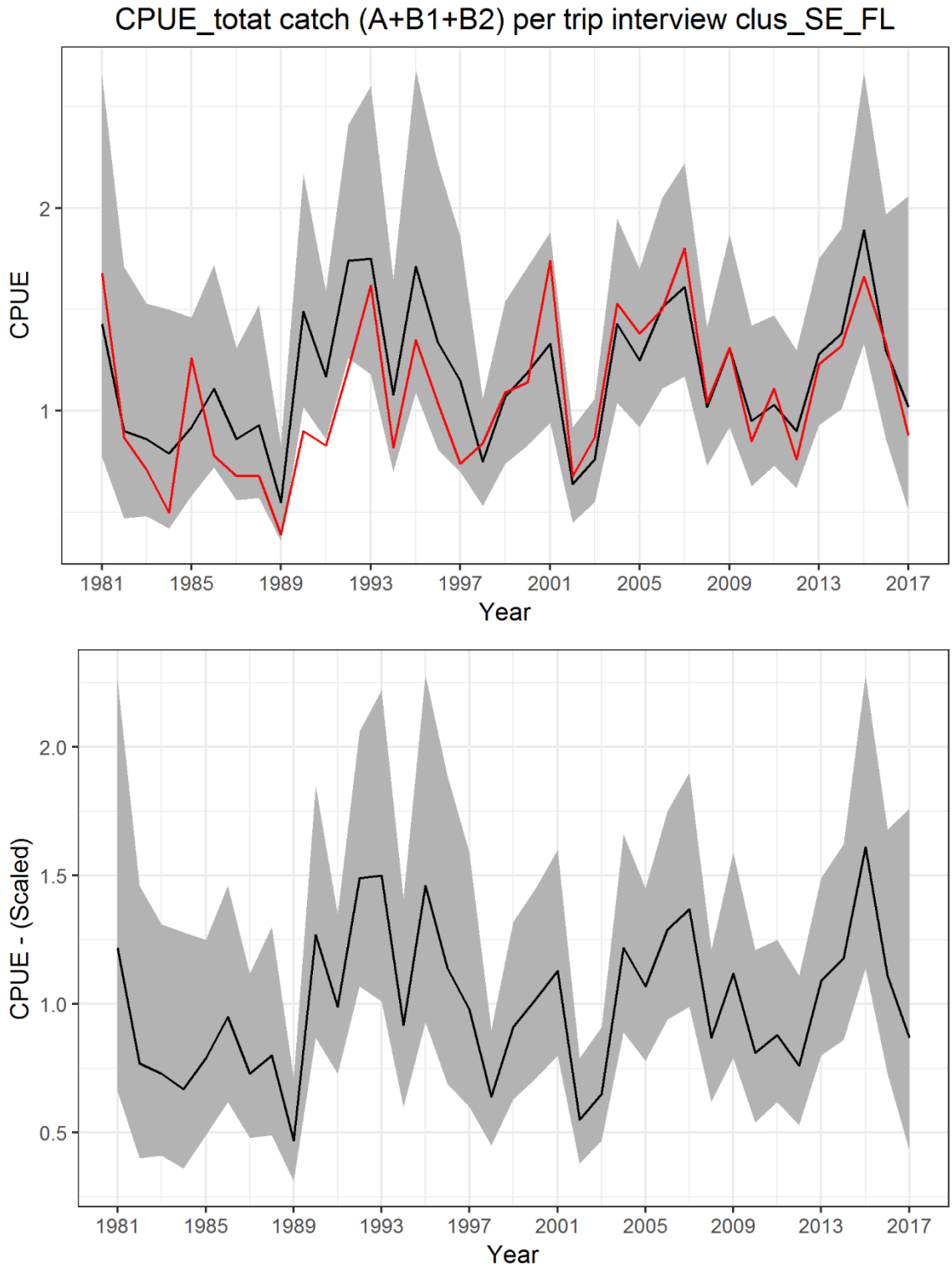

Figure 14. Standardized indices (black line) with 95% confidence intervals (grey ribbon) and nominal CPUE (red line) for SE_FL Yellowtail Snapper MRIP catch rate index.

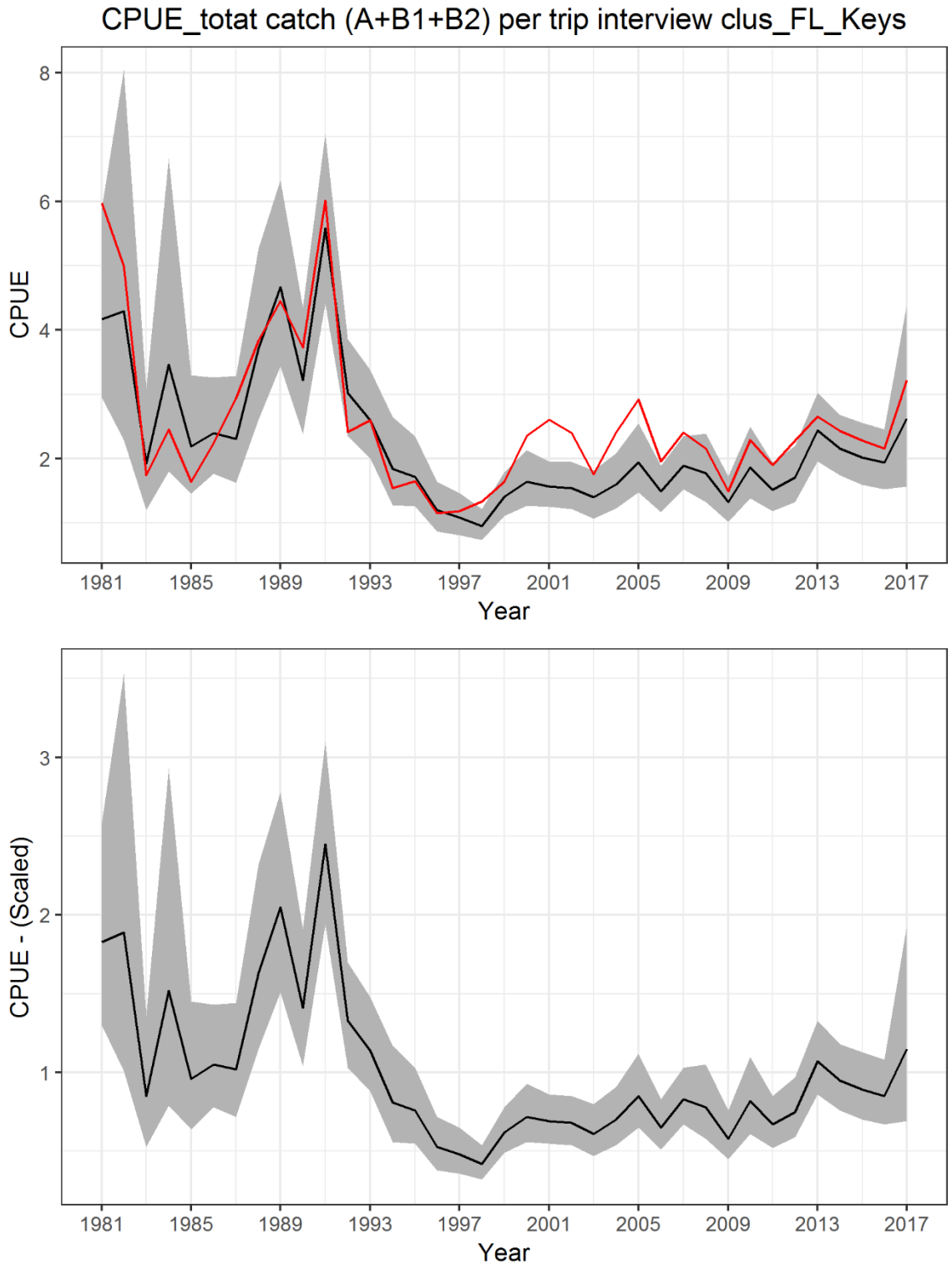

Figure 15. Standardized indices (black line) with 95% confidence intervals (grey ribbon) and nominal CPUE (red line) for Florida Keys Yellowtail Snapper MRIP catch rate index.

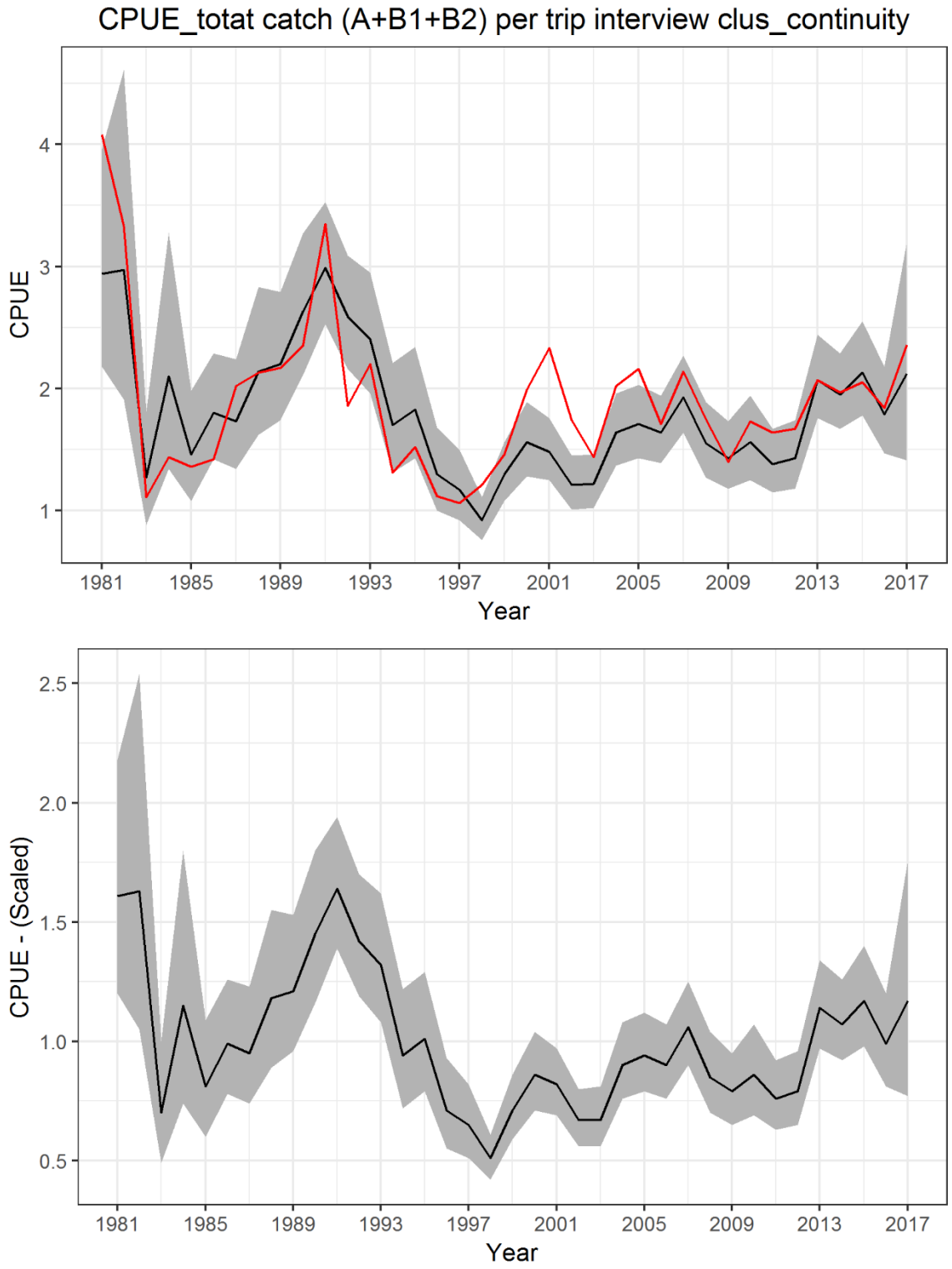

Figure 16. Standardized indices (black line) with 95% confidence intervals (grey ribbon) and nominal CPUE (red line) for the single area (continuity) model Yellowtail Snapper MRIP catch rate catch rate index.

ADDENDUM: June 28, 2019

Standardized Catch Rates of Yellowtail Snapper (*Ocyurus chrysurus*) from the Marine Recreational Information Program (MRIP) in Southeast Florida and the Florida Keys, 1981-2017

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SEDAR64

Per the request of the Indices Working Group which took place during the SEDAR64 Data Workshop held on June 25-27, 2019 in St. Petersburg, FL, the MRIP indices were updated based on two criteria.

First, the working group requested that the indices be produced only with trip records where hook-and-line was the primary recorded gear. Previously, the indices were produced with all trip records that were selected by the clustering algorithm with no regard made to gear type.

Additionally, the working group requested that the indices be produced using a start year of 1991. This choice was made due to the inconsistency in methods used to collapse trip-level catch for the early and later portion of the time series.

Therefore, a start year of 1991 and gear type (H&L) were selected for both regions. Species clustering and index standardization were performed per the methodology described in the original working paper.

Results

After species clustering, 9,315 trips remained in the SE_FL dataset and 19,050 in the FL_Keys dataset.

Table 1. Nominal mean CPUE and final modeled index for the SE_FL area model.

Year	Nominal CPUE	N	Proportion Positive	Index	Index CV
1991	0.83	231	0.26	0.86	0.12
1992	1.24	369	0.34	1.26	0.13
1993	1.67	286	0.36	1.31	0.17
1994	0.83	209	0.27	0.78	0.19
1995	1.35	201	0.24	1.24	0.21
1996	1.08	172	0.25	0.98	0.24
1997	0.78	177	0.18	0.88	0.23
1998	0.86	208	0.17	0.56	0.14
1999	1.12	405	0.25	0.8	0.16
2000	1.15	329	0.23	0.9	0.15
2001	1.76	355	0.24	0.98	0.14
2002	0.69	518	0.19	0.47	0.15
2003	0.89	471	0.19	0.57	0.13
2004	1.59	457	0.27	1.08	0.12
2005	1.41	479	0.27	0.92	0.12

2006	1.5	532	0.28	1.09	0.12
2007	1.84	480	0.29	1.2	0.13
2008	1.03	447	0.26	0.71	0.14
2009	1.32	366	0.3	0.96	0.15
2010	0.86	335	0.26	0.68	0.18
2011	1.12	225	0.27	0.76	0.15
2012	0.78	372	0.23	0.66	0.16
2013	1.28	318	0.24	0.98	0.13
2014	1.36	448	0.28	1.02	0.12
2015	1.7	401	0.35	1.42	0.14
2016	1.37	297	0.3	0.98	0.18
2017	0.92	227	0.24	0.78	0.18

Table 2. Nominal mean CPUE and final modeled index for the Keys area model.

Year	Nominal CPUE	N	Proportion Positive	Index	Index CV
1991	5.31	250	0.28	7.6	0.15
1992	1.74	450	0.25	3.18	0.15
1993	2.24	502	0.24	3.27	0.15
1994	1.45	475	0.23	2.52	0.2
1995	1.37	335	0.16	2.24	0.18
1996	1	462	0.18	1.61	0.18
1997	0.95	582	0.13	1.45	0.17
1998	1.01	792	0.12	1.38	0.15
1999	1.13	1276	0.11	1.89	0.15
2000	1.48	1216	0.14	2.06	0.16
2001	1.69	1139	0.12	2.02	0.15
2002	1.85	1108	0.18	2.28	0.14
2003	1.28	1205	0.13	2.04	0.16
2004	1.73	827	0.15	2.23	0.15
2005	2.1	698	0.19	2.66	0.15
2006	1.54	580	0.19	2.07	0.15
2007	1.98	745	0.2	2.66	0.13
2008	1.8	922	0.21	2.65	0.16
2009	1.17	577	0.15	1.87	0.15
2010	1.83	691	0.19	2.71	0.16
2011	1.51	583	0.17	2.33	0.15
2012	1.95	674	0.22	2.59	0.14
2013	2.38	523	0.25	3.5	0.14
2014	2.25	702	0.25	3.03	0.13
2015	2.07	747	0.24	2.76	0.14
2016	1.98	542	0.28	2.64	0.14
2017	2.95	447	0.33	3.61	0.17

Table 3. Nominal mean CPUE and final modeled index for the single area model.

Year	Nominal CPUE	N	Proportion Positive	Index	Index CV
1991	3.16	481	0.27	3.84	0.09
1992	1.52	819	0.29	2.96	0.09
1993	2.03	788	0.28	2.99	0.1
1994	1.26	684	0.24	2.27	0.13
1995	1.36	536	0.19	2.33	0.12
1996	1.02	634	0.2	1.71	0.13
1997	0.91	759	0.14	1.58	0.12
1998	0.98	1000	0.13	1.3	0.09
1999	1.13	1681	0.14	1.72	0.09
2000	1.41	1545	0.16	1.91	0.09
2001	1.71	1494	0.15	1.98	0.08
2002	1.48	1626	0.18	1.82	0.09
2003	1.17	1676	0.15	1.74	0.09
2004	1.68	1284	0.2	2.25	0.09
2005	1.82	1177	0.22	2.4	0.08
2006	1.52	1112	0.23	2.27	0.08
2007	1.93	1225	0.23	2.72	0.08
2008	1.55	1369	0.22	2.25	0.09
2009	1.23	943	0.21	2.09	0.09
2010	1.51	1026	0.21	2.29	0.11
2011	1.4	808	0.2	2.09	0.09
2012	1.53	1046	0.22	2.15	0.09
2013	1.96	841	0.25	3.02	0.08
2014	1.9	1150	0.26	2.76	0.08
2015	1.94	1148	0.28	2.95	0.09
2016	1.77	839	0.29	2.56	0.09
2017	2.27	674	0.3	2.93	0.11

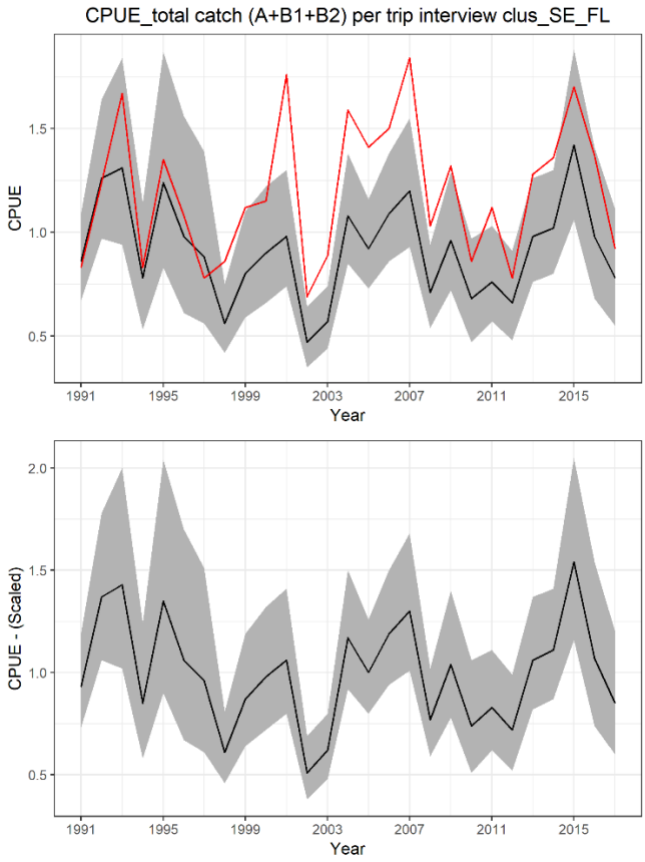

Figure 1. Standardized indices (black line) with 95% confidence intervals (grey ribbon) and nominal CPUE (red line) for SE_FL Yellowtail Snapper MRIP catch rate index.

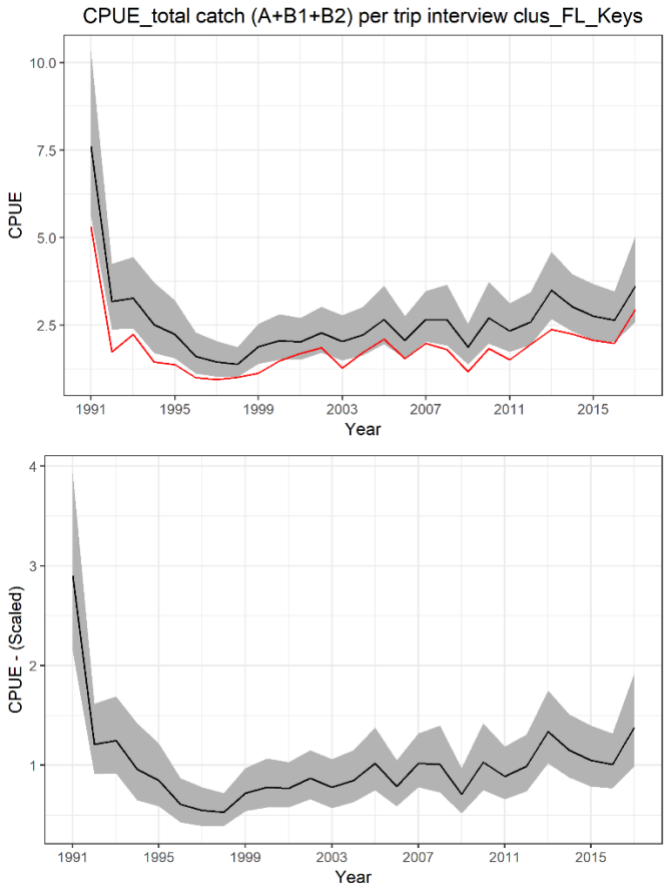

Figure 2. Standardized indices (black line) with 95% confidence intervals (grey ribbon) and nominal CPUE (red line) for FL_Keys Yellowtail Snapper MRIP catch rate index.

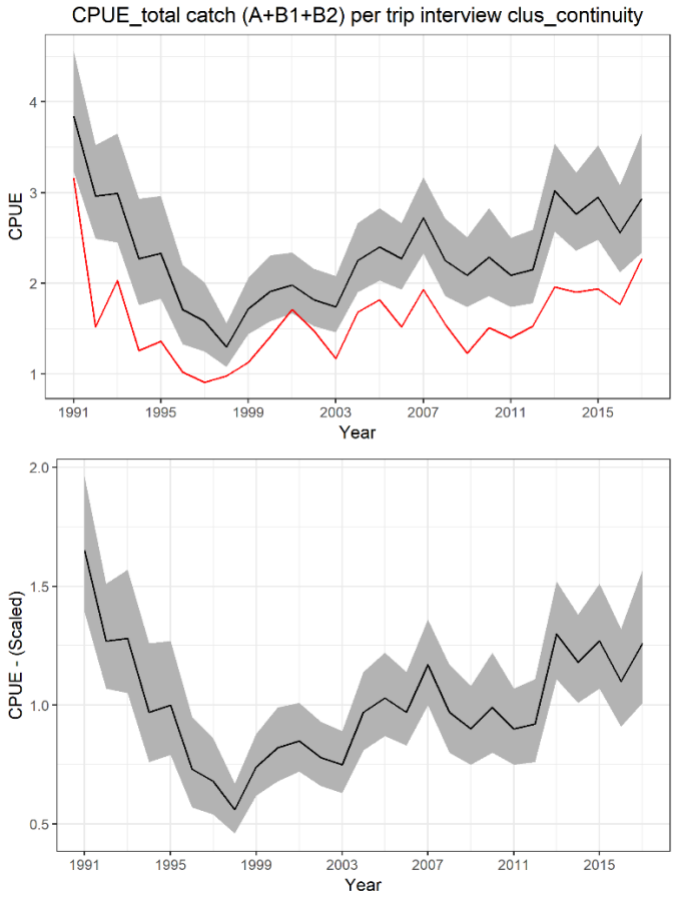

Figure 3. Standardized indices (black line) with 95% confidence intervals (grey ribbon) and nominal CPUE (red line) for single area (continuity) Yellowtail Snapper MRIP catch rate index.