

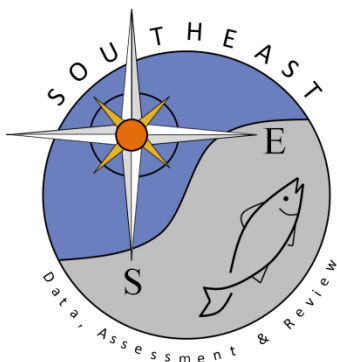
# Gray Triggerfish Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of America

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# Gray Triggerfish Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of America

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## **Abstract**

*The NOAA Fisheries - Southeast Fisheries Science Center - Population and Ecosystem Monitoring Division - Trawl and Plankton Branch and state partners have conducted groundfish surveys since 1972 in the northern Gulf of America during the summer and fall under two different sampling programs. In 1987, both groundfish surveys (summer and fall) were brought under the Southeast Area Monitoring and Assessment Program (SEAMAP) and followed the same survey design and methodologies. These fisheries independent data were used to develop abundance indices for gray triggerfish (*Balistes capriscus*). For this assessment, only data from the SEAMAP Fall Groundfish Survey was requested for analysis. However, some basic information about the summer survey was included for any potential future analysis. Six abundance indices were produced, two indices used all available data to represent a gulfwide index, with the other four indices being broken down by survey design (old and new) and area (West Gulf and East Gulf).*

## **Introduction**

The NOAA Fisheries - Southeast Fisheries Science Center (SEFSC) - Population and Ecosystem Monitoring Division - Trawl and Plankton Branch and state partners have conducted standardized fall groundfish surveys under the Southeast Area Monitoring and Assessment Program (SEAMAP) in the Gulf of America (Gulf) since 1987. Prior to 1987, the summer survey was conducted under SEAMAP protocols; however, the fall survey operated independent of SEAMAP and dates back to 1972. SEAMAP is a collaborative effort between federal, state and university programs, designed to collect, manage and distribute fishery independent data throughout the region. The primary objective of this trawl survey is to collect data on the abundance and distribution of demersal organisms in the northern Gulf. This survey, which is conducted semi-annually (summer and fall), provides an important source of fisheries independent information on many commercially and recreationally important species throughout the Gulf. The purpose of this document is to provide abundance indices for gray triggerfish (*Balistes capriscus*).

## **Methodology**

### ***Survey Design***

The survey methodologies and descriptions of the datasets used herein have been presented in detail by Nichols (2004) and Pollack and Ingram (2010). A change to the survey design was implemented between the summer and fall surveys of 2008. Prior to the fall survey of 2008, the basic structure of the groundfish surveys (i.e. 1987- summer of 2008) follows a stratified random

station location assignment with strata derived from depth zones (5-6, 6-7, 7-8, 8-9, 9-10, 10-11, 11-12, 12-13, 13-14, 14-15, 15-16, 16-17, 17-18, 18-19, 19-20, 20-22, 22-25, 25-30, 30-35, 35-40, 40-45, 45-50 and 50-60 fathoms), shrimp statistical zones (SSZ) (between 88° and 97° W longitude, SSZ from west to east: 21-20, 19-18, 17-16, 15-13 and 12-10), and time of day (i.e. day or night). Survey methodology prior to 1987 was presented in detail by Nichols (2004).

Starting in the fall of 2008 and continuing until the present, station allocation is randomized within each SSZ with a weighting by area. Other notable changes included a standardized 30 min tow and dropping the day/night stratification. The main purpose of these changes was to increase the sample size of each survey and expand the survey into the waters off of Florida. For additional information on the survey design changes see Pollack et al. (2025).

### ***Data***

A total of 19,008 stations were sampled from 1987- 2024 with 9800 and 9208 stations sampled during the summer and fall survey, respectively (Tables 1 and 2). Trawl data from SEFSC was obtained from the SEFSC Oracle database and combined with data from the Gulf States Marine Fisheries Commission (GSMFC) database, which contains data collected by state agencies/partners from Alabama, Florida, Louisiana, Mississippi and Texas. Age data was obtained from the NOAA Fisheries - SEFSC Biology and Life History branch. Finally, for this assessment, the Gulf was broken down into two areas, West Gulf (SSZ 13-21), and East Gulf (SSZ 1-12), for a subset of abundance indices.

### ***Data Caveats***

The survey area has been expanded throughout the course of the fall time series. Prior to 1987, the areas of eastern Louisiana and Mississippi/Alabama were considered the primary sampling area, areas directly west and east of the primary area were designated the secondary sampling areas; eastern Florida and Texas were not sampled. During this time, triplicate 10 min tows were usually done at each station, but may have been less for several reasons.

From 1987 – 2008 (summer), the area sampled was from Brownsville, TX to Mobile Bay, AL. Sampling rarely extended past Mobile Bay due to an increase in the number of hangs. During this time, tow length was dependent on how long it took to cover a full depth stratum (defined above). However, single tows never exceeded 55 min. Full details about this survey can be found in Nichols (2004).

Beginning in 2008, sampling was expanded to cover the eastern GOM, down to the Florida Keys. The other changes to the survey are outlined above in the survey design section and in Pollack and Ingram (2010).

### ***Data Exclusions***

Data was limited to stations where no problems were reported (i.e., net torn, doors crossed, etc.) and were sampled with a 40 ft shrimp trawl (data from the state of Texas was not utilized

because of the use of a 20 ft shrimp trawl). Data was also limited to a timeframe of 1987 – 2024 due to the limited spatial coverages in surveys prior to 1987.

### ***Index Construction***

Delta-lognormal modeling methods were used to estimate relative abundance indices for gray triggerfish from the SEAMAP Fall Groundfish Survey (Bradu and Mundlak 1970, Pennington 1983). The main advantage of using this method is allowance for the probability of zero catch (Ortiz *et al.* 2000). The index computed by this method is a mathematical combination of yearly abundance estimates from two distinct generalized linear models: a binomial (logistic) model which describes proportion of positive abundance values (i.e. presence/absence) and a lognormal model which describes variability in only the nonzero abundance data (*cf.* Lo *et al.* 1992).

The delta-lognormal index of relative abundance ( $I_y$ ) was estimated as:

$$(1) \quad I_y = c_y p_y,$$

where  $c_y$  is the estimate of mean CPUE for positive catches only for year  $y$ , and  $p_y$  is the estimate of mean probability of occurrence during year  $y$ . Both  $c_y$  and  $p_y$  were estimated using generalized linear models. Data used to estimate abundance for positive catches ( $c$ ) and probability of occurrence ( $p$ ) were assumed to have a lognormal distribution and a binomial distribution, respectively, and modeled using the following equations:

$$(2) \quad \ln(c) = X\beta + \varepsilon$$

and

$$(3) \quad p = \frac{e^{X\beta + \varepsilon}}{1 + e^{X\beta + \varepsilon}},$$

respectively, where  $c$  is a vector of the positive catch data,  $p$  is a vector of the presence/absence data,  $X$  is the design matrix for main effects,  $\beta$  is the parameter vector for main effects, and  $\varepsilon$  is a vector of independent normally distributed errors with expectation zero and variance  $\sigma^2$ . Therefore,  $c_y$  and  $p_y$  were estimated as least-squares means for each year along with their corresponding standard errors, SE ( $c_y$ ) and SE ( $p_y$ ), respectively. From these estimates,  $I_y$  was calculated, as in equation (1), and its variance calculated using the delta method approximation

$$(4) \quad V(I_y) \approx V(c_y) p_y^2 + c_y^2 V(p_y).$$

A covariance term is not included in the variance estimator since there is no correlation between the estimator of the proportion positive and the mean CPUE given presence. The two estimators are derived independently and have been shown to not covary for a given year (Christman, unpublished).

The submodels of the delta-lognormal model were built using a backward selection procedure based on type III analyses with an inclusion level of significance of  $\alpha = 0.05$ . Binomial

submodel performance was evaluated using Akaike Information Criterion (AIC), while the performance of the lognormal submodel was evaluated based on analyses of residual scatter and quantile-quantile (QQ) plots in addition to AIC. Variables that could be included in the submodels were:

***Abundance Index – Gulfwide – SEAMAP Fall Groundfish (old design)***

Year: 1987 – 2007  
Depth Zone: 22 levels (see Appendix Table 2 for full listing)  
Combined SSZ: 1011, 1315, 1617, 1819, 2021  
Time of Day: Day and Night

***Abundance Index – Gulfwide – SEAMAP Fall Groundfish (new design)***

Year: 2008 – 2024  
Depth: 9 – 110 m (continuous variable)  
SSZ: 2 – 21  
Time of Day: Day and Night

***Abundance Index – West Gulf – SEAMAP Fall Groundfish (old design)***

Year: 1987 – 2007  
Depth Zone: 22 levels (see Appendix Table 3 for full listing)  
Combined SSZ: 2 – 11  
Time of Day: Day and Night

***Abundance Index – West Gulf – SEAMAP Fall Groundfish (new design)***

Year: 2008 – 2024  
Depth: 9 – 110 m (continuous variable)  
SSZ: 2 – 11  
Time of Day: Day and Night

***Abundance Index – East Gulf – SEAMAP Fall Groundfish (new design)***

Year: 2008 – 2024  
Depth: 9 – 110 m (continuous variable)  
SSZ: 2 – 11  
Time of Day: Day and Night

**Results and Discussion**

***Distribution, Size and Age***

The distribution of gray triggerfish from the SEAMAP Summer and Fall Groundfish Surveys are presented in Figures 1 and 2, respectively, with seasonal/annual abundance and distribution

presented in the Appendix Figures 1 and 2. The total number of gray triggerfish captured during the fall survey was 12,000 individuals, with 6,424 being measured. The length frequency distribution of gray triggerfish captured is shown in Figure 3 for the summer survey and Figure 4 for the fall survey. Tables 3 – 6, present the breakdown of number collected and number measured by year, along with general information (minimum, maximum, and average length) from the fall survey. Each table is representative of a survey design (old or new) and an area (West Gulf and East Gulf). Aging information, which was only available from 2008 – 2024, is presented in Figure 5 by season (Summer and Fall) and area.

#### ***Abundance Index – Gulfwide – SEAMAP Fall Groundfish (old design)***

For the SEAMAP Fall Groundfish Survey (Gulfwide, 1987-2007) abundance index of gray triggerfish, year, depth, combined SSZ, and TOD were retained in the binomial submodel, while year, depth, and combined SSZ were retained in the lognormal submodel. A summary of the factors used in the analysis is presented in Appendix Table 1. Table 7 summarizes the backward selection process and the final set of variables used in the submodels and their significance. The AIC for the binomial and lognormal submodels were 25,299.9 and 3399.3, respectively. Diagnostic plots for the lognormal submodels are shown in Figure 6. Annual abundance indices are presented in Table 8 and Figure 7.

#### ***Abundance Index – Gulfwide – SEAMAP Fall Groundfish (new design)***

For the SEAMAP Fall Groundfish Survey (Gulfwide, 2008-2024) abundance index of gray triggerfish, year, depth, and SSZ were retained in both the binomial and lognormal submodels. A summary of the factors used in the analysis is presented in Appendix Table 2. Table 9 summarizes the backward selection process and the final set of variables used in the submodels and their significance. The AIC for the binomial and lognormal submodels were 21,807.2 and 2394.5, respectively. Diagnostic plots for the lognormal submodels are shown in Figure 8. Annual abundance indices are presented in Table 10 and Figure 9.

#### ***Abundance Index – West Gulf – SEAMAP Fall Groundfish (old design)***

For the SEAMAP Fall Groundfish Survey (West Gulf, 1987-2007) abundance index of gray triggerfish, year, depth, combined SSZ, and TOD were retained in the binomial submodel, while year, depth, and combined SSZ were retained in the lognormal submodel. A summary of the factors used in the analysis is presented in Appendix Table 3. Table 11 summarizes the backward selection process and the final set of variables used in the submodels and their significance. The AIC for the binomial and lognormal submodels were 19,451.1 and 3159.0, respectively. Diagnostic plots for the lognormal submodels are shown in Figure 10. Annual abundance indices are presented in Table 12 and Figure 11.

#### ***Abundance Index – East Gulf – SEAMAP Fall Groundfish (old design)***

Due to the limited spatial coverage across the entire east gulf (SSZ 2 – 13) from 1987 – 2007 (Figure 2), no index was produced for the area.

### ***Abundance Index – West Gulf – SEAMAP Fall Groundfish (new design)***

For the SEAMAP Fall Groundfish Survey (West Gulf, 2008-2024) abundance index of gray triggerfish, year, depth and SSZ were retained in both the binomial and lognormal submodels. A summary of the factors used in the analysis is presented in Appendix Table 4. Table 7 summarizes the backward selection process and the final set of variables used in the submodels and their significance. The AIC for the binomial and lognormal submodels were 11,976.6 and 1496.8, respectively. Diagnostic plots for the lognormal submodels are shown in Figure 12. Annual abundance indices are presented in Table 14 and Figure 13.

### ***Abundance Index – East Gulf – SEAMAP Fall Groundfish (new design)***

For the SEAMAP Fall Groundfish Survey (East Gulf, 2008-2024) abundance index of gray triggerfish, year, depth, and SSZ were retained in the binomial submodel, while year and SSZ were retained in the lognormal submodel. A summary of the factors used in the analysis is presented in Appendix Table 5. Table 15 summarizes the backward selection process and the final set of variables used in the submodels and their significance. The AIC for the binomial and lognormal submodels were 9900.7 and 864.7, respectively. Diagnostic plots for the lognormal submodels are shown in Figure 14. Annual abundance indices are presented in Table 16 and Figure 15.

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Table 1. Number of stations sampled by shrimp statistical zone during the SEAMAP Summer Groundfish Survey from 1987-2024.

Year	Shrimp Statistical Zone																				Total
	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	19	20	21	
1987										28	61	6	20	19	25	20	16	25	28	19	267
1988										18	48	5	4	3	19	24	14	25	28	23	211
1989										23	31		3	18	25	7	15	20	29	24	195
1990											69	11	20	15	23	16	20	23	24	20	241
1991											46	12	24	13	23	22	24	18	23	26	231
1992									1	45	2	20	24	20	25	12	31	26	20	226	
1993										46	10	19	17	24	19	14	29	24	22	224	
1994										61	6	17	22	25	17	20	22	26	22	238	
1995										45	10	16	18	22	23	13	27	26	21	221	
1996										46	14	13	19	22	18	17	21	26	25	221	
1997										44		12	16	22	23	10	28	26	26	207	
1998										36	2	14	21	25	18	14	22	36	17	205	
1999										44	7	20	19	20	23	13	25	32	20	223	
2000										45	2	19	15	19	27	8	29	31	21	216	
2001										36	7	18	18	13	3	10	9	17	21	152	
2002										45	11	14	21	27	19	15	25	29	22	228	
2003										44	9	10	8	2	17	20	22	26	23	181	
2004										39	11	18	17	20	25	21	19	25	21	216	
2005										32	11	9	12	16	21	5	28	22	27	183	
2006										45	11	21	12	20	23	17	23	31	18	221	
2007										41		7	16	24	23	7	29	32	21	200	
2008				1	8	11	6	11	8	11	45	12	17	16	23	21	16	24	21	28	279
2009				36	23	29	16	16	18	25	67	25	21	37	39	47	50	33	29	23	534
2010			31	26	21	26	10	12	14	15	21	5	19	18	21	33	34	27	27	19	379
2011		11	24	22	20	29	2	15	11	8	16	7	14	17	23	29	29	18	21	13	329
2012		12	39	33	29	30	19	16	16	13	16	7	14	18	25	30	27	20	20	15	399
2013		9	27	28	23	19	8	11	8	7	14	5	13	14	22	22	22	16	17	12	297
2014		15	31	23	24	30	17	15	9	7	17	6	15	18	22	28	23	18	18	14	350
2015	1	9	32	29	22	27	22	18	10	8	16	7	15	18	21	29	27	19	20	13	363
2016		9	25	29	26	23	15	15	10	8	15	6	16	16	22	30	23	19	17	14	338
2017		10	28	19	28	14	15	14	6	10	17	7	14	13	23	26	24	19	21	14	322
2018		8	30	28	24	23	16	12	5	7	14	7	12	14	21	26	19	11	11	14	302
2019		11	31	24	21	15	5	15	8	9	14	3	12	13	20	27	22	16	20	12	298
2021		9	24	21	19	3		9	7	6	6	4	9	8	17	22	20	14	14	11	223
2022		6	23	21	20	24	2	11	9	6	11	5	17	15	18	20	21	15	15	9	268
2023		8	26	28	24	17	8	9	7	6	15	5	13	13	19	27	23	19	17	11	295

Shrimp Statistical Zone

Year	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	19	20	21	Total
2024		9	30	30	25	24	10	12	9	6	13	3	11	13	23	24	22	19	20	14	317
<i>Total</i>	1	126	401	398	357	344	171	211	155	222	1266	261	550	604	795	854	707	807	875	695	9800

Table 2. Number of stations sampled by shrimp statistical zone during the SEAMAP Fall Groundfish Survey from 1987-2024.

Year	Shrimp Statistical Zone																				Total
	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	19	20	21	
1987										13	23	15	14	16	17	15	15	15	18	3	164
1988										8	28	7	22	17	18	26	19	21	31	20	217
1989											45	12	19	17	22	20	17	22	25	26	225
1990											52	14	12	23	22	19	18	22	19	27	228
1991											46	6	24	14	20	25	24	19	25	22	225
1992											34	7	23	14	25	18	17	27	30	18	213
1993											73	10	19	17	26	18	16	25	28	18	250
1994											50	9	16	21	25	20	21	23	24	20	229
1995											40	10	17	18	24	19	14	26	30	19	217
1996											45	9	18	19	17	28	13	25	29	24	227
1997											44	10	17	20	26	19	18	23	22	24	223
1998											44	10	22	14	34	11	15	24	29	22	225
1999											42	10	17	18	29	18	12	28	29	22	225
2000											43	10	14	22	20	26	12	30	25	21	223
2001											45	10	17	19	26	20	14	27	28	23	229
2002										1	51	10	13	22	22	23	14	26	30	21	233
2003										1	76	9	16	21	24	22	20	23	25	23	260
2004											43		11	18	17	27	14	24	30	21	205
2005											45	11	20	16	33	18	14	23	24	27	231
2006										1	46	7	22	14	18	28	13	23	32	19	223
2007											33	9	20	17	18	28	17	20	18	26	206
2008					15	14	4	4	3	4	35	8	22	32	42	46	44	19	36	20	348
2009				20	21	25	11	21	13	12	50	12	23	23	30	49	47	31	36	22	446
2010				9	25	27	17	16	11	14	15	7	15	18	26	30	29	18	19	14	310
2011								9	11	7	15	6	15	16	27	31	28	21	18	15	219
2012			2	3	6	6	17	10	7	5	12	5	11	13	19	23	22	13	15	11	200
2013		4	14	11	10	11	10	10	6	5	10	5	11	12	4	12	16	12	14	9	186
2014	1	8	31	25	22	23	13	12	7	7	16	5	14	15	21	27	22	15	17	12	313
2015	1	10	28	25	25	21	13	12	9	11	16	6	13	13	19	27	21	16	17	12	315
2016	1	5	4	8	11	9	6	13	5	4	8	4	12	12	18	22	17	13	13	8	193
2017		9	19	27	19	18	8	12	7	7	15	6	9	12	22	25	22	15	18	14	284
2018		9	29	21	14	10	7	13	8	7	13	5	12	15	21	25	22	13	15	14	273
2019		11	17	17	19	24	9	11	9	10	12	4	9	13	20	25	22	16	16	12	276
2020		9	15	17	20	8	4	8	7	9	12	4	9	10	18	22	18	15	14	11	230
2021		6	23	17	17	14	2	12	5	6	12	4	11	12	19	25	22	16	16	12	251
2022		6	22	20	14	16	9	10	7	6	10	2	10		2	11	11	16	16	12	200

Shrimp Statistical Zone

Year	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	19	20	21	Total
2023		8	26	25	21	17	9	7	2	6	12	6	13	11	15	25	22	13	15	9	262
2024		8	23	27	17	21	13	14	9	3	15	5	12	14	18	15	6	4			224
<i>Total</i>	3	93	253	272	276	264	152	194	126	147	1226	289	594	618	824	888	728	762	846	653	9208

Table 3. Summary of the gray triggerfish length data collected during SEAMAP Fall Groundfish Surveys conducted between 1987 and 2007 (West Gulf).

Survey Year	Number of Stations	Number Collected	Number Measured	Minimum Fork Length (mm)	Maximum Fork Length (mm)	Mean Fork Length (mm)	Standard Deviation (mm)
1987	128	165	45	105	176	137	19
1988	181	141	53	87	354	154	50
1989	180	267	137	25	246	138	31
1990	176	73	49	82	454	154	70
1991	179	1388	546	76	350	155	34
1992	179	81	67	65	367	169	71
1993	177	811	367	54	421	156	66
1994	179	590	349	66	392	146	39
1995	177	303	173	73	334	139	53
1996	182	181	86	60	452	144	74
1997	179	171	106	86	288	169	37
1998	181	11	6	115	338	166	86
1999	183	402	218	76	305	141	34
2000	180	561	375	60	369	142	36
2001	184	1738	510	73	450	124	30
2002	181	287	171	82	374	125	43
2003	183	215	91	86	395	144	44
2004	162	192	162	82	304	149	36
2005	186	362	162	84	346	143	33
2006	176	293	103	76	381	160	63
2007	173	279	95	77	300	143	41
Total Number of Years	Total Number of Stations	Total Number Collected	Total Number Measured	Overall Mean Fork Length (mm)			
21	3706	8511	3871	145			

Table 4. Summary of the gray triggerfish length data collected during SEAMAP Fall Groundfish Surveys conducted between 2008 and 2024 (West Gulf).

Survey Year	Number of Stations	Number Collected	Number Measured	Minimum Fork Length (mm)	Maximum Fork Length (mm)	Mean Fork Length (mm)	Standard Deviation (mm)
2008	269	298	286	86	404	134	40
2009	273	51	43	73	260	145	44
2010	176	138	60	79	307	140	42
2011	177	128	57	99	193	153	21
2012	132	291	205	71	375	122	33
2013	95	32	17	100	238	143	31
2014	148	139	94	76	232	143	29
2015	144	91	90	81	424	146	40
2016	119	35	35	82	307	138	52
2017	143	99	82	78	304	145	36
2018	142	98	81	79	389	140	50
2019	137	235	174	87	332	148	26
2020	121	83	69	88	283	132	36
2021	137	113	97	85	218	139	28
2022	80	115	80	99	267	142	34
2023	129	214	140	96	430	131	31
2024	74	19	9	116	310	174	62
Total Number of Years	Total Number of Stations	Total Number Collected	Total Number Measured	Overall Mean Fork Length (mm)			
17	2496	2179	1619	138			

Table 5. Summary of the gray triggerfish length data collected during SEAMAP Fall Groundfish Surveys conducted between 1987 and 2007 (East Gulf).

Survey Year	Number of Stations	Number Collected	Number Measured	Minimum Fork Length (mm)	Maximum Fork Length (mm)	Mean Fork Length (mm)	Standard Deviation (mm)
1987	36	11	2	93	150	122	40
1988	36	14	14	76	139	115	23
1989	45	8	2	115	372	243	182
1990	53	1	1	264	264	264	.
1991	46	27	16	107	223	190	32
1992	34	5	2	90	122	106	23
1993	73	14	10	102	233	169	48
1994	50	29	28	106	379	161	59
1995	40	1	1	100	100	100	.
1996	46	24	17	93	152	115	14
1997	45	5	5	176	244	207	31
1998	44	1	1	278	278	278	.
1999	43	4	4	171	226	201	27
2000	44	37	24	80	209	168	26
2001	45	14	14	103	353	149	65
2002	52	5	2	97	135	116	27
2003	77	9	7	129	205	151	26
2004	43	5	5	92	364	187	104
2005	45	20	8	118	270	169	63
2006	47	22	13	82	250	172	46
2007	33	1	1	101	101	101	.
Total Number of Years	Total Number of Stations	Total Number Collected	Total Number Measured	Overall Mean Fork Length (mm)			
21	977	257	177	159			

Table 6. Summary of the gray triggerfish length data collected during SEAMAP Fall Groundfish Surveys conducted between 2008 and 2024 (East Gulf).

Survey Year	Number of Stations	Number Collected	Number Measured	Minimum Fork Length (mm)	Maximum Fork Length (mm)	Mean Fork Length (mm)	Standard Deviation (mm)
2008	79	24	24	90	346	158	76
2009	173	66	61	102	362	208	63
2010	134	57	50	104	370	162	67
2011	42	19	18	135	390	236	84
2012	68	20	20	87	407	158	65
2013	91	50	23	90	264	138	51
2014	164	227	85	72	363	160	40
2015	170	87	87	81	306	170	56
2016	73	14	14	109	403	211	92
2017	141	42	42	103	391	151	48
2018	131	42	36	103	349	181	62
2019	139	95	66	98	333	156	43
2020	109	70	29	66	544	196	93
2021	114	63	61	87	372	156	41
2022	120	39	36	99	341	186	64
2023	133	70	51	82	357	180	79
2024	150	68	54	92	491	234	90
Total Number of Years	Total Number of Stations	Total Number Collected	Total Number Measured	Overall Mean Fork Length (mm)			
17	2031	1053	757	176			

Table 7. Summary of backward selection procedure for building delta-lognormal submodels for gray triggerfish SEAMAP Fall Groundfish Survey index of relative abundance from 1987 to 2007 (Gulfwide).

<b>Model Run #1</b>	<i>Binomial Submodel Type 3 Tests (AIC 25,299.9)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 3402.5)</i>			
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>
<i>Year</i>	20	4631	216.19	10.81	<.0001	<.0001	20	1122	6.11	<.0001
<i>Depth Zone</i>	21	4631	397.24	18.92	<.0001	<.0001	21	1122	12.48	<.0001
<i>Combined Statistical Zone</i>	4	4631	271.61	67.90	<.0001	<.0001	4	1122	13.25	<.0001
<i>Time of Day</i>	1	4631	4.21	4.21	0.0403	0.0403	1	1122	0.61	0.4357
<b>Model Run #2</b>	<i>Binomial Submodel Type 3 Tests (AIC 25,299.9)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 3399.3)</i>			
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>
<i>Year</i>	20	4631	216.19	10.81	<.0001	<.0001	20	1123	6.11	<.0001
<i>Depth Zone</i>	21	4631	397.24	18.92	<.0001	<.0001	21	1123	12.48	<.0001
<i>Combined Statistical Zone</i>	4	4631	271.61	67.90	<.0001	<.0001	4	1123	13.26	<.0001
<i>Time of Day</i>	1	4631	4.21	4.21	0.0403	0.0403		Dropped		

Table 8. Indices of gray triggerfish abundance developed using the delta-lognormal (DL) model for SEAMAP Fall Groundfish Survey from 1987-2007 (Gulfwide). The nominal frequency of occurrence, the number of samples ( $N$ ), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

Survey Year	Frequency	$N$	DL Index	Scaled Index	CV	LCL	UCL
1987	0.25610	164	1.13621	0.63376	0.24159	0.39359	1.02046
1988	0.20737	217	0.94011	0.52438	0.23334	0.33086	0.83108
1989	0.29333	225	1.92292	1.07257	0.19085	0.73474	1.56573
1990	0.13596	228	0.32511	0.18134	0.27790	0.10510	0.31290
1991	0.46667	225	5.82862	3.25110	0.14001	2.46039	4.29591
1992	0.11268	213	0.32348	0.18043	0.31327	0.09785	0.33271
1993	0.32400	250	3.48251	1.94248	0.16814	1.39099	2.71261
1994	0.36245	229	2.96847	1.65576	0.16571	1.19134	2.30121
1995	0.24885	217	1.38472	0.77237	0.21287	0.50696	1.17672
1996	0.21145	227	1.33718	0.74586	0.22569	0.47758	1.16482
1997	0.17937	223	0.67666	0.37743	0.24601	0.23243	0.61289
1998	0.03111	225	0.06214	0.03466	0.55719	0.01225	0.09807
1999	0.27111	225	1.51870	0.84710	0.19938	0.57074	1.25727
2000	0.35874	223	3.38744	1.88945	0.17020	1.34759	2.64920
2001	0.34934	229	4.89308	2.72927	0.17100	1.94352	3.83270
2002	0.21459	233	1.31462	0.73327	0.22058	0.47418	1.13393
2003	0.16923	260	1.00950	0.56308	0.23443	0.35454	0.89429
2004	0.29756	205	1.14509	0.63871	0.19849	0.43108	0.94634
2005	0.29004	231	1.40347	0.78283	0.19041	0.53673	1.14178
2006	0.21076	223	1.17524	0.65553	0.22842	0.41755	1.02914
2007	0.25728	206	1.41388	0.78864	0.21515	0.51536	1.20682

Table 9. Summary of backward selection procedure for building delta-lognormal submodels for gray triggerfish SEAMAP Fall Groundfish Survey index of relative abundance from 2008 to 2024 (Gulfwide).

<b>Model Run #1</b>	<i>Binomial Submodel Type 3 Tests (AIC 21,811.8)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 2398.4)</i>			
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>
<i>Year</i>	16	4490	132.47	8.28	<.0001	<.0001	16	945	1.76	0.0321
<i>Depth</i>	1	4490	158.68	158.68	<.0001	<.0001	1	945	34.90	<.0001
<i>Statistical Zone</i>	18	4490	154.98	8.61	<.0001	<.0001	18	945	4.23	<.0001
<i>Time of Day</i>	1	4490	0.33	0.33	0.5677	0.5677	1	945	0.16	0.6868
<b>Model Run #2</b>	<i>Binomial Submodel Type 3 Tests (AIC 21,807.2)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 2394.5)</i>			
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>
<i>Year</i>	16	4491	132.75	8.30	<.0001	<.0001	16	946	1.77	0.0312
<i>Depth</i>	1	4491	158.92	158.92	<.0001	<.0001	1	946	35.06	<.0001
<i>Statistical Zone</i>	18	4491	154.97	8.61	<.0001	<.0001	18	946	4.23	<.0001
<i>Time of Day</i>				Dropped					Dropped	

Table 10. Indices of gray triggerfish abundance developed using the delta-lognormal (DL) model for SEAMAP Fall Groundfish Survey from 2008-2024 (Gulfwide). The nominal frequency of occurrence, the number of samples ( $N$ ), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

Survey Year	Frequency	$N$	DL Index	Scaled Index	CV	LCL	UCL
2008	0.37644	348	2.06468	2.08194	0.10724	1.68109	2.57837
2009	0.14574	446	0.45708	0.46090	0.16066	0.33492	0.63426
2010	0.16452	310	0.79553	0.80218	0.17848	0.56293	1.14311
2011	0.22831	219	0.84944	0.85654	0.17984	0.59950	1.22380
2012	0.33000	200	1.64888	1.66267	0.14978	1.23432	2.23967
2013	0.15054	186	0.66157	0.66710	0.23757	0.41751	1.06589
2014	0.24679	312	1.12365	1.13305	0.14164	0.85474	1.50198
2015	0.21338	314	0.93302	0.94082	0.15359	0.69323	1.27683
2016	0.12500	192	0.36781	0.37089	0.25836	0.22307	0.61664
2017	0.18662	284	0.66263	0.66817	0.17350	0.47348	0.94292
2018	0.20879	273	0.78994	0.79655	0.16686	0.57184	1.10956
2019	0.24638	276	1.39428	1.40594	0.14986	1.04358	1.89412
2020	0.18261	230	0.75221	0.75850	0.19485	0.51557	1.11590
2021	0.24701	251	1.11782	1.12716	0.15749	0.82419	1.54151
2022	0.22000	200	1.22569	1.23594	0.18663	0.85365	1.78942
2023	0.23282	262	1.29600	1.30683	0.15835	0.95396	1.79024
2024	0.16071	224	0.71880	0.72481	0.21055	0.47788	1.09933

Table 11. Summary of backward selection procedure for building delta-lognormal submodels for gray triggerfish SEAMAP Fall Groundfish Survey index of relative abundance from 1987 to 2007 (West Gulf).

<b>Model Run #1</b>	<i>Binomial Submodel Type 3 Tests (AIC 19,451.1)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 3162.5)</i>			
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>
<i>Year</i>	20	3660	210.98	10.55	<.0001	<.0001	20	1037	6.24	<.0001
<i>Depth Zone</i>	21	3660	377.98	18.00	<.0001	<.0001	21	1037	12.43	<.0001
<i>Combined Statistical Zone</i>	3	3660	113.15	37.72	<.0001	<.0001	3	1037	14.32	<.0001
<i>Time of Day</i>	1	3660	5.22	5.22	0.0223	0.0224	1	1037	0.23	0.6311
<b>Model Run #2</b>	<i>Binomial Submodel Type 3 Tests (AIC 19,451.1)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 3159.0)</i>			
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>
<i>Year</i>	20	3660	210.98	10.55	<.0001	<.0001	20	1038	6.25	<.0001
<i>Depth Zone</i>	21	3660	377.98	18.00	<.0001	<.0001	21	1038	12.45	<.0001
<i>Combined Statistical Zone</i>	3	3660	113.15	37.72	<.0001	<.0001	3	1038	14.35	<.0001
<i>Time of Day</i>	1	3660	5.22	5.22	0.0223	0.0224		Dropped		

Table 12. Indices of gray triggerfish abundance developed using the delta-lognormal (DL) model for SEAMAP Fall Groundfish Survey from 1987-2007 (West Gulf). The nominal frequency of occurrence, the number of samples ( $N$ ), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

Survey Year	Frequency	$N$	DL Index	Scaled Index	CV	LCL	UCL
1987	0.28125	128	1.27622	0.53219	0.25784	0.32041	0.88395
1988	0.21547	181	1.02421	0.42710	0.24765	0.26219	0.69574
1989	0.35556	180	2.60979	1.08830	0.18808	0.74955	1.58014
1990	0.17045	176	0.45962	0.19166	0.28190	0.11024	0.33322
1991	0.55307	179	7.97245	3.32455	0.13545	2.53875	4.35359
1992	0.12291	179	0.38863	0.16206	0.32601	0.08583	0.30601
1993	0.41243	177	4.81845	2.00932	0.17213	1.42766	2.82795
1994	0.43017	179	3.86452	1.61153	0.16580	1.15931	2.24014
1995	0.29944	177	2.02073	0.84265	0.21050	0.55563	1.27795
1996	0.23626	182	1.54011	0.64223	0.23568	0.40341	1.02245
1997	0.21788	179	0.95107	0.39660	0.24664	0.24394	0.64480
1998	0.03315	181	0.08786	0.03664	0.60337	0.01202	0.11166
1999	0.32240	183	2.12050	0.88426	0.19780	0.59761	1.30841
2000	0.40556	180	4.33066	1.80591	0.17285	1.28133	2.54525
2001	0.40761	184	6.90880	2.88101	0.17040	2.05398	4.04105
2002	0.25967	181	1.83021	0.76321	0.22438	0.48993	1.18892
2003	0.20219	183	1.36123	0.56764	0.25394	0.34430	0.93584
2004	0.34568	162	1.63098	0.68013	0.20266	0.45534	1.01590
2005	0.33333	186	1.76713	0.73690	0.19353	0.50217	1.08135
2006	0.23295	176	1.38704	0.57840	0.24200	0.35894	0.93206
2007	0.30058	173	2.00884	0.83770	0.21246	0.55028	1.27524

Table 13. Summary of backward selection procedure for building delta-lognormal submodels for gray triggerfish SEAMAP Fall Groundfish Survey index of relative abundance from 2008 to 2024 (West Gulf).

<b>Model Run #1</b>	<i>Binomial Submodel Type 3 Tests (AIC 11,979.4)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 1500.1)</i>			
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>
<i>Year</i>	16	2469	144.04	9.00	<.0001	<.0001	16	553	1.95	0.0147
<i>Depth</i>	1	2469	87.93	87.93	<.0001	<.0001	1	553	38.83	<.0001
<i>Statistical Zone</i>	8	2469	90.73	11.34	<.0001	<.0001	8	553	3.52	0.0005
<i>Time of Day</i>	1	2469	0.20	0.20	0.6539	0.6540	1	553	0.12	0.7239
<b>Model Run #2</b>	<i>Binomial Submodel Type 3 Tests (AIC 11,976.6)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 1496.8)</i>			
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>
<i>Year</i>	16	2470	144.24	9.02	<.0001	<.0001	16	554	1.95	0.0144
<i>Depth</i>	1	2470	87.98	87.98	<.0001	<.0001	1	554	38.80	<.0001
<i>Statistical Zone</i>	8	2470	90.60	11.33	<.0001	<.0001	8	554	3.56	0.0005
<i>Time of Day</i>				Dropped					Dropped	

Table 14. Indices of gray triggerfish abundance developed using the delta-lognormal (DL) model for SEAMAP Fall Groundfish Survey from 2008-2024 (West Gulf). The nominal frequency of occurrence, the number of samples ( $N$ ), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

Survey Year	Frequency	$N$	DL Index	Scaled Index	CV	LCL	UCL
2008	0.42379	269	2.75268	2.38368	0.11747	1.88611	3.01252
2009	0.12088	273	0.34875	0.30200	0.23112	0.19136	0.47660
2010	0.14773	176	0.90679	0.78523	0.25606	0.47436	1.29984
2011	0.22034	177	1.02965	0.89162	0.20716	0.59174	1.34348
2012	0.39394	132	2.57262	2.22776	0.17039	1.58829	3.12469
2013	0.14737	95	0.67491	0.58444	0.34349	0.29969	1.13974
2014	0.29054	148	1.30521	1.13025	0.19617	0.76628	1.66709
2015	0.21528	144	0.84521	0.73191	0.23391	0.46130	1.16126
2016	0.11765	119	0.34722	0.30067	0.34762	0.15301	0.59083
2017	0.18881	143	0.72343	0.62645	0.25120	0.38197	1.02743
2018	0.21127	142	0.83645	0.72432	0.23821	0.45276	1.15875
2019	0.23358	137	1.46482	1.26846	0.22817	0.80836	1.99044
2020	0.21488	121	0.96336	0.83422	0.25458	0.50538	1.37704
2021	0.29197	137	1.23937	1.07324	0.20204	0.71937	1.60116
2022	0.27500	80	1.82981	1.58452	0.27135	0.92977	2.70035
2023	0.22481	129	1.43132	1.23946	0.23825	0.77471	1.98299
2024	0.10811	74	0.36003	0.31177	0.45668	0.13056	0.74451

Table 15. Summary of backward selection procedure for building delta-lognormal submodels for gray triggerfish SEAMAP Fall Groundfish Survey index of relative abundance from 2008 to 2024 (East Gulf).

<b>Model Run #1</b>	<i>Binomial Submodel Type 3 Tests (AIC 9905.1)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 1456.3)</i>				
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>	
<i>Year</i>	16	2003	16.46	1.03	0.4211	0.4218	16	374	1.01	0.4424	
<i>Depth</i>	1	2003	72.65	72.65	<.0001	<.0001	1	374	2.46	0.1179	
<i>Statistical Zone</i>	9	2003	58.59	6.51	<.0001	<.0001	9	374	3.53	0.0003	
<i>Time of Day</i>	1	2003	0.17	0.17	0.6821	0.6821	1	374	1.67	0.1967	
<b>Model Run #2</b>	<i>Binomial Submodel Type 3 Tests (AIC 9900.7)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 870.8)</i>				
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>	
<i>Year</i>	16	2004	16.49	1.03	0.4193	0.4200	16	375	1.04	0.4100	
<i>Depth</i>	1	2004	72.82	72.82	<.0001	<.0001	1	375	2.48	0.1160	
<i>Statistical Zone</i>	9	2004	58.90	6.54	<.0001	<.0001	9	375	3.39	0.0005	
<i>Time of Day</i>				Dropped						Dropped	
<b>Model Run #3</b>	<i>Binomial Submodel Type 3 Tests (AIC 9900.7)</i>						<i>Lognormal Submodel Type 3 Tests (AIC 864.7)</i>				
<i>Effect</i>	<i>Num DF</i>	<i>Den DF</i>	<i>Chi-Square</i>	<i>F Value</i>	<i>Pr &gt; ChiSq</i>	<i>Pr &gt; F</i>	<i>Num DF</i>	<i>Den DF</i>	<i>F Value</i>	<i>Pr &gt; F</i>	
<i>Year</i>	16	2004	16.49	1.03	0.4193	0.4200	16	376	1.03	0.4209	
<i>Depth</i>	1	2004	72.82	72.82	<.0001	<.0001			Dropped		
<i>Statistical Zone</i>	9	2004	58.90	6.54	<.0001	<.0001	9	376	3.96	<.0001	
<i>Time of Day</i>				Dropped						Dropped	

Table 16. Indices of gray triggerfish abundance developed using the delta-lognormal (DL) model for SEAMAP Fall Groundfish Survey from 2008-2024 (East Gulf). The nominal frequency of occurrence, the number of samples ( $N$ ), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

Survey Year	Frequency	$N$	DL Index	Scaled Index	CV	LCL	UCL
2008	0.21519	79	0.82956	1.15190	0.28443	0.65940	2.01225
2009	0.18497	173	0.60103	0.83456	0.21779	0.54259	1.28364
2010	0.18657	134	0.66903	0.92899	0.24229	0.57618	1.49784
2011	0.26190	42	0.53585	0.74406	0.37646	0.35925	1.54107
2012	0.20588	68	0.58507	0.81240	0.31808	0.43663	1.51156
2013	0.15385	91	0.58802	0.81649	0.32049	0.43688	1.52598
2014	0.20732	164	0.91038	1.26411	0.20139	0.84839	1.88354
2015	0.21176	170	0.90481	1.25638	0.19695	0.85050	1.85596
2016	0.13699	73	0.35341	0.49073	0.37729	0.23658	1.01792
2017	0.18440	141	0.54384	0.75516	0.23376	0.47609	1.19781
2018	0.20611	131	0.66231	0.91966	0.22751	0.58682	1.44129
2019	0.25899	139	1.16773	1.62147	0.19102	1.11040	2.36776
2020	0.14679	109	0.48993	0.68030	0.30093	0.37754	1.22586
2021	0.19298	114	0.88977	1.23549	0.25129	0.75319	2.02664
2022	0.18333	120	0.77377	1.07443	0.25012	0.65647	1.75849
2023	0.24060	133	1.00875	1.40071	0.20479	0.93388	2.10089
2024	0.18667	150	0.72963	1.01314	0.22307	0.65202	1.57428

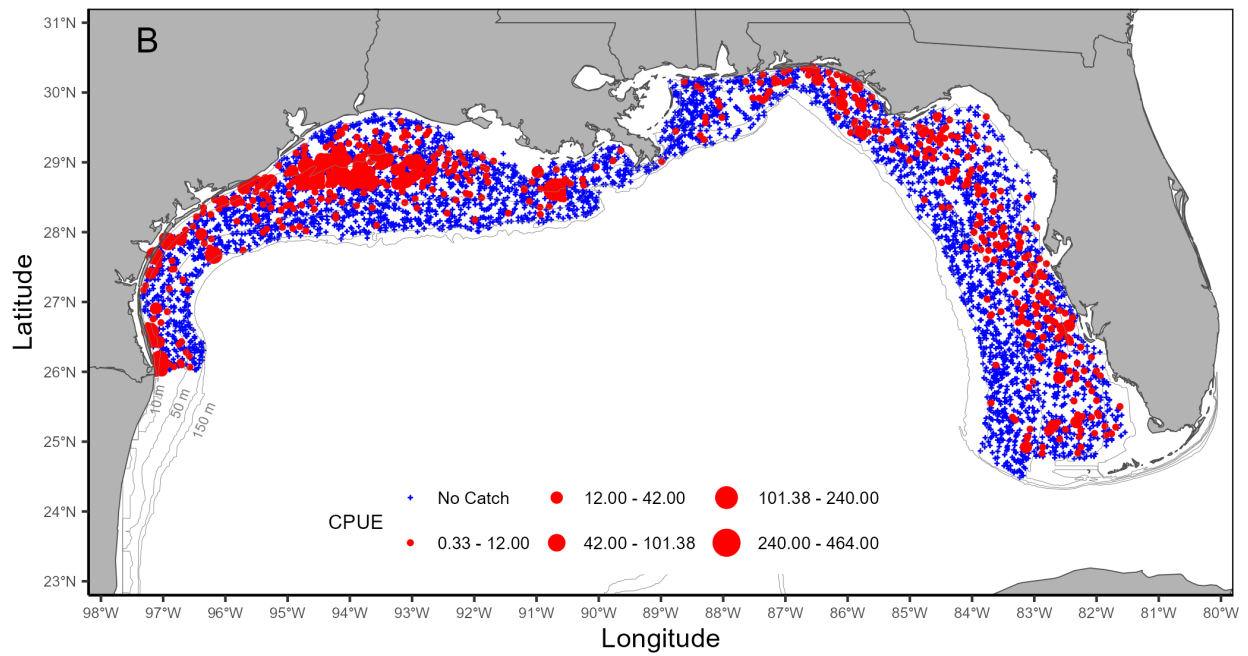
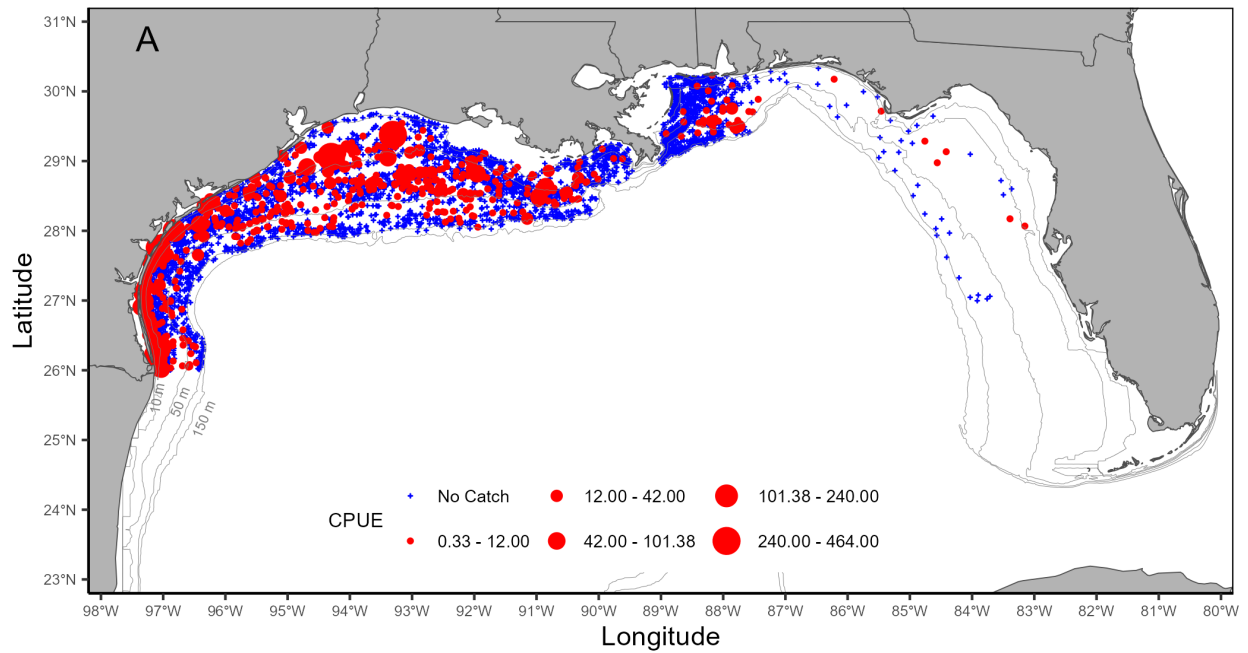


Figure 1. Stations sampled during the Summer SEAMAP Groundfish Survey with the CPUE for gray triggerfish from **A.** 1987 – 2008 and **B.** 2009 – 2024.

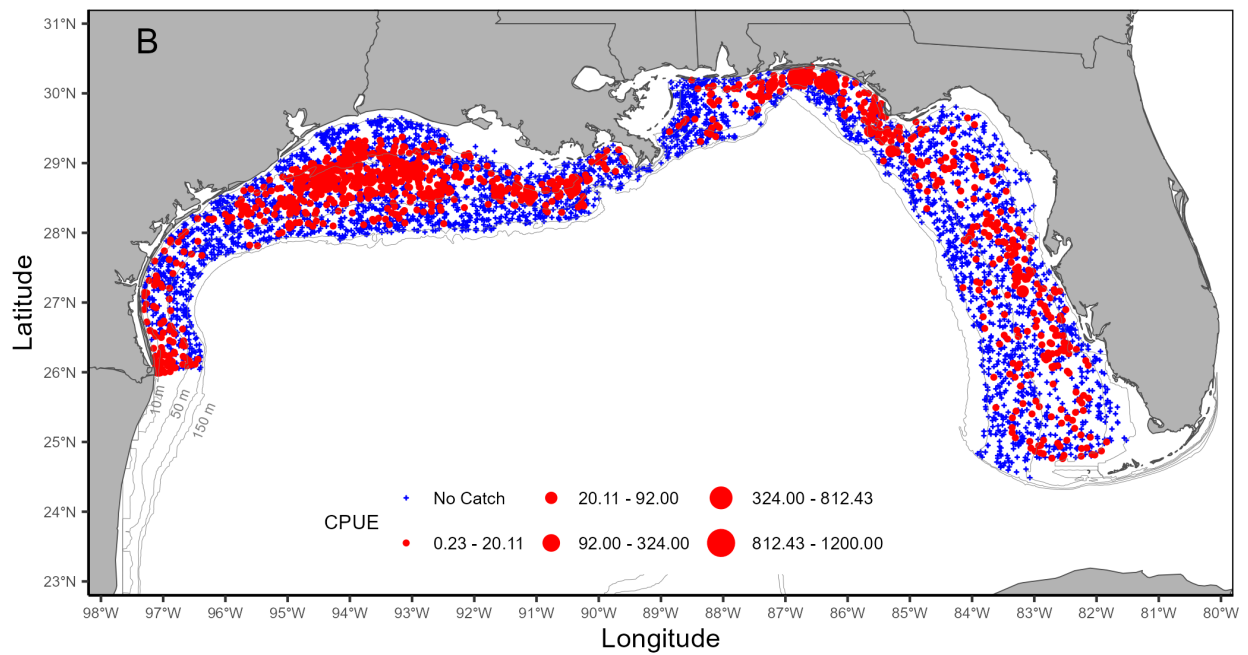
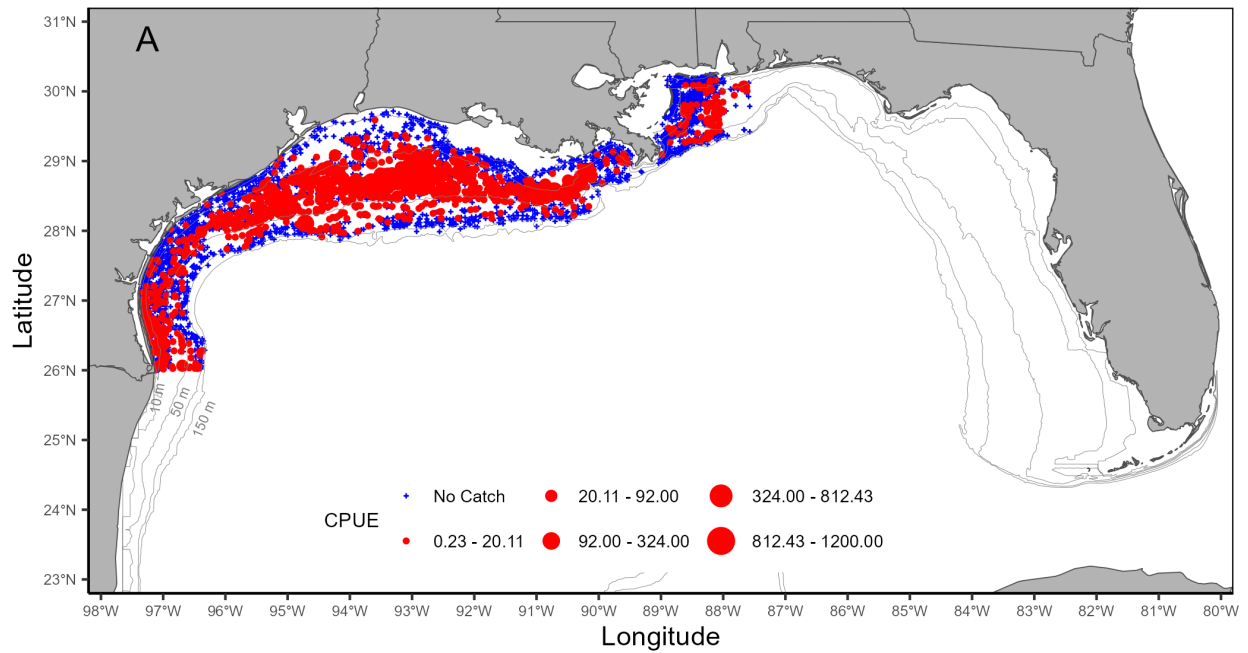


Figure 2. Stations sampled during the Fall SEAMAP Groundfish Survey with the CPUE (number per trawl hour) for gray triggerfish from **A.** 1987 – 2007 and **B.** 2008 – 2024.

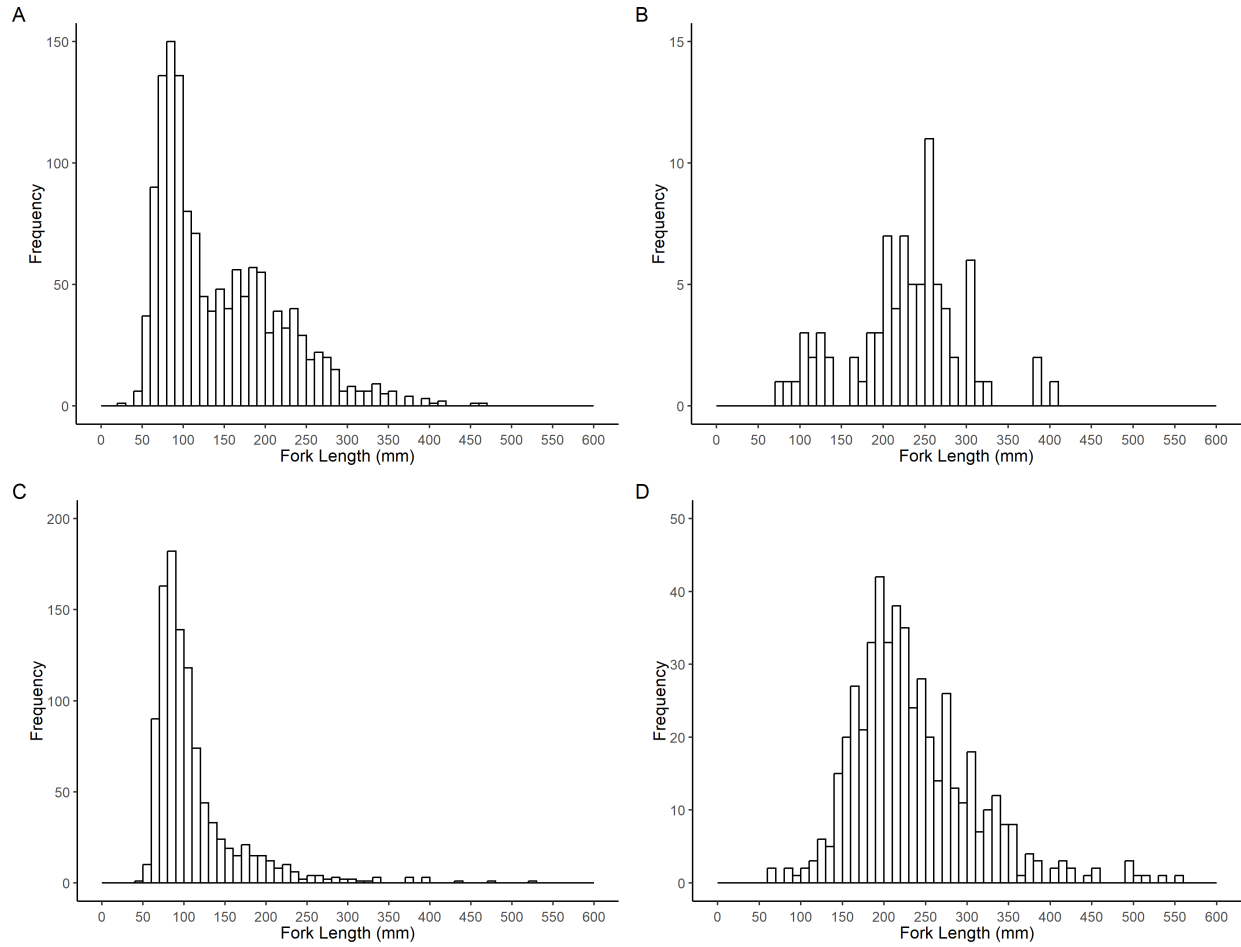


Figure 3. Length frequency histograms for gray triggerfish captured during Summer SEAMAP Groundfish Surveys **A.** West Gulf (1987-2007), **B.** East Gulf (1987-2007), **C.** West Gulf (2008-2024) and **D.** East Gulf (2008-2024).

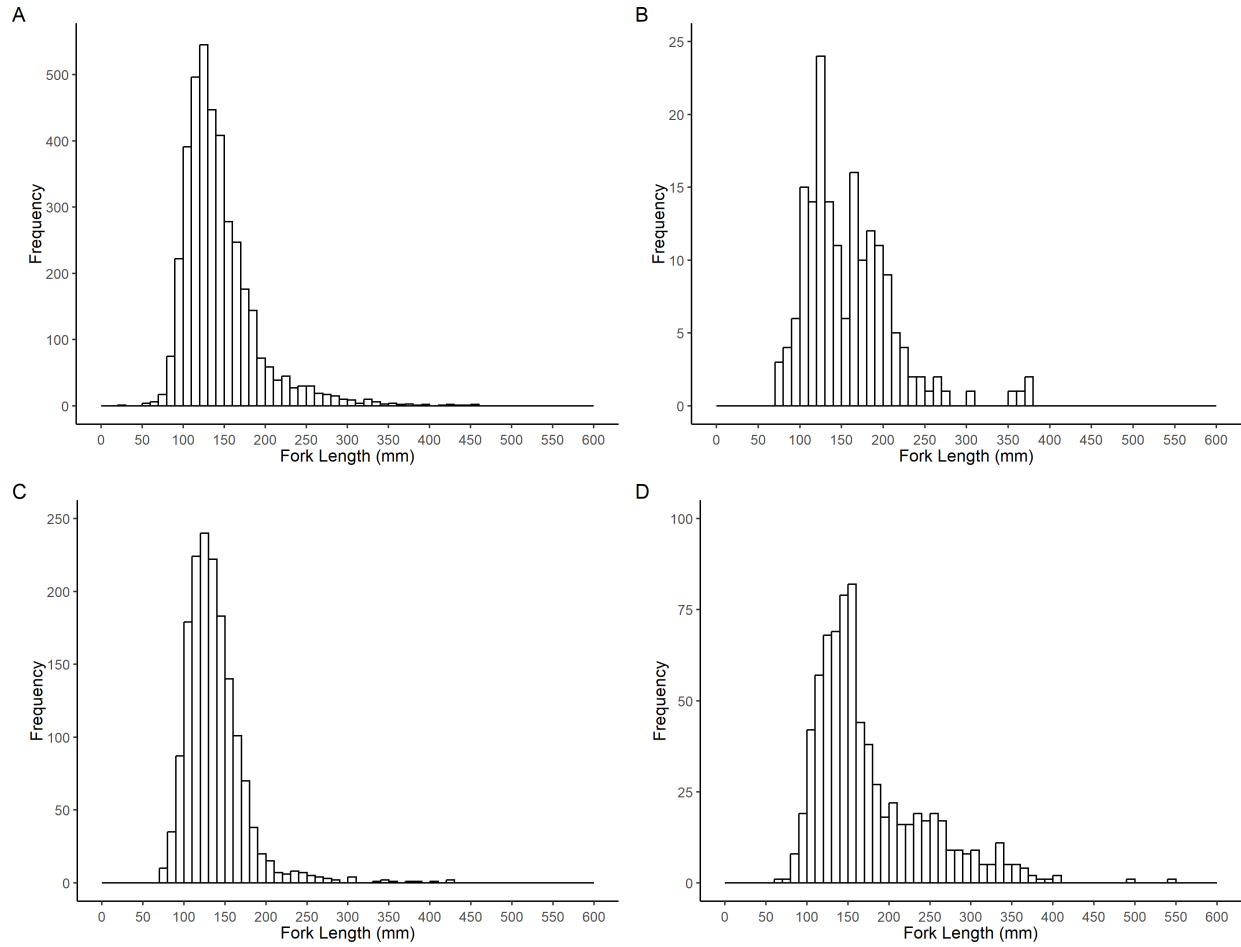


Figure 4. Length frequency histograms for gray triggerfish captured during Fall SEAMAP Groundfish Surveys **A.** West Gulf (1987-2007), **B.** East Gulf (1987-2007), **C.** West Gulf (2008-2024) and **D.** East Gulf (2008-2024).

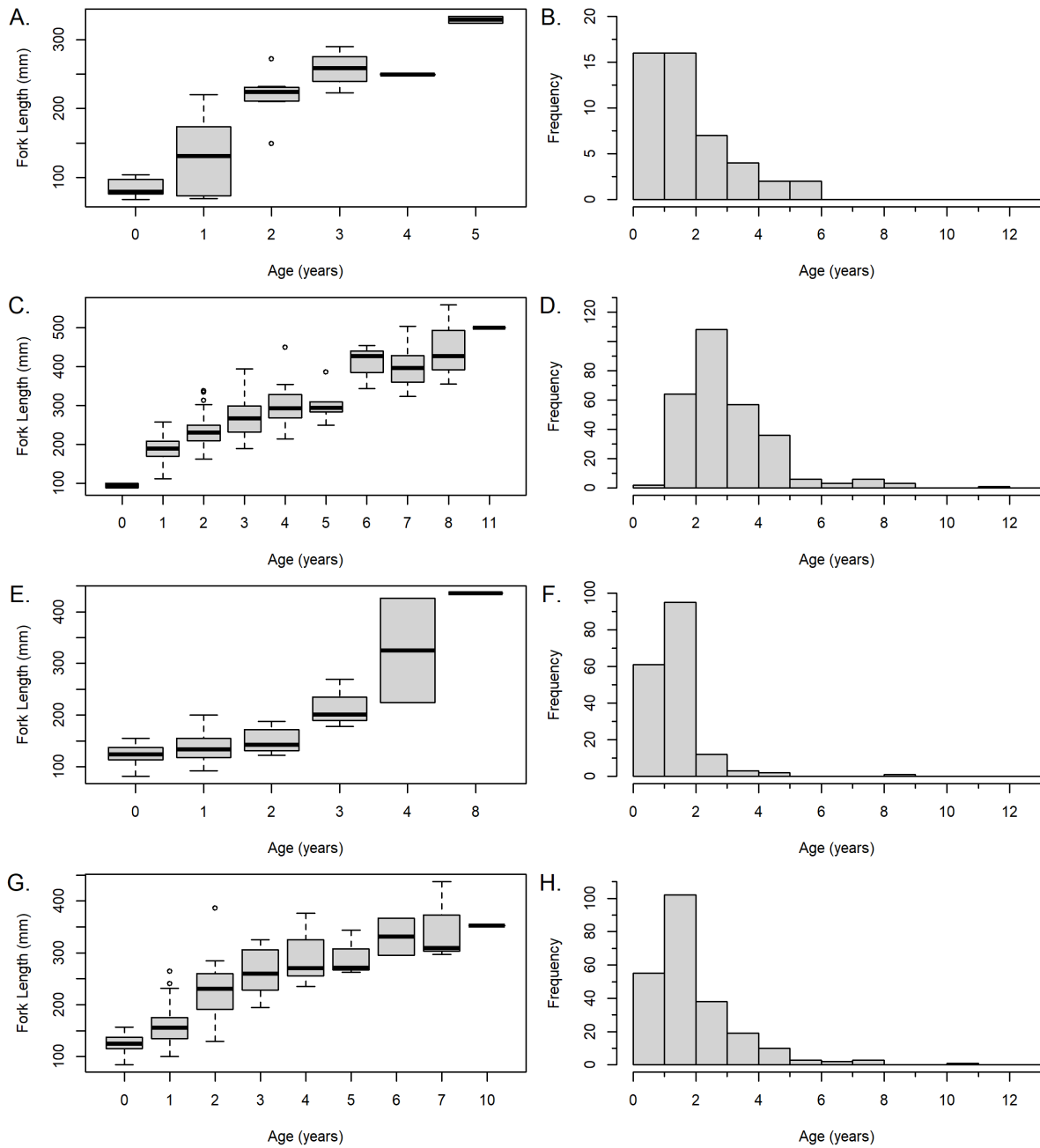


Figure 5. Length at age distribution and age distribution for gray triggerfish captured during the SEAMAP Groundfish Survey (2008-2024) in the: **A.** and **B.** Summer - West Gulf, **C.** and **D.** Summer - East Gulf, **E.** and **F.** Fall - West Gulf, and **G.** and **H.** Fall – East Gulf.

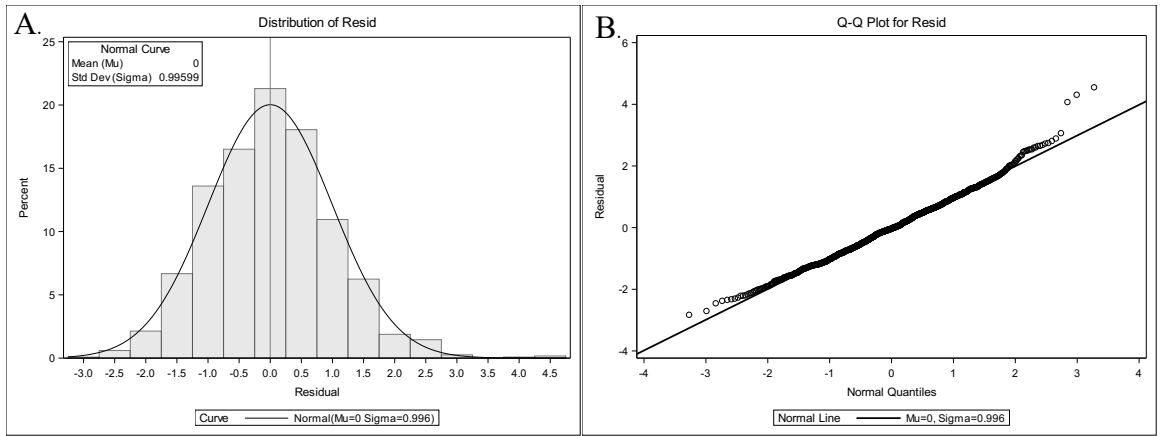


Figure 6. Diagnostic plots for lognormal component of the gray triggerfish SEAMAP Fall Groundfish Survey (Gulfwide - 1987-2007) model: **A.** the frequency distribution of log (CPUE) on positive stations and **B.** the cumulative normalized residuals (QQ plot).

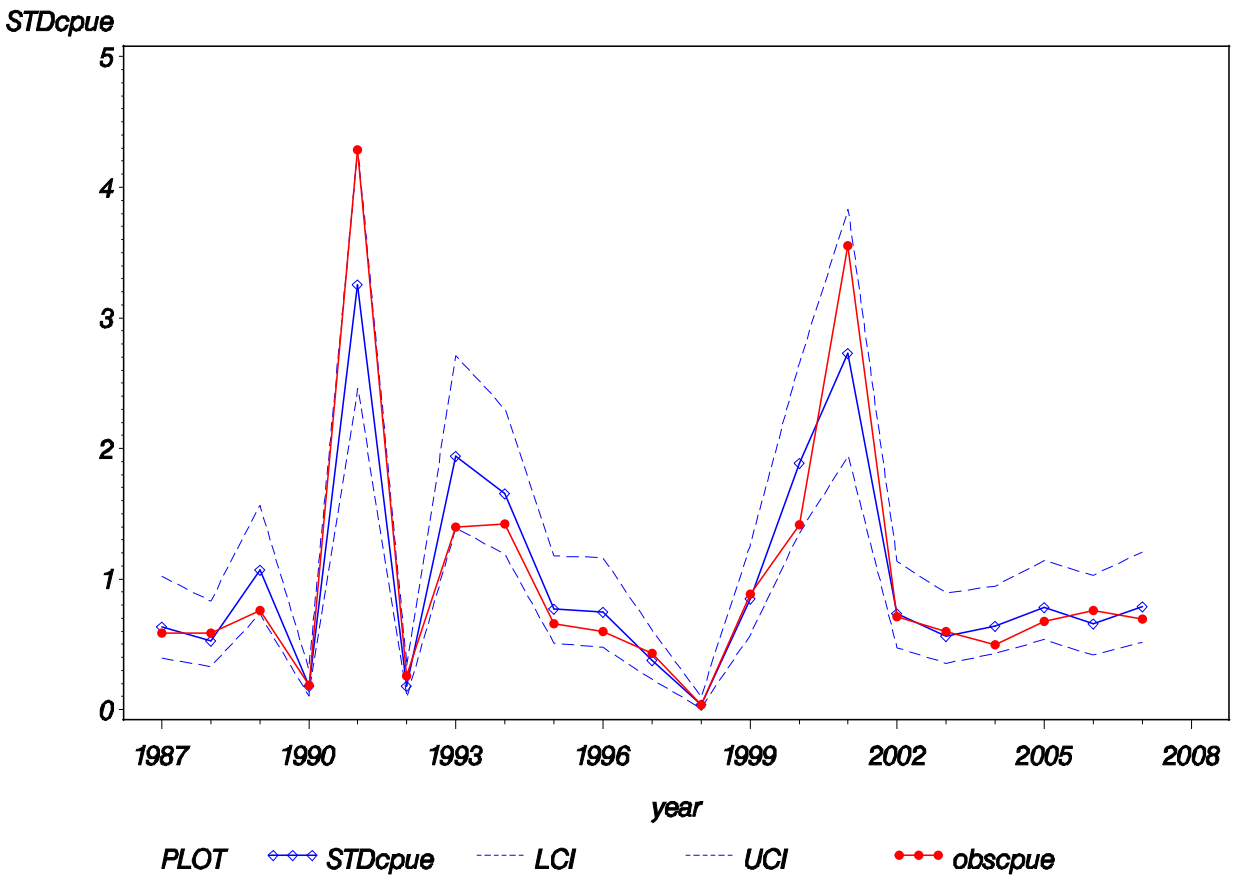


Figure 7. Annual index of abundance for gray triggerfish from the SEAMAP Fall Groundfish Survey from 1987 – 2007 (Gulfwide).

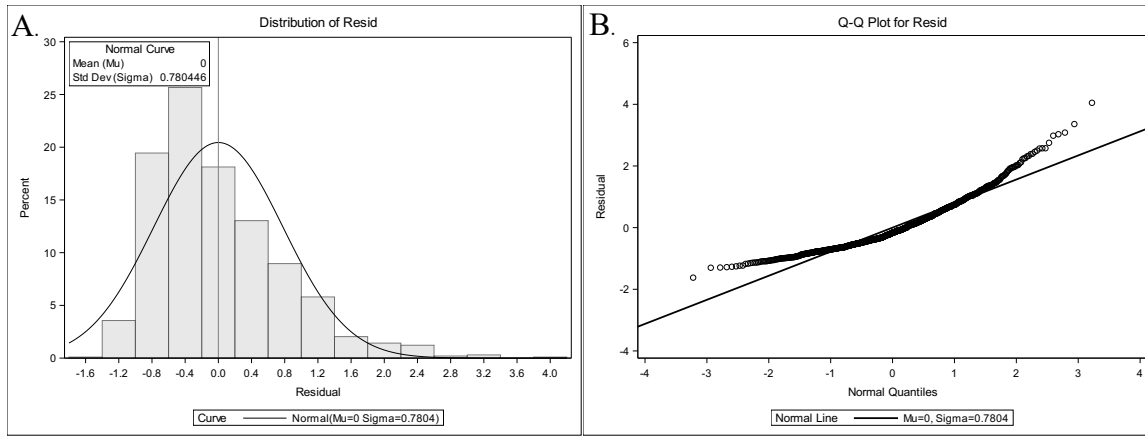


Figure 8. Diagnostic plots for lognormal component of the gray triggerfish SEAMAP Fall Groundfish Survey (Gulfwide - 2008 - 2024) model: **A.** the frequency distribution of log (CPUE) on positive stations and **B.** the cumulative normalized residuals (QQ plot).

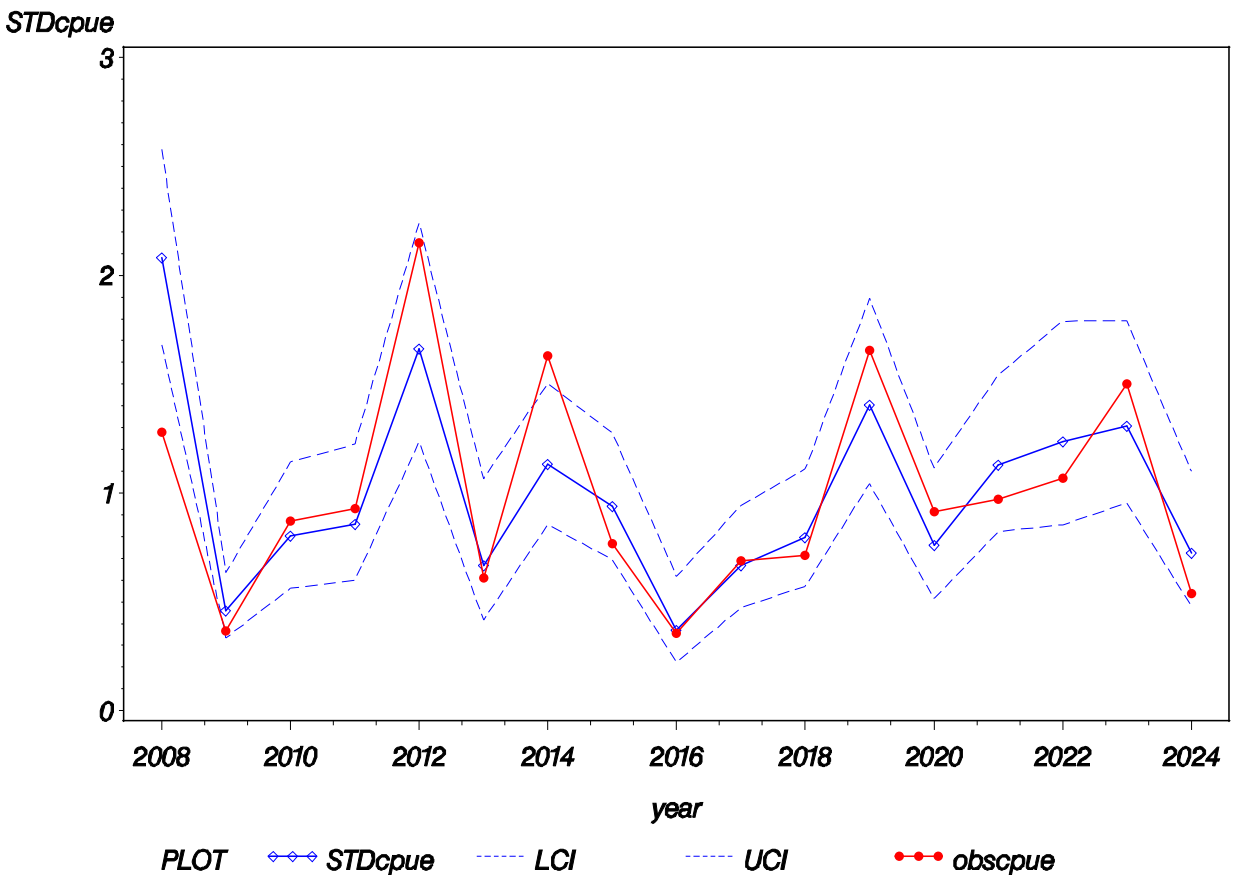


Figure 9. Annual index of abundance for gray triggerfish from the SEAMAP Fall Groundfish Survey from 2008 – 2024 (Gulfwide).

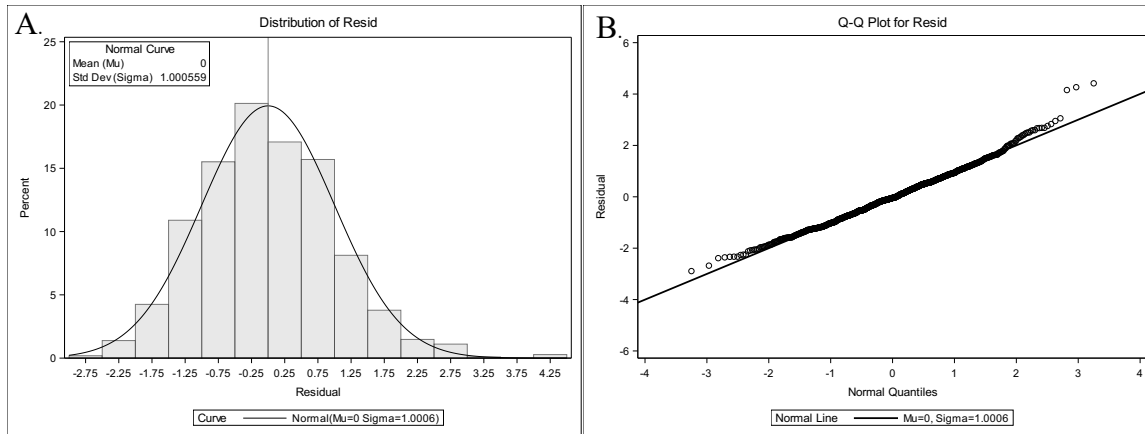


Figure 10. Diagnostic plots for lognormal component of the gray triggerfish SEAMAP Fall Groundfish Survey (West Gulf - 1987-2007) model: **A.** the frequency distribution of log (CPUE) on positive stations and **B.** the cumulative normalized residuals (QQ plot).

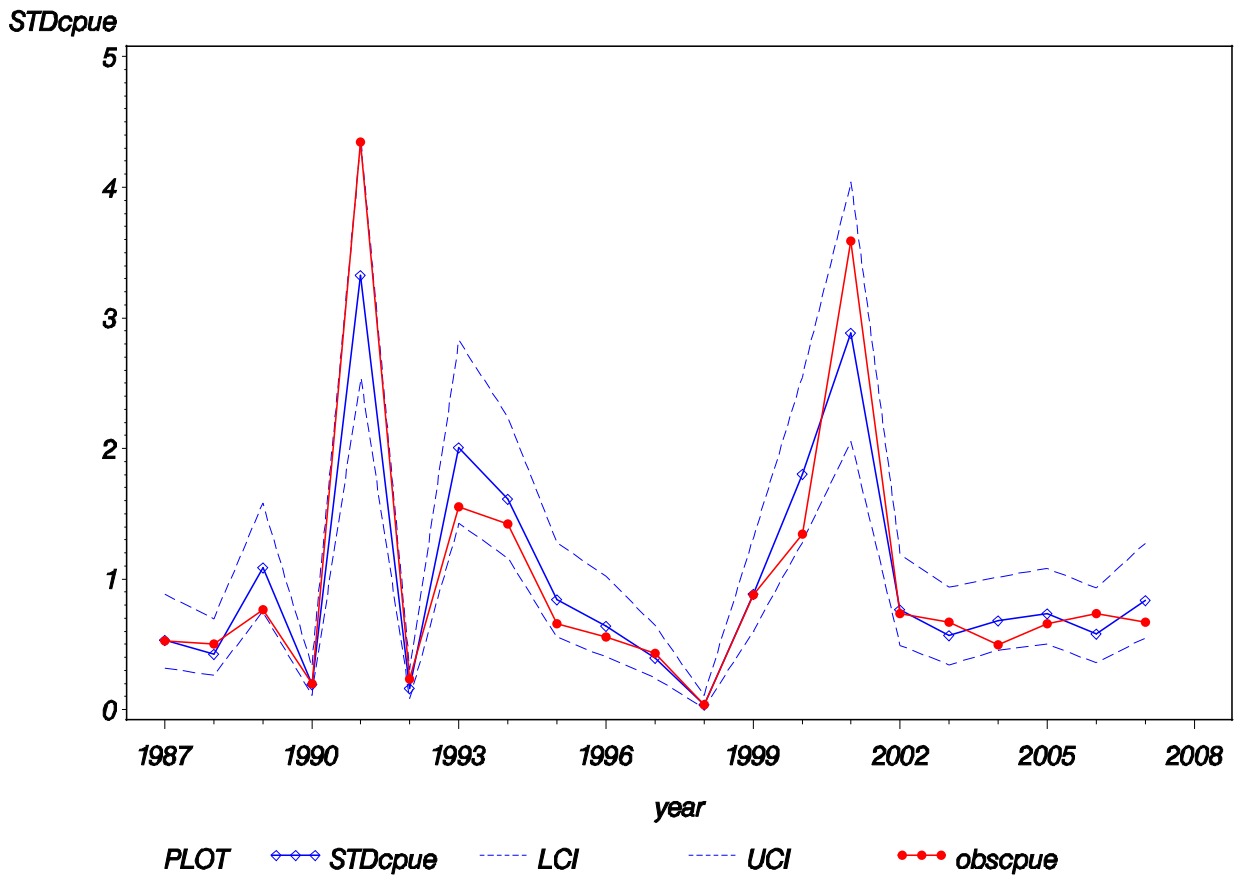


Figure 11. Annual index of abundance for gray triggerfish from the SEAMAP Fall Groundfish Survey from 1987 – 2007 (West Gulf).

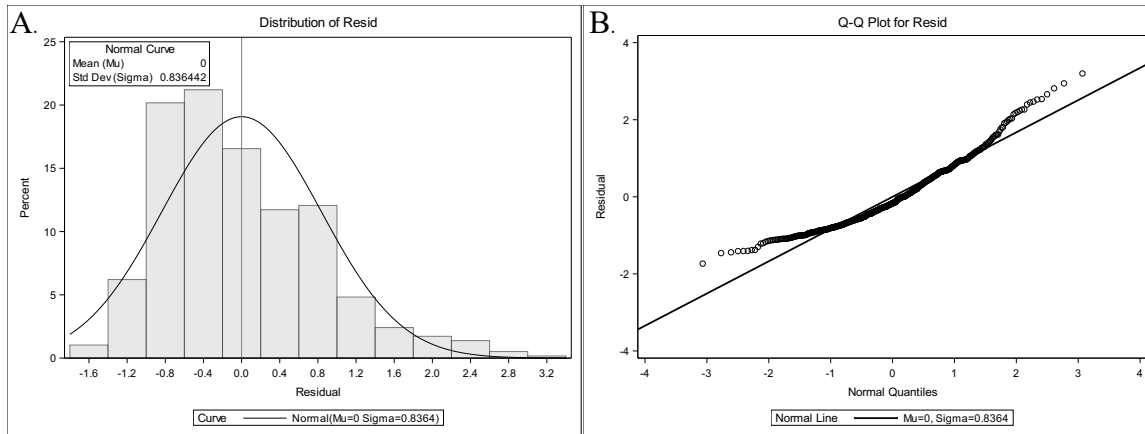


Figure 12. Diagnostic plots for lognormal component of the gray triggerfish SEAMAP Fall Groundfish Survey (West Gulf - 2008 - 2024) model: **A.** the frequency distribution of log (CPUE) on positive stations and **B.** the cumulative normalized residuals (QQ plot).

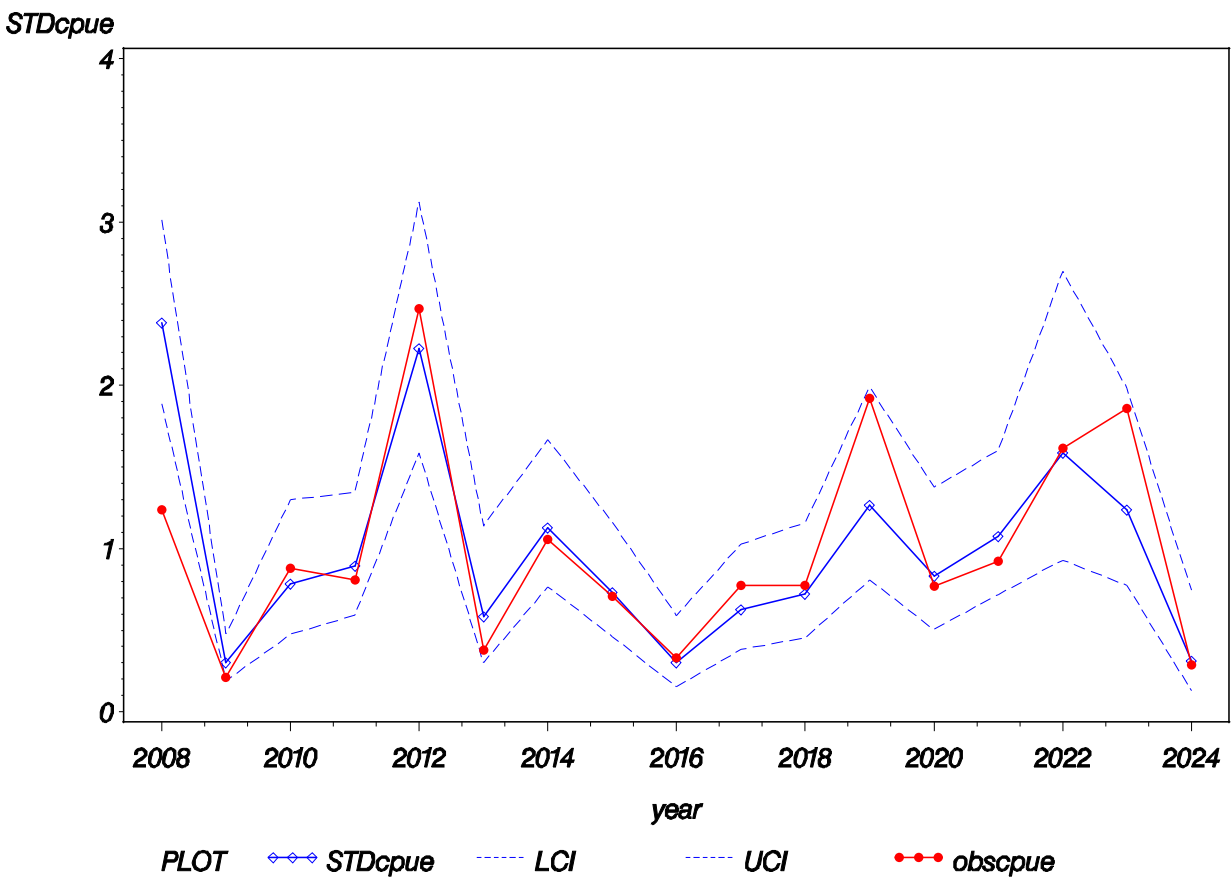


Figure 13. Annual index of abundance for gray triggerfish from the SEAMAP Fall Groundfish Survey from 2008 – 2024 (West Gulf).

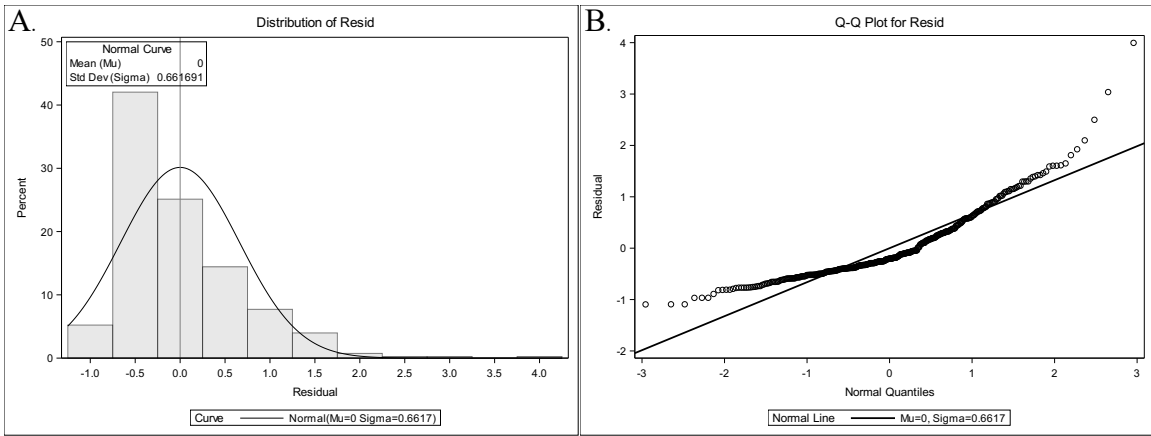


Figure 14. Diagnostic plots for lognormal component of the gray triggerfish SEAMAP Fall Groundfish Survey (East Gulf - 2008-2024) model: **A.** the frequency distribution of log (CPUE) on positive stations and **B.** the cumulative normalized residuals (QQ plot).

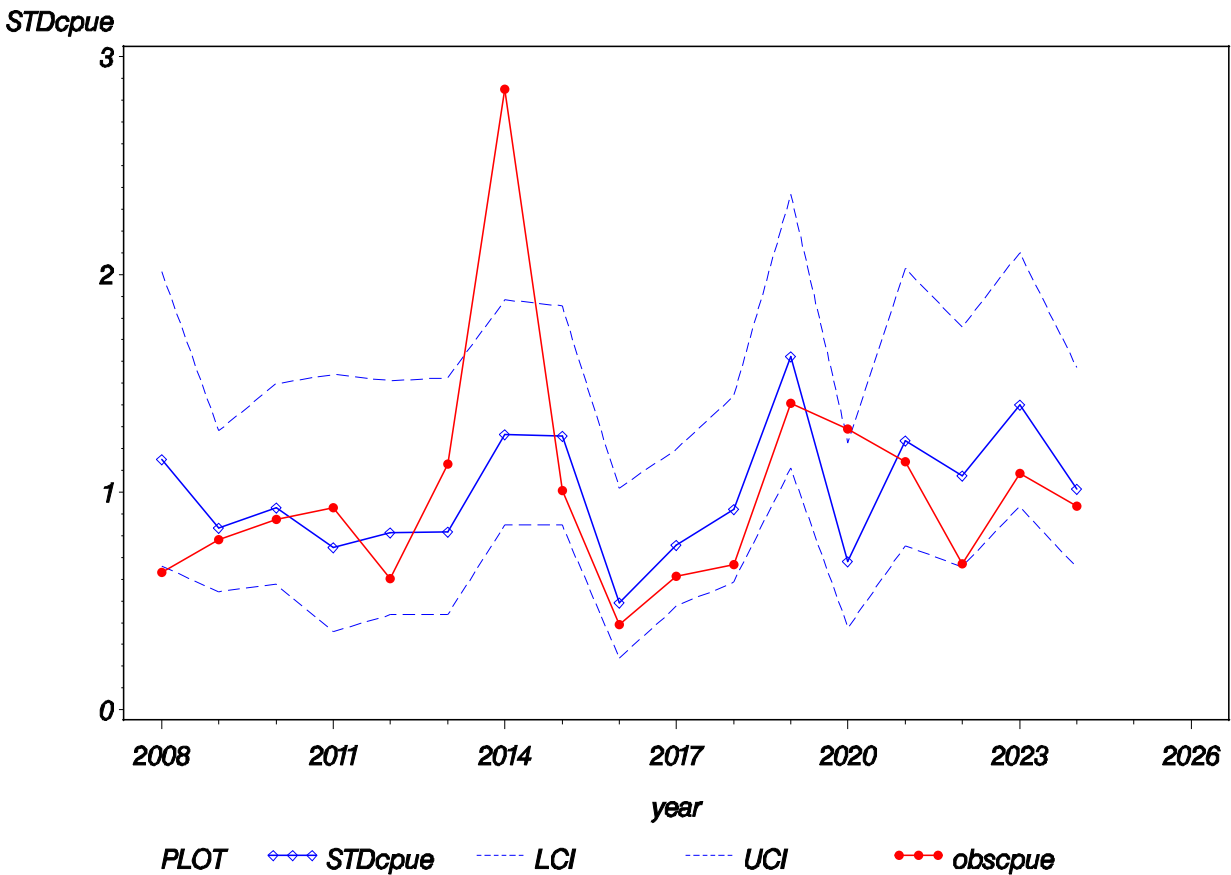


Figure 15. Annual index of abundance for gray triggerfish from the SEAMAP Fall Groundfish Survey from 2008 – 2024 (East Gulf).

# **Appendix**

Appendix Table 1. Summary of the factors used in constructing the gray triggerfish abundance index from the SEAMAP Fall Groundfish Survey (Gulfwide - 1987-2007) data.

Factor	Level	Number of Observations	Number of Positive Observations	Proportion Positive	Mean CPUE
Time of Day	Day	2328	613	0.26332	3.4822
Time of Day	Night	2350	556	0.23660	2.7764
Year	1987	164	42	0.25610	1.8132
Year	1988	217	45	0.20737	1.8046
Year	1989	225	66	0.29333	2.3490
Year	1990	228	31	0.13596	0.5825
Year	1991	225	105	0.46667	13.2396
Year	1992	213	24	0.11268	0.8057
Year	1993	250	81	0.32400	4.3229
Year	1994	229	83	0.36245	4.3857
Year	1995	217	54	0.24885	2.0247
Year	1996	227	48	0.21145	1.8479
Year	1997	223	40	0.17937	1.3289
Year	1998	225	7	0.03111	0.1193
Year	1999	225	61	0.27111	2.7429
Year	2000	223	80	0.35874	4.3762
Year	2001	229	80	0.34934	10.9843
Year	2002	233	50	0.21459	2.2034
Year	2003	260	44	0.16923	1.8413
Year	2004	205	61	0.29756	1.5290
Year	2005	231	67	0.29004	2.0950
Year	2006	223	47	0.21076	2.3534
Year	2007	206	53	0.25728	2.1377
Depth Zone	0506	212	3	0.01415	0.1321
Depth Zone	0607	241	10	0.04149	0.2278
Depth Zone	0708	209	11	0.05263	0.4568
Depth Zone	0809	178	18	0.10112	0.9457
Depth Zone	0910	209	35	0.16746	1.2709
Depth Zone	1011	243	47	0.19342	2.1796
Depth Zone	1112	214	57	0.26636	2.7015
Depth Zone	1213	175	63	0.36000	6.4417
Depth Zone	1314	246	63	0.25610	8.1598
Depth Zone	1415	201	69	0.34328	4.9025
Depth Zone	1516	184	66	0.35870	6.3751
Depth Zone	1617	208	74	0.35577	5.9272
Depth Zone	1718	232	76	0.32759	3.9703
Depth Zone	1819	203	75	0.36946	4.1138
Depth Zone	1920	183	77	0.42077	5.0531
Depth Zone	2022	214	94	0.43925	8.8982

Factor	Level	Number of Observations	Number of Positive Observations	Proportion Positive	Mean CPUE
Depth Zone	2225	198	95	0.47980	4.1761
Depth Zone	2530	201	100	0.49751	2.9163
Depth Zone	3035	204	74	0.36275	1.0254
Depth Zone	3540	193	39	0.20207	0.6249
Depth Zone	4045	191	16	0.08377	0.1598
Depth Zone	4560	339	7	0.02065	0.0783
Combined Statistical Zone	1011	972	86	0.08848	0.4804
Combined Statistical Zone	1315	945	229	0.24233	2.7555
Combined Statistical Zone	1617	931	374	0.40172	7.2423
Combined Statistical Zone	1819	833	282	0.33854	4.4198
Combined Statistical Zone	2021	997	198	0.19860	1.1393

Appendix Table 2. Summary of the factors used in constructing the gray triggerfish abundance index from the SEAMAP Fall Groundfish Survey (Gulfwide - 2008-2024) data.

Factor	Level	Number of Observations	Number of Positive Observations	Proportion Positive	Mean CPUE
Statistical Zone	2	93	16	0.17204	0.58065
Statistical Zone	3	253	37	0.14625	0.44255
Statistical Zone	4	272	58	0.21324	0.77098
Statistical Zone	5	276	60	0.21739	0.90756
Statistical Zone	6	264	51	0.19318	0.64992
Statistical Zone	7	152	24	0.15789	0.44655
Statistical Zone	8	194	57	0.29381	1.71790
Statistical Zone	9	126	37	0.29365	5.02497
Statistical Zone	10	123	35	0.28455	1.51131
Statistical Zone	11	278	27	0.09712	0.27267
Statistical Zone	13	94	9	0.09574	0.36046
Statistical Zone	14	221	44	0.19910	1.31234
Statistical Zone	15	241	43	0.17842	0.73277
Statistical Zone	16	341	81	0.23754	1.58890
Statistical Zone	17	440	123	0.27955	2.73763
Statistical Zone	18	391	134	0.34271	3.63798
Statistical Zone	19	266	46	0.17293	0.79183
Statistical Zone	20	295	30	0.10169	0.39843
Statistical Zone	21	207	70	0.33816	1.63887
Time of Day	Day	2191	487	0.22227	1.52527
Time of Day	Night	2336	495	0.21190	1.32218
Year	2008	348	131	0.37644	1.84092
Year	2009	446	65	0.14574	0.52544
Year	2010	310	51	0.16452	1.25290
Year	2011	219	50	0.22831	1.33530
Year	2012	200	66	0.33000	3.09078
Year	2013	186	28	0.15054	0.87923
Year	2014	312	77	0.24679	2.34431
Year	2015	314	67	0.21338	1.10476
Year	2016	192	24	0.12500	0.50905
Year	2017	284	53	0.18662	0.98946
Year	2018	273	57	0.20879	1.02420
Year	2019	276	68	0.24638	2.37936
Year	2020	230	42	0.18261	1.31301
Year	2021	251	62	0.24701	1.39502
Year	2022	200	44	0.22000	1.53693
Year	2023	262	61	0.23282	2.16092
Year	2024	224	36	0.16071	0.77634

Appendix Table 3. Summary of the factors used in constructing the gray triggerfish abundance index from the SEAMAP Fall Groundfish Survey (West Gulf - 1987-2007) data.

Factor	Level	Number of Observations	Number of Positive Observations	Proportion Positive	Mean CPUE
Time of Day	Day	1851	572	0.30902	4.2643
Time of Day	Night	1855	511	0.27547	3.3805
Year	1987	128	36	0.28125	2.0004
Year	1988	181	39	0.21547	1.8910
Year	1989	180	64	0.35556	2.8923
Year	1990	176	30	0.17045	0.7476
Year	1991	179	99	0.55307	16.4227
Year	1992	179	22	0.12291	0.8967
Year	1993	177	73	0.41243	5.8653
Year	1994	179	77	0.43017	5.3668
Year	1995	177	53	0.29944	2.4766
Year	1996	182	43	0.23626	2.0969
Year	1997	179	39	0.21788	1.6343
Year	1998	181	6	0.03315	0.1458
Year	1999	183	59	0.32240	3.3173
Year	2000	180	73	0.40556	5.0779
Year	2001	184	75	0.40761	13.5719
Year	2002	181	47	0.25967	2.7785
Year	2003	183	37	0.20219	2.5212
Year	2004	162	56	0.34568	1.8849
Year	2005	186	62	0.33333	2.4781
Year	2006	176	41	0.23295	2.7749
Year	2007	173	52	0.30058	2.5340
Depth Zone	0506	170	3	0.01765	0.1647
Depth Zone	0607	170	9	0.05294	0.2876
Depth Zone	0708	163	10	0.06135	0.5366
Depth Zone	0809	161	16	0.09938	0.9012
Depth Zone	0910	166	33	0.19880	1.5320
Depth Zone	1011	170	40	0.23529	2.9157
Depth Zone	1112	166	46	0.27711	3.0505
Depth Zone	1213	163	61	0.37423	6.8491
Depth Zone	1314	164	58	0.35366	11.9851
Depth Zone	1415	162	68	0.41975	6.0715
Depth Zone	1516	166	66	0.39759	7.0663
Depth Zone	1617	168	70	0.41667	7.2090
Depth Zone	1718	161	69	0.42857	5.4209
Depth Zone	1819	162	74	0.45679	5.1434
Depth Zone	1920	162	73	0.45062	5.5636
Depth Zone	2022	157	85	0.54140	11.8169

Factor	Level	Number of Observations	Number of Positive Observations	Proportion Positive	Mean CPUE
Depth Zone	2225	160	87	0.54375	4.7793
Depth Zone	2530	166	92	0.55422	3.4268
Depth Zone	3035	162	66	0.40741	1.1637
Depth Zone	3540	157	34	0.21656	0.6808
Depth Zone	4045	153	16	0.10458	0.1995
Depth Zone	4560	277	7	0.02527	0.0959
Combined Statistical Zone	1315	945	229	0.24233	2.7555
Combined Statistical Zone	1617	931	374	0.40172	7.2423
Combined Statistical Zone	1819	833	282	0.33854	4.4198
Combined Statistical Zone	2021	997	198	0.19860	1.1393

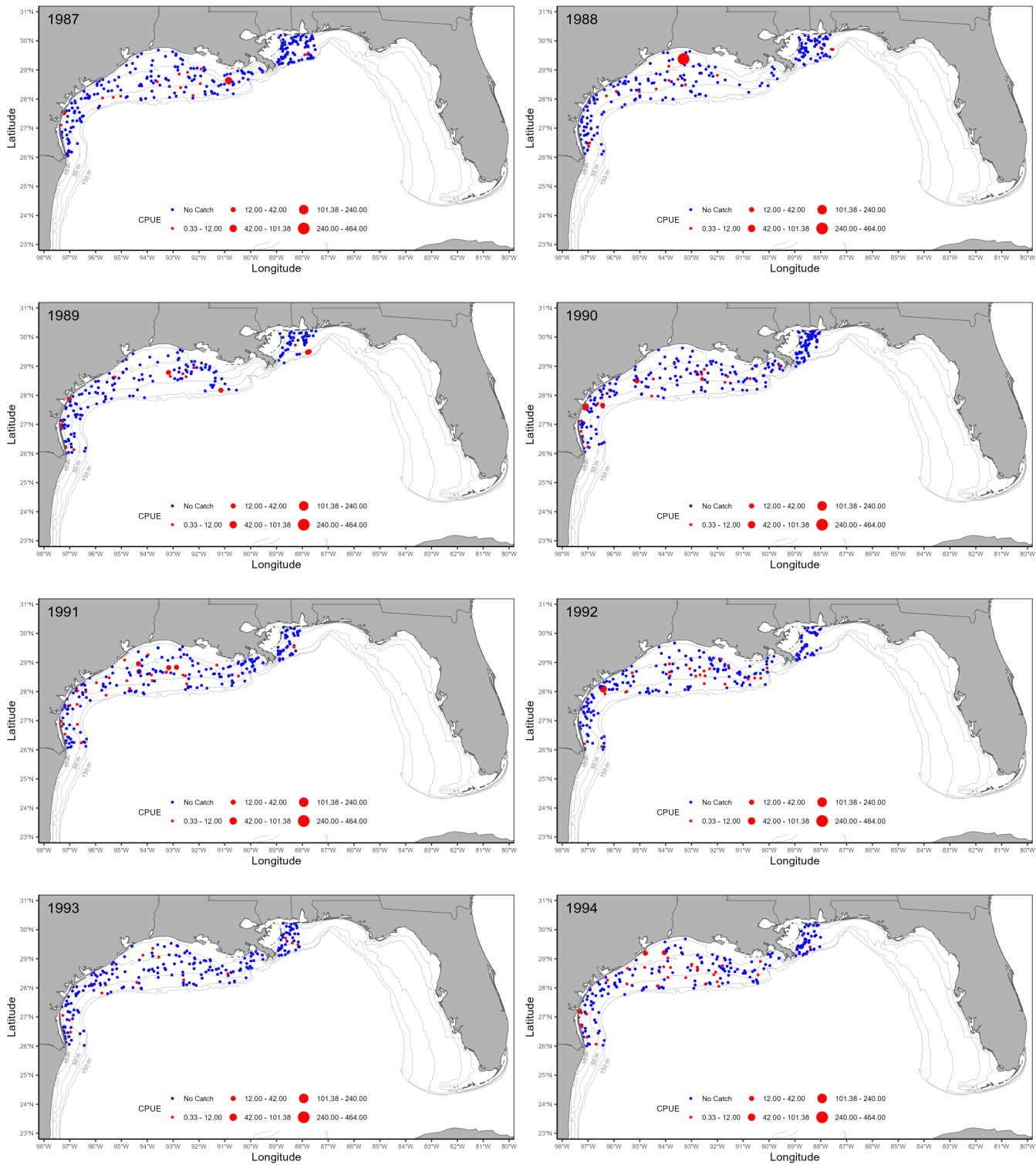
Appendix Table 4. Summary of the factors used in constructing the gray triggerfish abundance index from the SEAMAP Fall Groundfish Survey (West Gulf - 2008-2024) data.

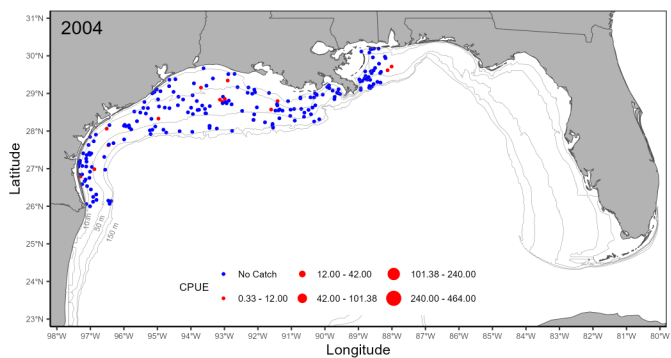
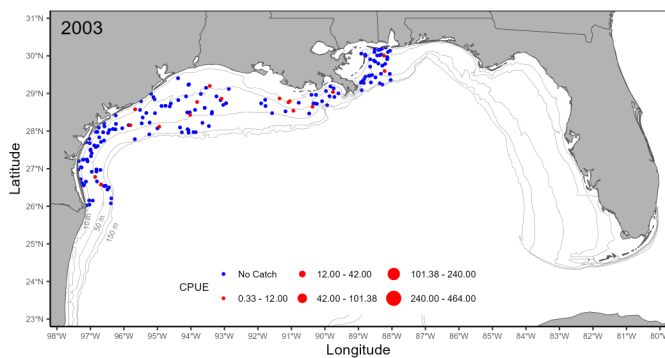
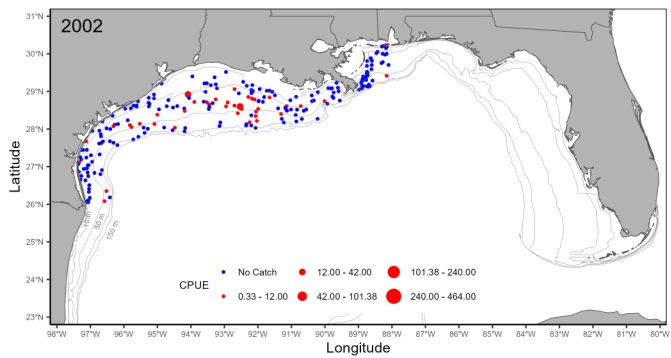
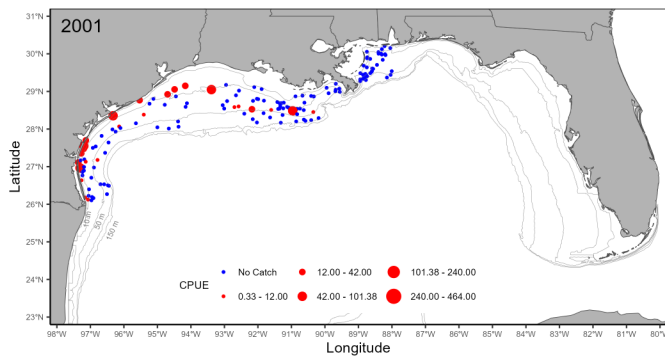
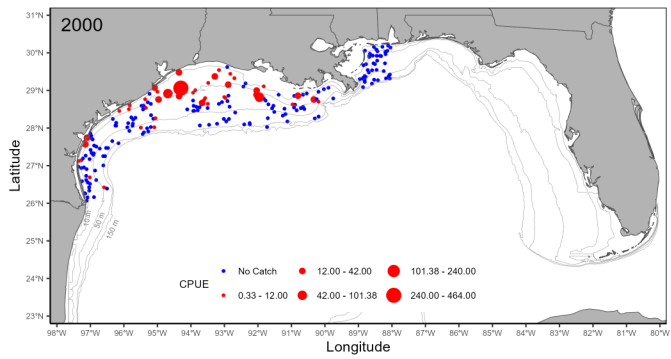
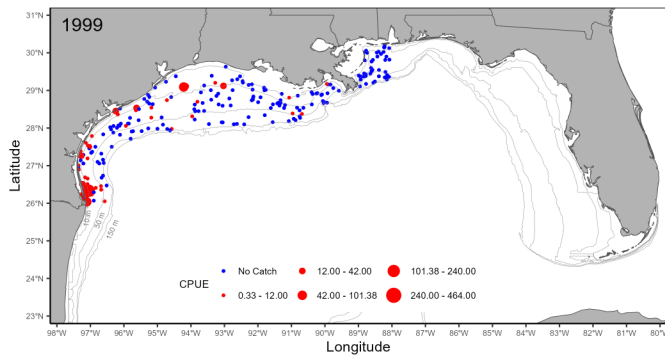
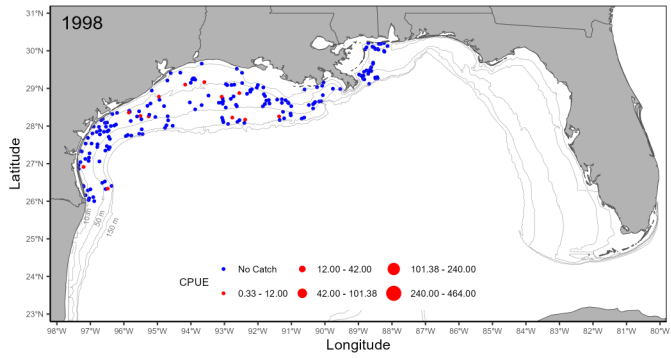
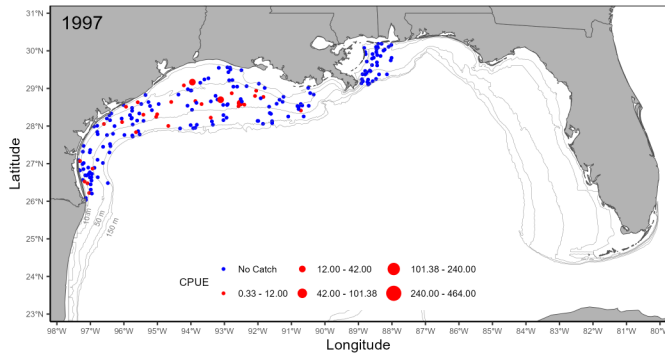
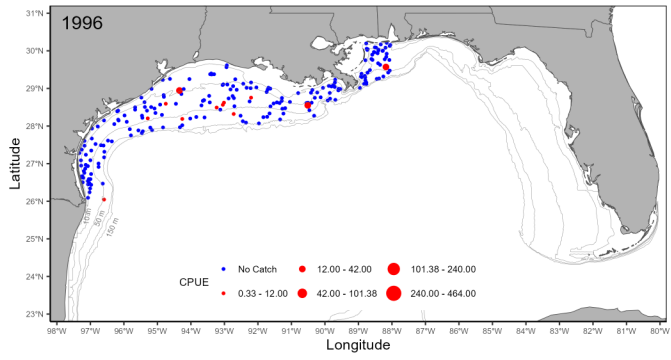
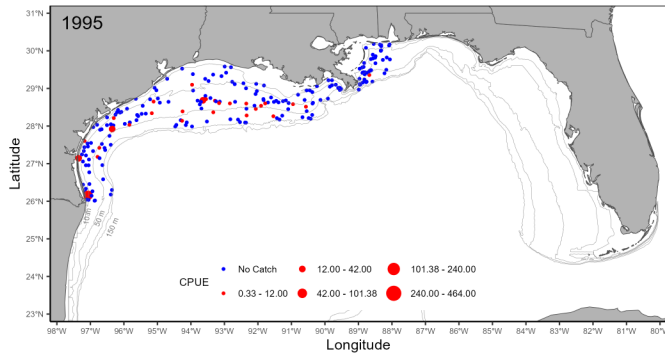
Factor	Level	Number of Observations	Number of Positive Observations	Proportion Positive	Mean CPUE
Statistical Zone	13	94	9	0.09574	0.36046
Statistical Zone	14	221	44	0.19910	1.31234
Statistical Zone	15	241	43	0.17842	0.73277
Statistical Zone	16	341	81	0.23754	1.58890
Statistical Zone	17	440	123	0.27955	2.73763
Statistical Zone	18	391	134	0.34271	3.63798
Statistical Zone	19	266	46	0.17293	0.79183
Statistical Zone	20	295	30	0.10169	0.39843
Statistical Zone	21	207	70	0.33816	1.63887
Time of Day	Day	1206	285	0.23632	1.82927
Time of Day	Night	1290	295	0.22868	1.65166
Year	2008	269	114	0.42379	2.20177
Year	2009	273	33	0.12088	0.37663
Year	2010	176	26	0.14773	1.56049
Year	2011	177	39	0.22034	1.43858
Year	2012	132	52	0.39394	4.38230
Year	2013	95	14	0.14737	0.67132
Year	2014	148	43	0.29054	1.87483
Year	2015	144	31	0.21528	1.25647
Year	2016	119	14	0.11765	0.58732
Year	2017	143	27	0.18881	1.37826
Year	2018	142	30	0.21127	1.37180
Year	2019	137	32	0.23358	3.40729
Year	2020	121	26	0.21488	1.36725
Year	2021	137	40	0.29197	1.63665
Year	2022	80	22	0.27500	2.86732
Year	2023	129	29	0.22481	3.30374
Year	2024	74	8	0.10811	0.51249

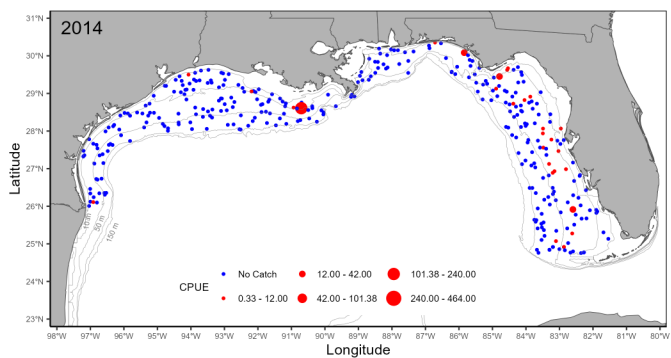
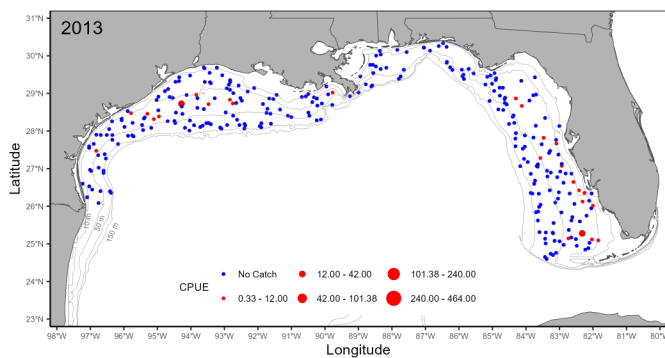
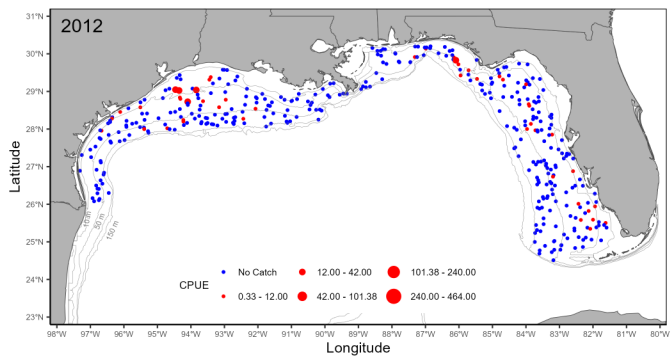
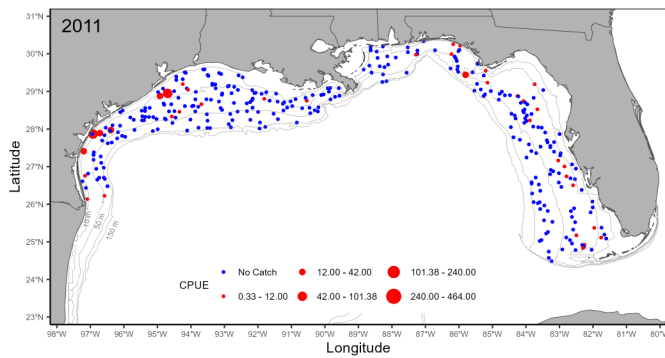
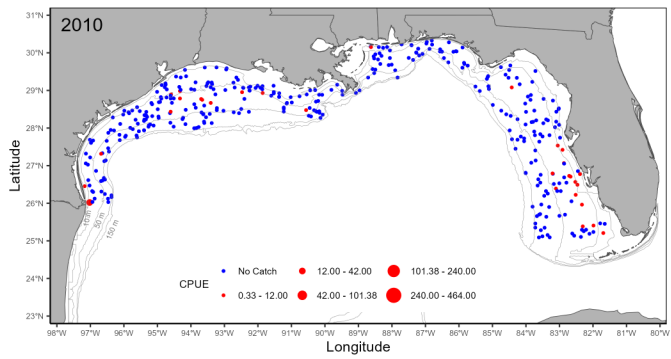
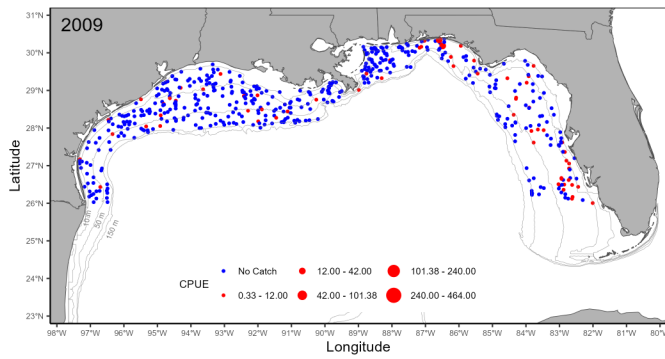
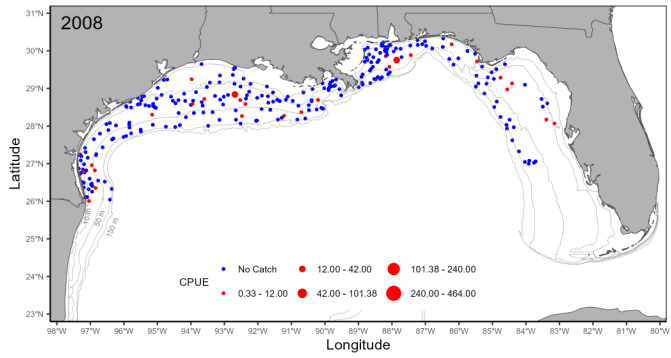
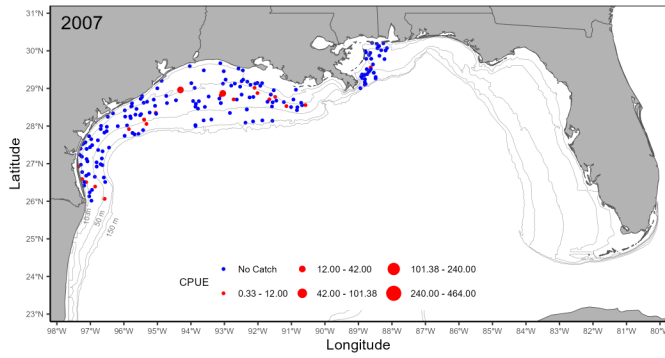
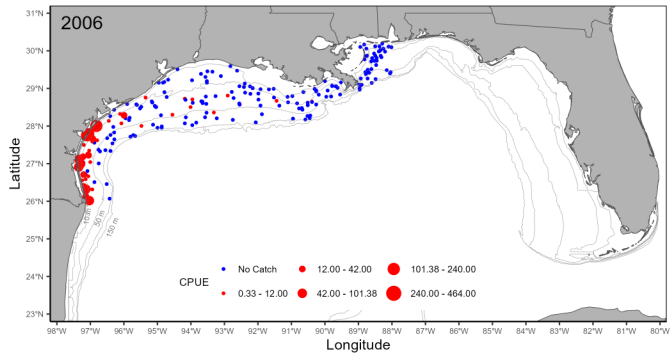
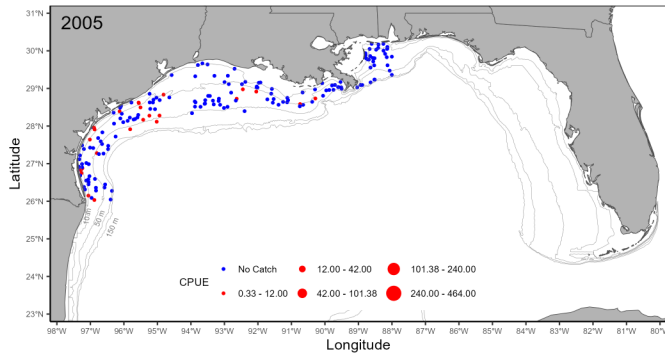
Appendix Table 5. Summary of the factors used in constructing the gray triggerfish abundance index from the SEAMAP Fall Groundfish Survey (East Gulf - 2008-2024) data.

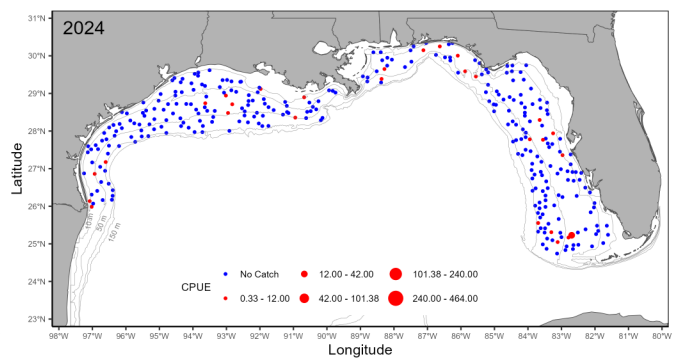
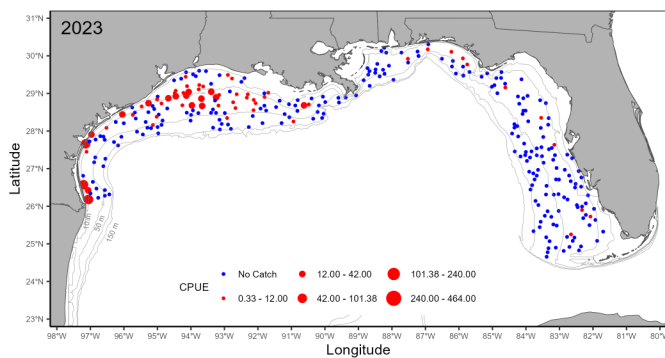
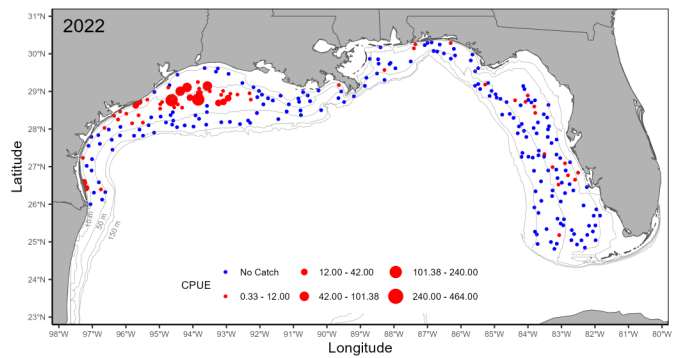
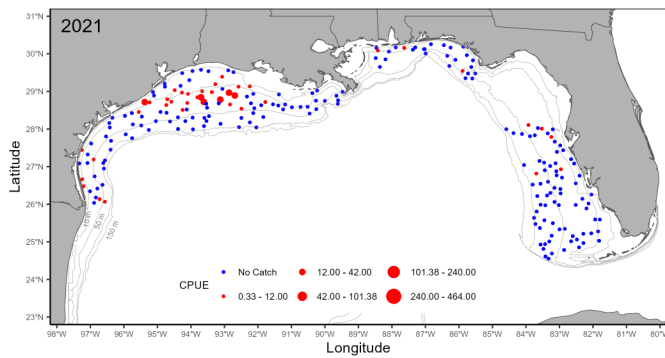
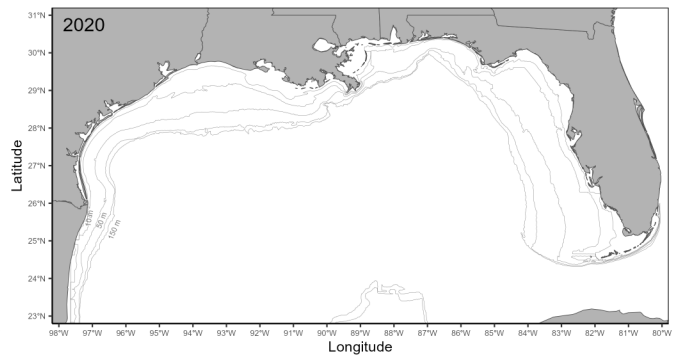
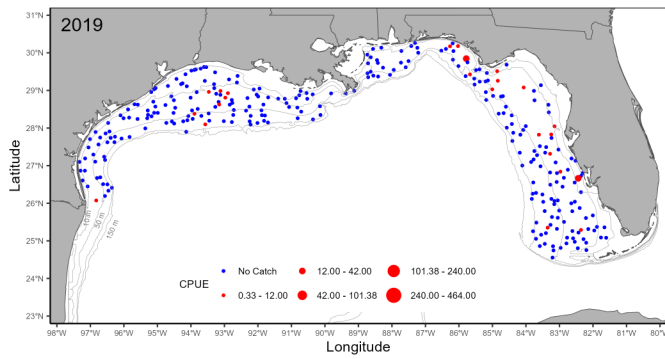
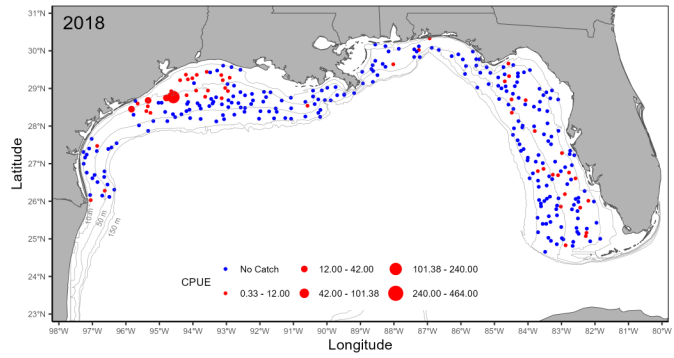
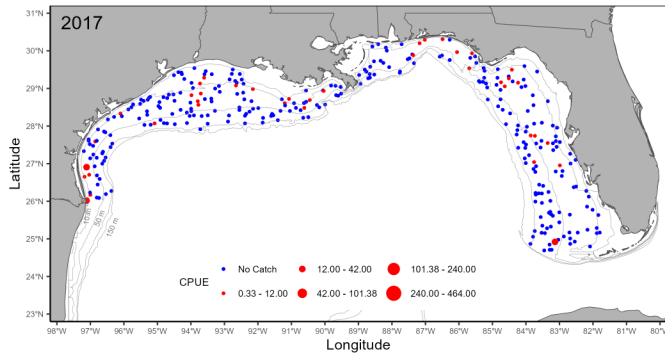
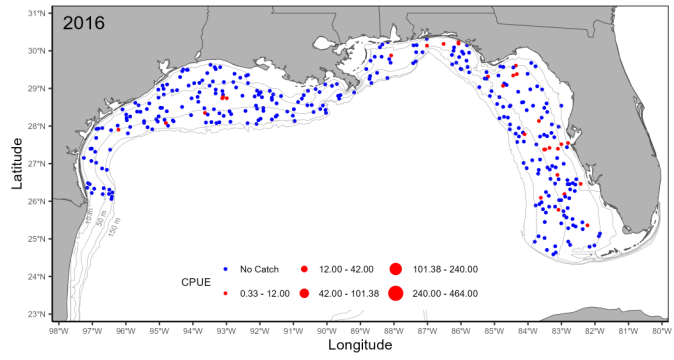
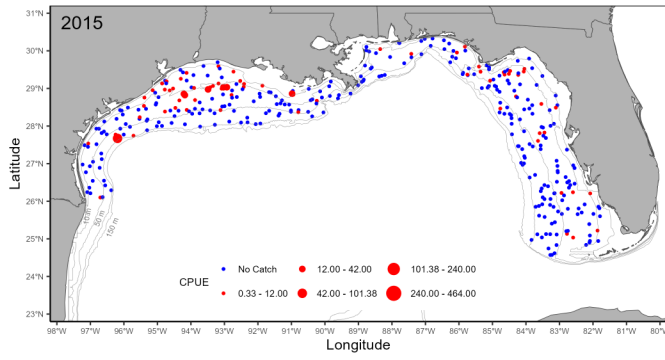
Factor	Level	Number of Observations	Number of Positive Observations	Proportion Positive	Mean CPUE
Statistical Zone	2	93	16	0.17204	0.58065
Statistical Zone	3	253	37	0.14625	0.44255
Statistical Zone	4	272	58	0.21324	0.77098
Statistical Zone	5	276	60	0.21739	0.90756
Statistical Zone	6	264	51	0.19318	0.64992
Statistical Zone	7	152	24	0.15789	0.44655
Statistical Zone	8	194	57	0.29381	1.71790
Statistical Zone	9	126	37	0.29365	5.02497
Statistical Zone	10	123	35	0.28455	1.51131
Statistical Zone	11	278	27	0.09712	0.27267
Time of Day	Day	985	202	0.20508	1.15306
Time of Day	Night	1046	200	0.19120	0.91584
Year	2008	79	17	0.21519	0.61222
Year	2009	173	32	0.18497	0.76026
Year	2010	134	25	0.18657	0.84891
Year	2011	42	11	0.26190	0.90005
Year	2012	68	14	0.20588	0.58371
Year	2013	91	14	0.15385	1.09629
Year	2014	164	34	0.20732	2.76798
Year	2015	170	36	0.21176	0.97624
Year	2016	73	10	0.13699	0.38145
Year	2017	141	26	0.18440	0.59515
Year	2018	131	27	0.20611	0.64742
Year	2019	139	36	0.25899	1.36622
Year	2020	109	16	0.14679	1.25279
Year	2021	114	22	0.19298	1.10465
Year	2022	120	22	0.18333	0.65000
Year	2023	133	32	0.24060	1.05247
Year	2024	150	28	0.18667	0.90650

Appendix Figure 1. Annual survey effort and catch of gray triggerfish from the SEAMAP Summer Groundfish Survey.

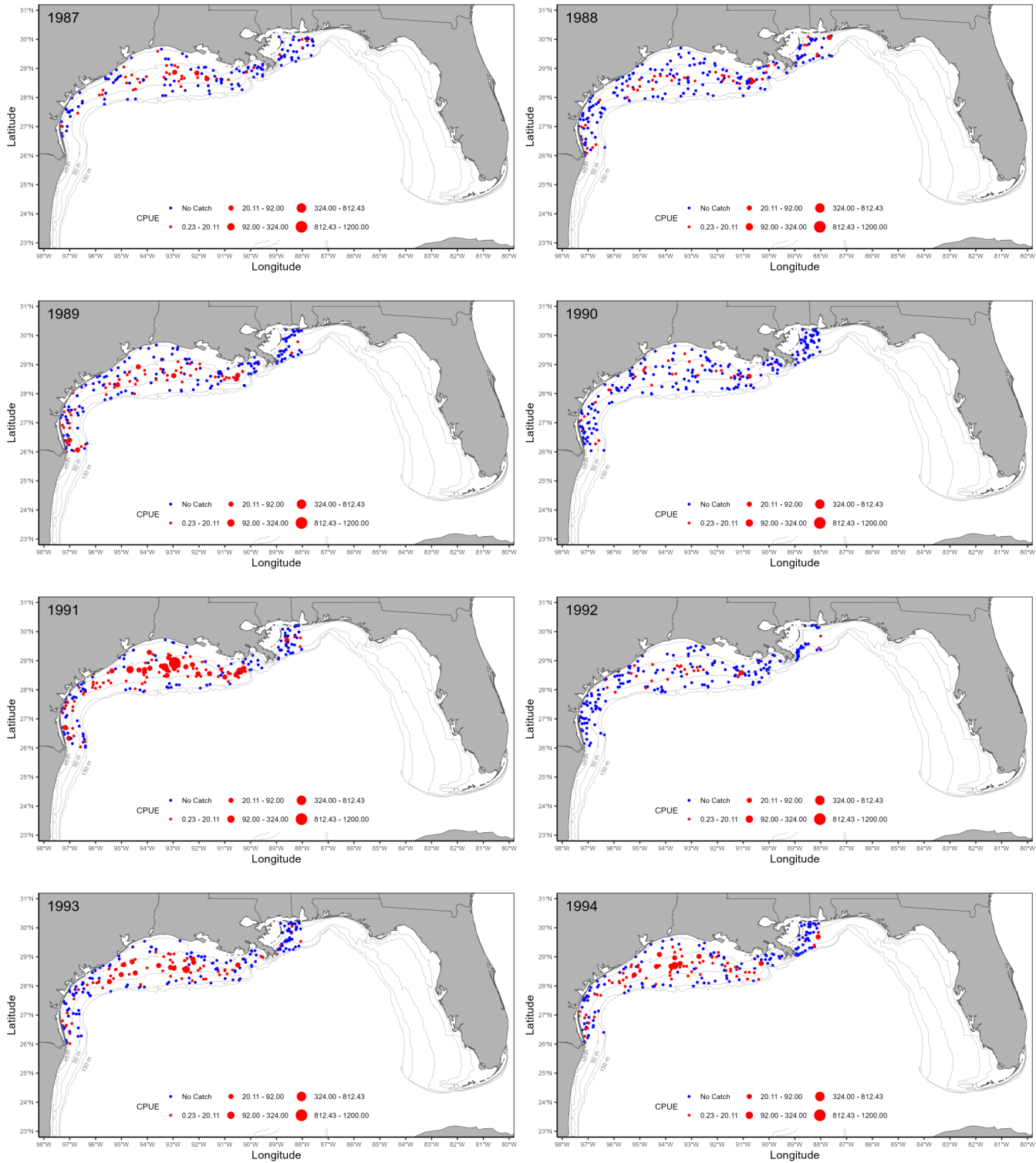


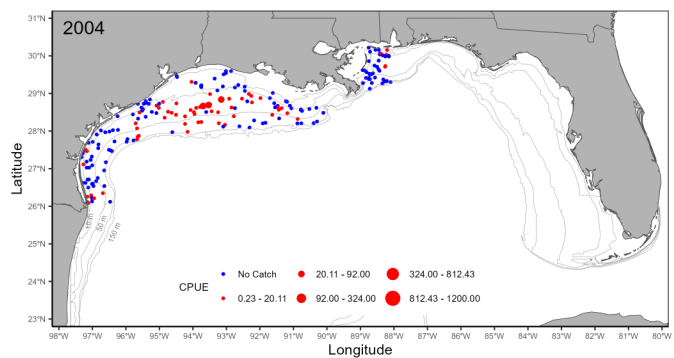
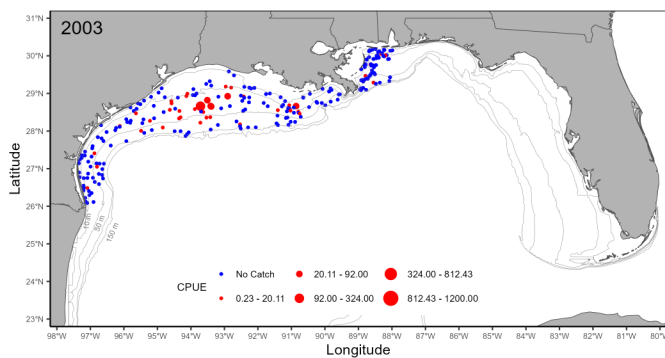
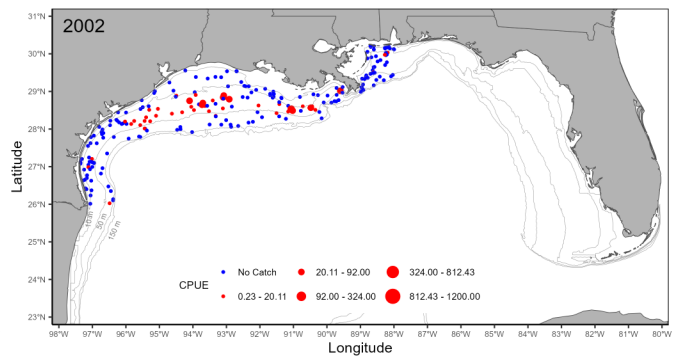
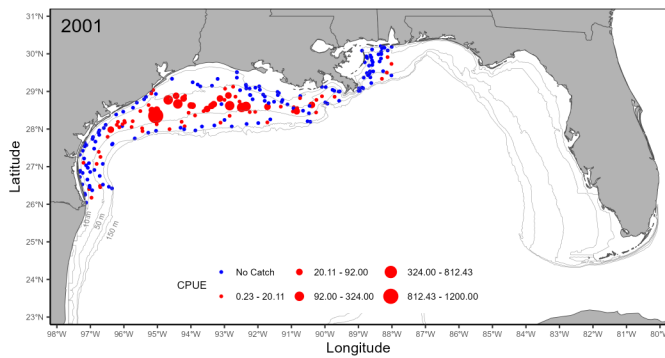
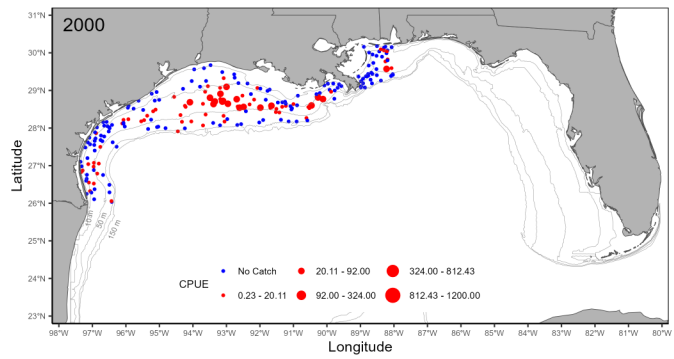
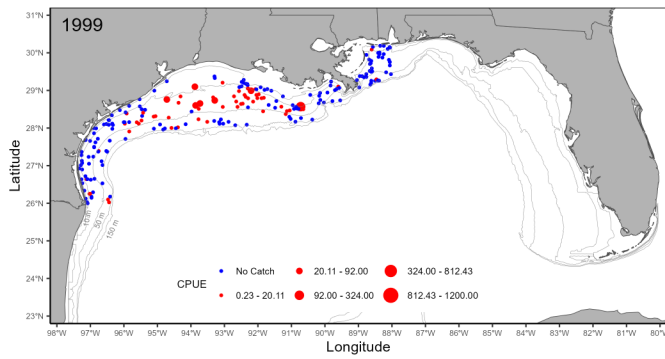
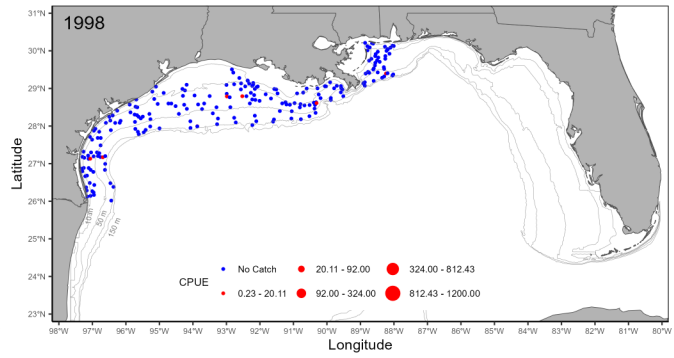
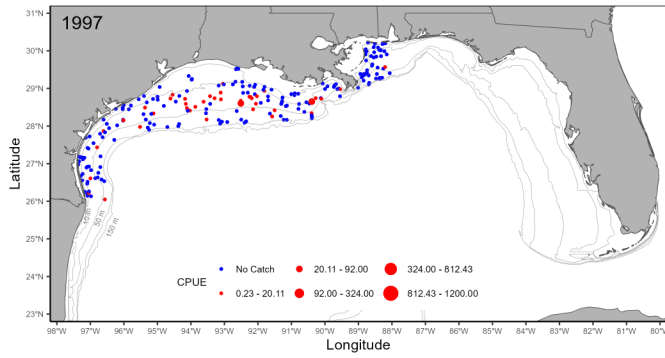
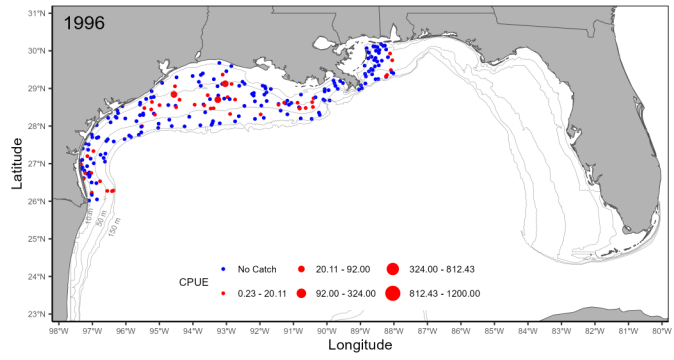
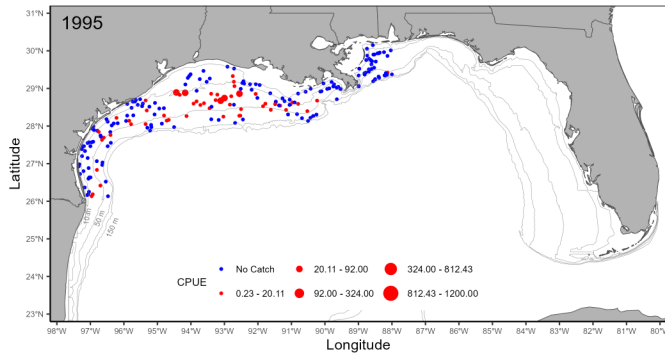


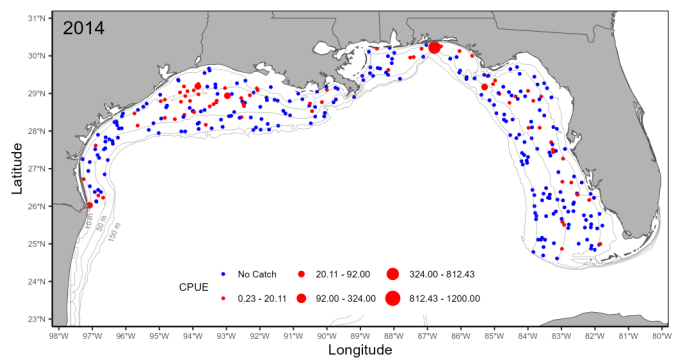
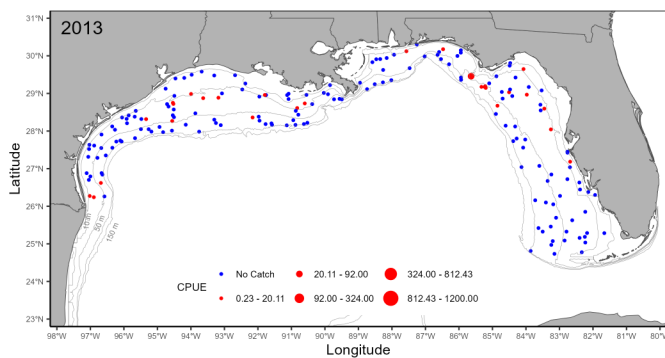
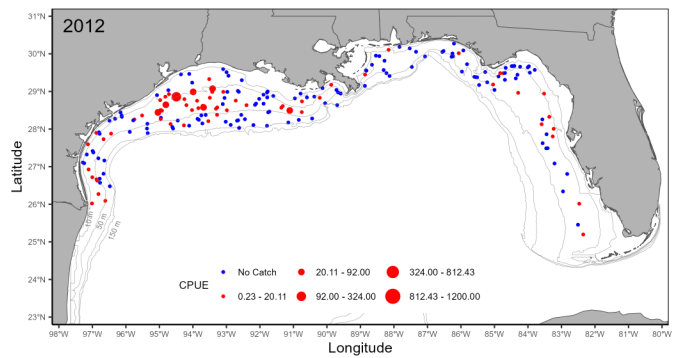
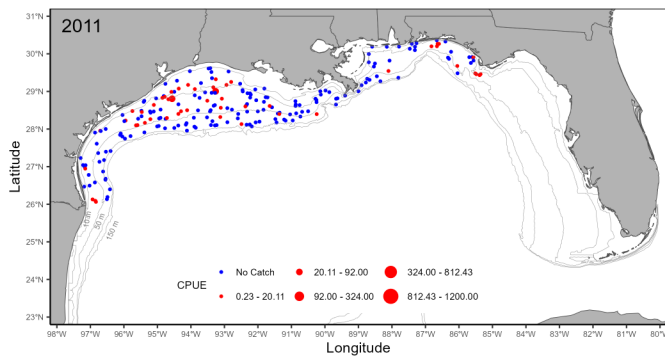
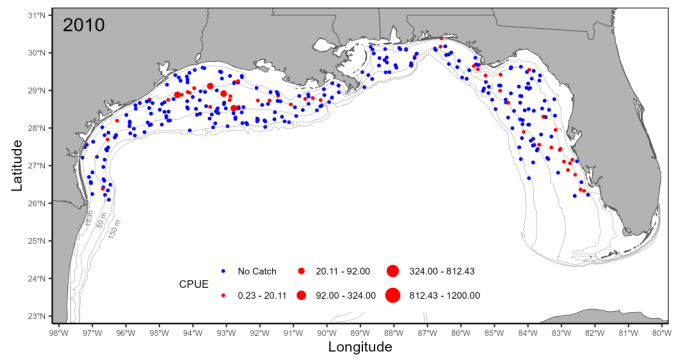
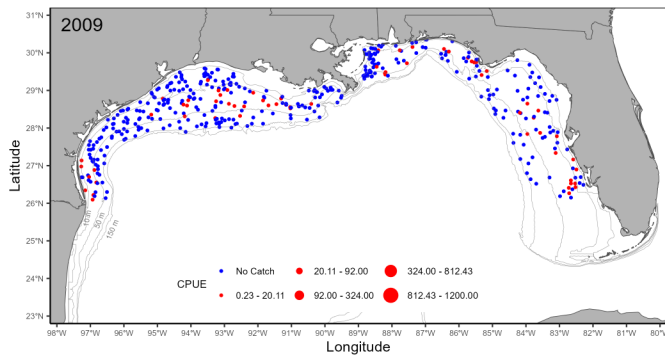
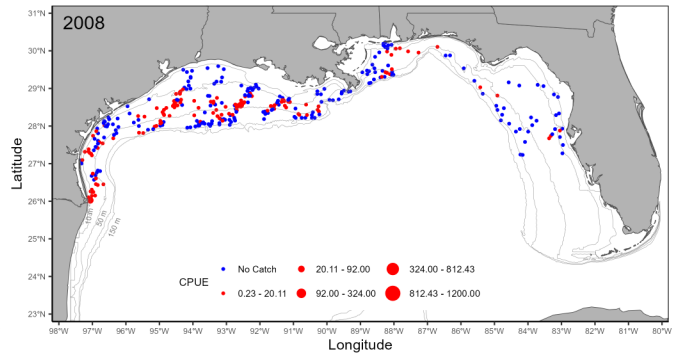
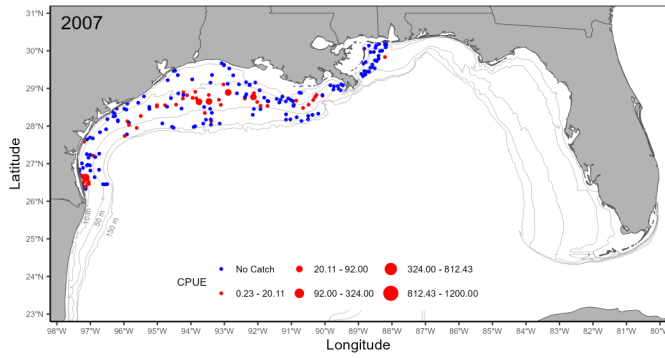
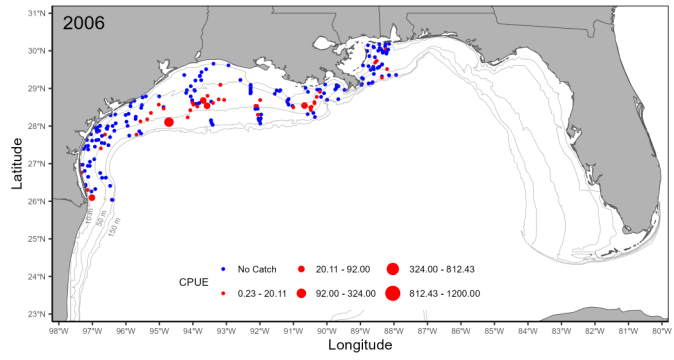
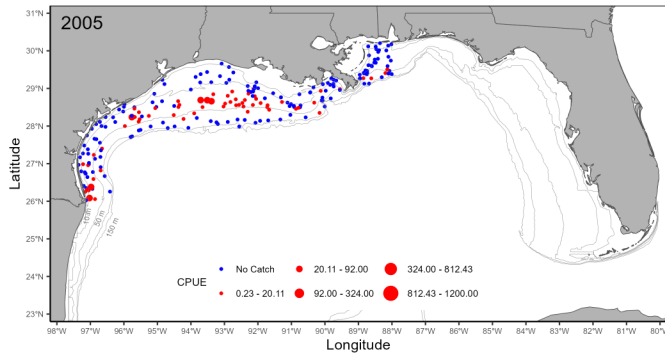


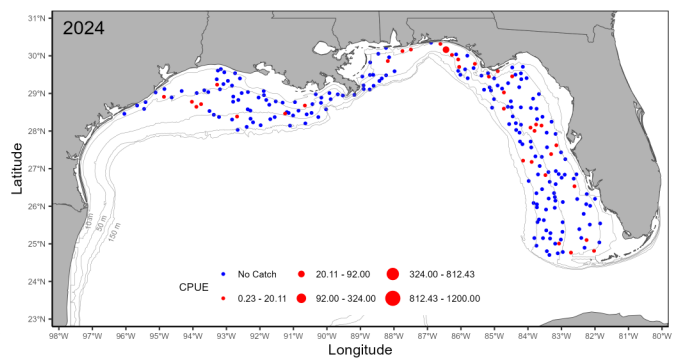
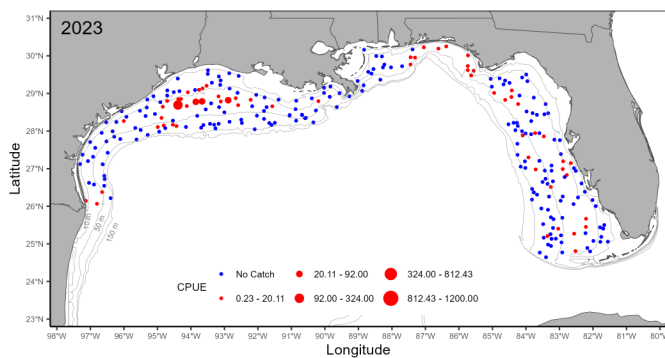
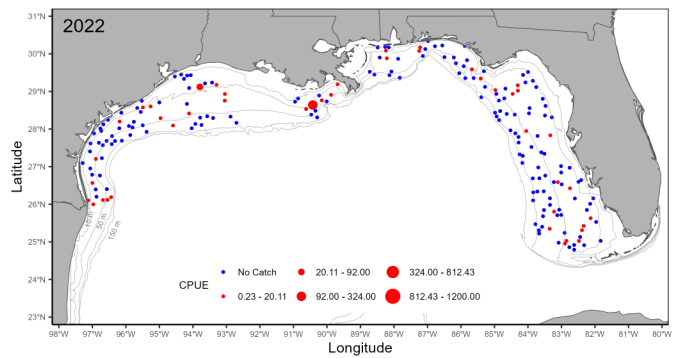
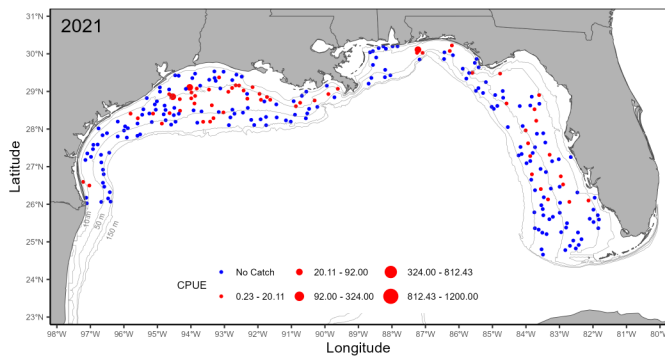
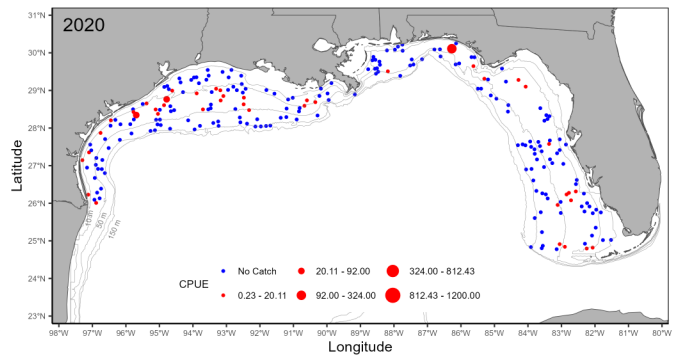
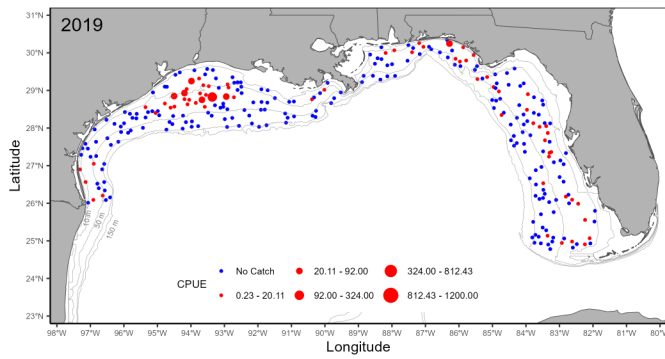
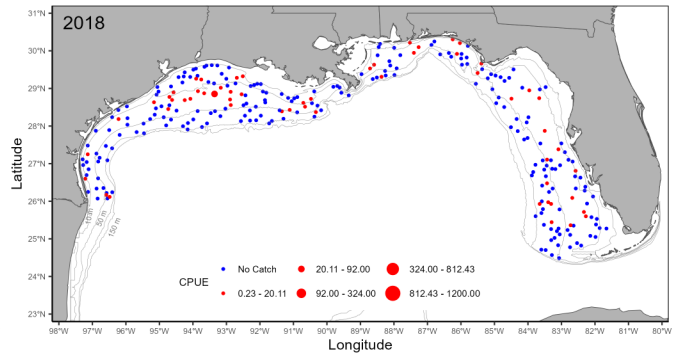
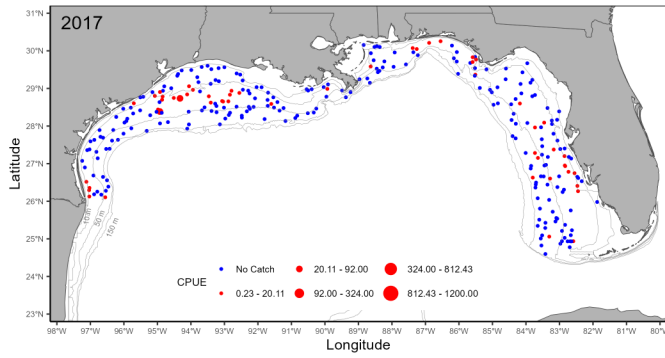
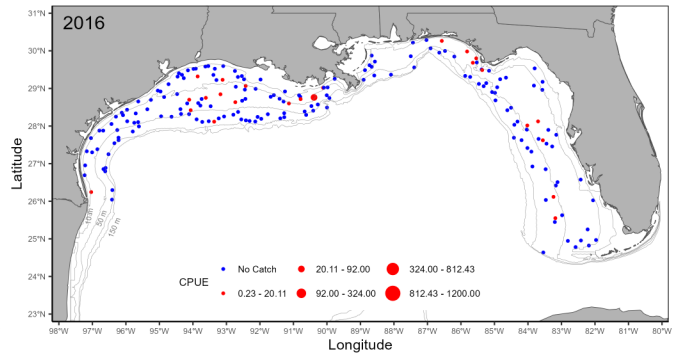
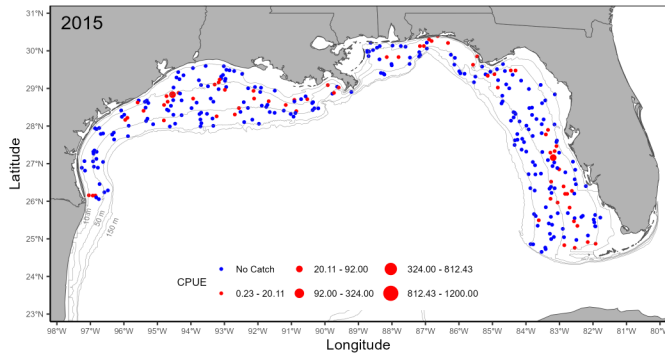


Appendix Figure 2. Annual survey effort and catch of gray triggerfish from the SEAMAP Fall Groundfish Survey.









# **Addendum**

During the discussion of the SEAMAP Summer and Fall Groundfish Surveys, the Index and Bycatch Working Group asked the authors to examine the feasibility of combining the data from summer and fall surveys into a single index for each time frame and region. Historically, the summer and fall surveys were analyzed separately because of difference in the proportion of size/age of captured gray triggerfish. However, based on the length frequency distributions of both surveys (Figures 3 and 4) and the distribution of ages (Figure 5), there did not appear to be any significant differences in the length or age data that would indicate that different portions of the population were being indexed between the two surveys. Therefore, the new indices were developed using the same methodology outlined in the main text, with the only deviation being the addition of a new variable 'season' with the levels 'Summer' and 'Fall' in the binomial and lognormal submodels. An addition variable also was added to the eastern gulf index that categorized the weight of sponge captured in the tow (0, < 50kg, > 50 kg).

The following is a summary of the results of the models runs with the significant variables for the binomial and lognormal submodels along with the table and figure references for the abundance index:

Gulfwide – SEAMAP Summer and Fall Groundfish (old design)

Binomial submodel variables: Year, SSZ, Season, Depth  
Lognormal submodel variables: Year, SSZ, Season, Time of Day, Depth  
Abundance indices: Addendum Table 1 and Addendum Figure 1

Gulfwide – SEAMAP Summer and Fall Groundfish (new design)

Binomial submodel variables: Year, SSZ, Season, Depth  
Lognormal submodel variables: Year, SSZ, Time of Day, Depth  
Abundance indices: Addendum Table 2 and Addendum Figure 2

West Gulf – SEAMAP Summer and Fall Groundfish (old design)

Binomial submodel variables: Year, SSZ, Season, Depth  
Lognormal submodel variables: Year, SSZ, Season, Time of Day, Depth  
Abundance indices: Addendum Table 3 and Addendum Figure 3

West Gulf – SEAMAP Summer and Fall Groundfish (new design)

Binomial submodel variables: Year, SSZ, Season, Depth  
Lognormal submodel variables: Year, SSZ, Time of Day, Depth  
Abundance indices: Addendum Table 4 and Addendum Figure 4

East Gulf – SEAMAP Summer and Fall Groundfish (new design)

Binomial submodel variables: Year, SSZ, Season, Weight of Sponge, Depth  
Lognormal submodel variables: Year, SSZ, Season  
Abundance indices: Addendum Table 5 and Addendum Figure 5

Addendum Table 1. Indices of gray triggerfish abundance developed using the delta-lognormal (DL) model for SEAMAP Summer and Fall Groundfish Survey from 1987-2008 (Gulfwide). The nominal frequency of occurrence, the number of samples ( $N$ ), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

Survey Year	Frequency	$N$	DL Index	Scaled Index	CV	LCL	UCL
1987	0.13846	390	0.79193	0.56835	0.19422	0.38679	0.83512
1988	0.14428	402	0.69015	0.49530	0.18968	0.34007	0.72138
1989	0.20151	397	1.31619	0.94459	0.16063	0.68645	1.29980
1990	0.12154	469	0.63468	0.45549	0.19061	0.31217	0.66460
1991	0.30044	456	2.95472	2.12051	0.12036	1.66831	2.69528
1992	0.10959	438	0.38211	0.27423	0.20794	0.18172	0.41383
1993	0.20464	474	1.92358	1.38049	0.14471	1.03511	1.84111
1994	0.25696	467	2.02640	1.45428	0.12897	1.12483	1.88023
1995	0.19406	438	1.28157	0.91974	0.15517	0.67559	1.25212
1996	0.13393	448	0.91317	0.65535	0.18580	0.45337	0.94732
1997	0.16047	430	0.79363	0.56956	0.17321	0.40383	0.80330
1998	0.04651	430	0.14677	0.10533	0.32013	0.05640	0.19673
1999	0.23214	448	1.72296	1.23651	0.13952	0.93670	1.63230
2000	0.29157	439	2.73257	1.96108	0.12436	1.53071	2.51246
2001	0.27822	381	4.13913	2.97053	0.13786	2.25764	3.90851
2002	0.19565	460	1.31238	0.94186	0.15086	0.69773	1.27141
2003	0.13864	440	0.69455	0.49846	0.18469	0.34559	0.71896
2004	0.18052	421	0.69885	0.50154	0.16484	0.36148	0.69586
2005	0.21981	414	1.16354	0.83504	0.15025	0.61934	1.12586
2006	0.20542	443	1.92308	1.38013	0.15047	1.02320	1.86159
2007	0.18719	406	1.07327	0.77025	0.16508	0.55489	1.06920
2008	0.26565	527	1.33958	0.96138	0.12369	0.75139	1.23005

Addendum Table 2. Indices of gray triggerfish abundance developed using the delta-lognormal (DL) model for SEAMAP Summer and Fall Groundfish Survey from 2009-2024 (Gulfwide). The nominal frequency of occurrence, the number of samples ( $N$ ), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

Survey Year	Frequency	$N$	DL Index	Scaled Index	CV	LCL	UCL
2009	0.13673	980	0.43214	0.61897	0.11589	0.49130	0.77982
2010	0.11756	689	0.48877	0.70009	0.14607	0.52354	0.93619
2011	0.15876	548	0.63287	0.90649	0.13997	0.68609	1.19770
2012	0.19032	599	0.84600	1.21177	0.12073	0.95266	1.54136
2013	0.11180	483	0.44866	0.64263	0.17613	0.45305	0.91156
2014	0.15861	662	0.64939	0.93016	0.12766	0.72131	1.19947
2015	0.20562	676	0.88283	1.26452	0.10983	1.01581	1.57412
2016	0.10189	530	0.33436	0.47892	0.17682	0.33718	0.68025
2017	0.15182	606	0.52863	0.75718	0.13612	0.57745	0.99286
2018	0.19130	575	0.68773	0.98507	0.12388	0.76962	1.26085
2019	0.16028	574	0.80017	1.14612	0.13527	0.87553	1.50034
2020	0.18261	230	0.54540	0.78121	0.20421	0.52143	1.17040
2021	0.21519	474	0.92114	1.31940	0.12839	1.02168	1.70387
2022	0.22222	468	1.30061	1.86293	0.12511	1.45193	2.39027
2023	0.22083	557	1.20381	1.72429	0.11596	1.36844	2.17267
2024	0.11830	541	0.46793	0.67024	0.16309	0.48473	0.92675

Addendum Table 3. Indices of gray triggerfish abundance developed using the delta-lognormal (DL) model for SEAMAP Summer and Fall Groundfish Survey from 1987-2008 (West Gulf). The nominal frequency of occurrence, the number of samples ( $N$ ), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

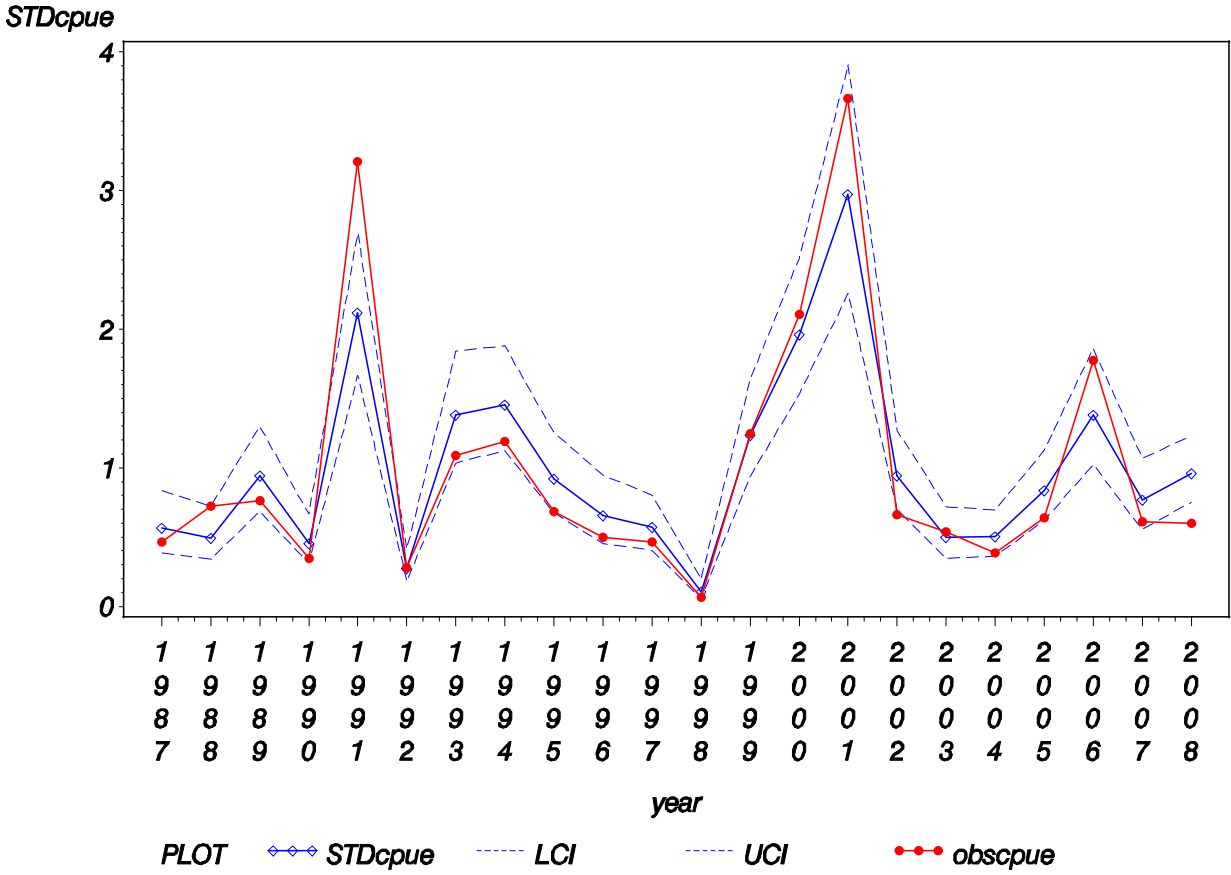
Survey Year	Frequency	$N$	DL Index	Scaled Index	CV	LCL	UCL
1987	0.16993	306	0.92418	0.56304	0.19792	0.38043	0.83330
1988	0.15951	326	0.74279	0.45253	0.20054	0.30422	0.67316
1989	0.23988	321	1.57392	0.95888	0.16346	0.69298	1.32681
1990	0.15805	348	0.78747	0.47975	0.19439	0.32639	0.70518
1991	0.35440	364	3.47814	2.11900	0.12341	1.65709	2.70967
1992	0.12813	359	0.43500	0.26502	0.21294	0.17392	0.40382
1993	0.24225	355	2.24675	1.36879	0.15369	1.00838	1.85803
1994	0.31461	356	2.32044	1.41369	0.13303	1.08470	1.84246
1995	0.23513	353	1.58169	0.96362	0.15656	0.70590	1.31543
1996	0.15126	357	0.91137	0.55524	0.19615	0.37645	0.81894
1997	0.19883	342	0.97446	0.59367	0.17437	0.41997	0.83921
1998	0.05429	350	0.18489	0.11264	0.33014	0.05920	0.21432
1999	0.28177	362	2.11717	1.28985	0.14009	0.97600	1.70463
2000	0.34473	351	3.17505	1.93435	0.12721	1.50136	2.49220
2001	0.33667	300	5.13694	3.12960	0.14041	2.36658	4.13863
2002	0.23352	364	1.58813	0.96754	0.15502	0.71091	1.31681
2003	0.16250	320	0.76775	0.46774	0.20036	0.31455	0.69555
2004	0.20354	339	0.81736	0.49796	0.17310	0.35314	0.70217
2005	0.25519	337	1.32874	0.80951	0.15419	0.59577	1.09994
2006	0.24148	352	2.22862	1.35775	0.15563	0.99644	1.85008
2007	0.22289	332	1.29121	0.78665	0.16702	0.56456	1.09611
2008	0.29306	447	1.49887	0.91316	0.12750	0.70834	1.17720

Addendum Table 4. Indices of gray triggerfish abundance developed using the delta-lognormal (DL) model for SEAMAP Summer and Fall Groundfish Survey from 2009-2024 (West Gulf). The nominal frequency of occurrence, the number of samples ( $N$ ), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

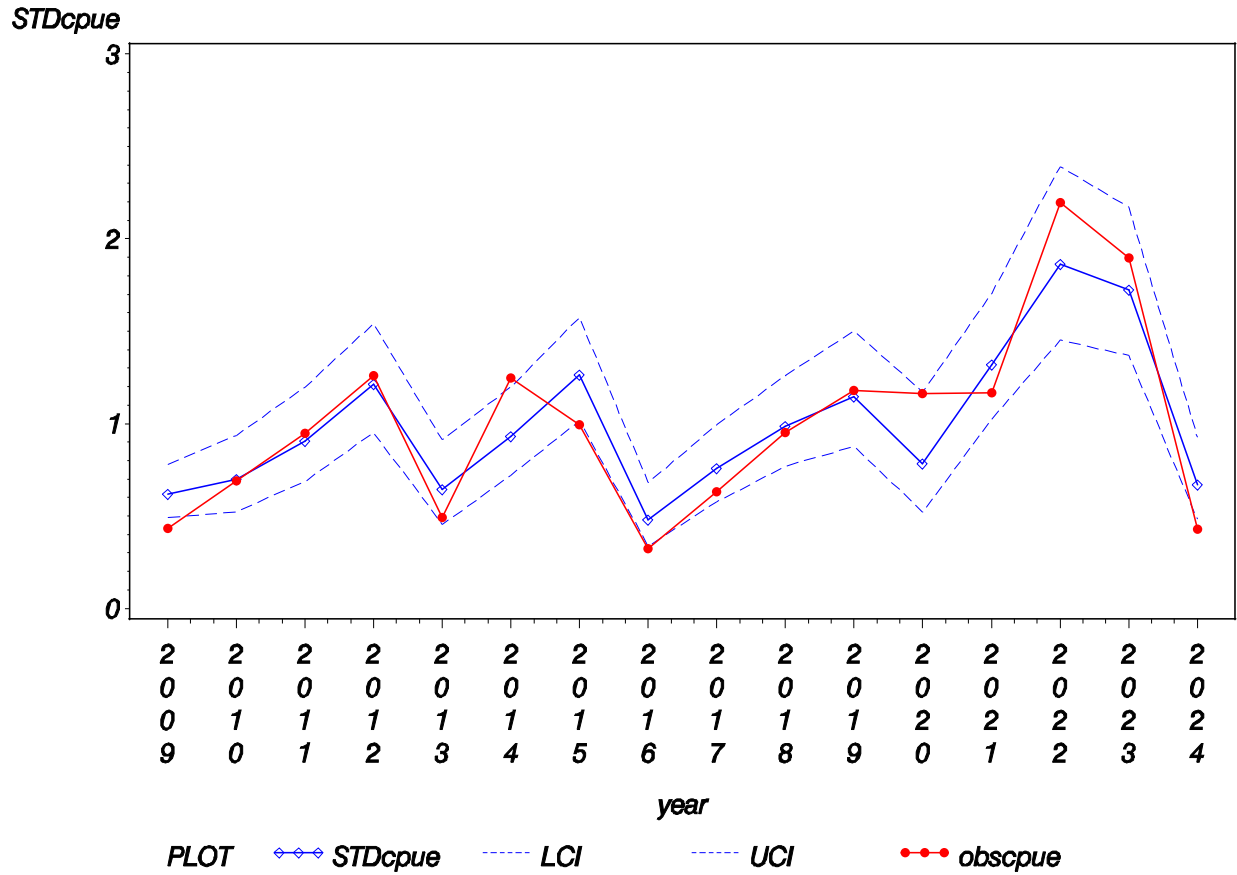
Survey Year	Frequency	$N$	DL Index	Scaled Index	CV	LCL	UCL
2009	0.09879	577	0.29312	0.30954	0.18981	0.21247	0.45095
2010	0.10290	379	0.51230	0.54099	0.22447	0.34722	0.84289
2011	0.15805	348	0.82635	0.87263	0.18966	0.59916	1.27091
2012	0.24026	308	1.50171	1.58582	0.16013	1.15356	2.18004
2013	0.10504	238	0.45294	0.47830	0.27617	0.27812	0.82259
2014	0.15484	310	0.64967	0.68605	0.20383	0.45826	1.02708
2015	0.23962	313	1.24350	1.31314	0.16091	0.95375	1.80794
2016	0.07092	282	0.19773	0.20880	0.31060	0.11380	0.38312
2017	0.15789	304	0.63624	0.67187	0.20299	0.44952	1.00420
2018	0.21300	277	0.87862	0.92783	0.18334	0.64496	1.33475
2019	0.14184	282	0.81568	0.86136	0.22143	0.55610	1.33420
2020	0.21488	121	0.75879	0.80129	0.27829	0.46405	1.38361
2021	0.28125	256	1.37600	1.45306	0.16381	1.04940	2.01200
2022	0.29767	215	2.62157	2.76839	0.17071	1.97249	3.88544
2023	0.28986	276	2.11143	2.22968	0.15389	1.64194	3.02782
2024	0.08520	223	0.27580	0.29125	0.31778	0.15662	0.54159

Addendum Table 5. Indices of gray triggerfish abundance developed using the delta-lognormal (DL) model for SEAMAP Summer and Fall Groundfish Survey from 2009-2024 (East Gulf). The nominal frequency of occurrence, the number of samples ( $N$ ), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

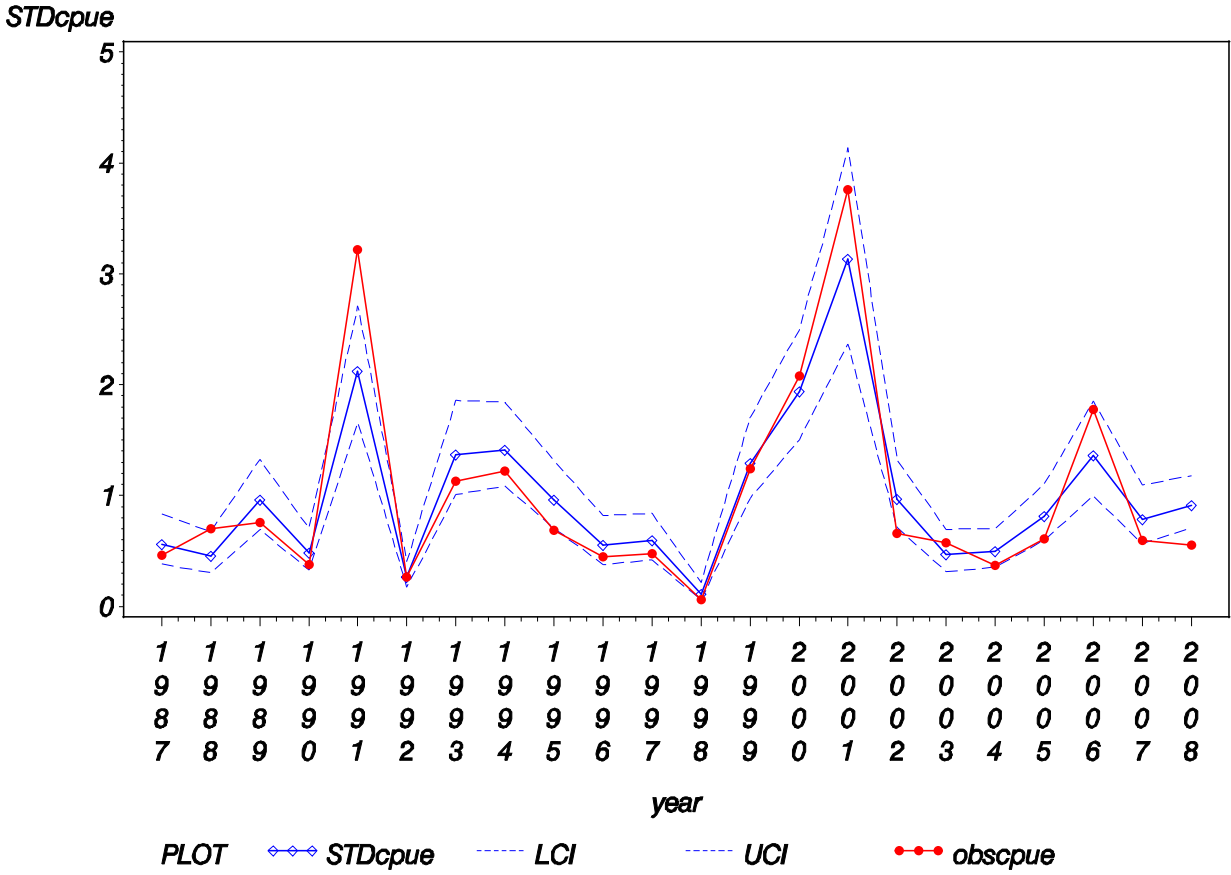
Survey Year	Frequency	$N$	DL Index	Scaled Index	CV	LCL	UCL
2009	0.19107	403	0.66597	1.26805	0.13895	0.96167	1.67204
2010	0.13548	310	0.52643	1.00236	0.18506	0.69444	1.44682
2011	0.16000	200	0.51419	0.97905	0.20750	0.64934	1.47618
2012	0.13746	291	0.44729	0.85167	0.18818	0.58646	1.23680
2013	0.11837	245	0.46943	0.89383	0.21944	0.57928	1.37920
2014	0.16193	352	0.63632	1.21160	0.15712	0.88659	1.65576
2015	0.17631	363	0.63448	1.20810	0.14859	0.89896	1.62354
2016	0.13710	248	0.47706	0.90836	0.20037	0.61084	1.35079
2017	0.14570	302	0.41438	0.78901	0.17841	0.55377	1.12418
2018	0.17114	298	0.49525	0.94298	0.16406	0.68069	1.30635
2019	0.17808	292	0.73178	1.39336	0.16137	1.01110	1.92012
2020	0.14679	109	0.31784	0.60520	0.30197	0.33520	1.09267
2021	0.13761	218	0.50236	0.95653	0.21544	0.62473	1.46456
2022	0.15810	253	0.53740	1.02324	0.18347	0.71111	1.47237
2023	0.15302	281	0.53697	1.02242	0.17948	0.71610	1.45978
2024	0.14151	318	0.49591	0.94424	0.17638	0.66535	1.34002



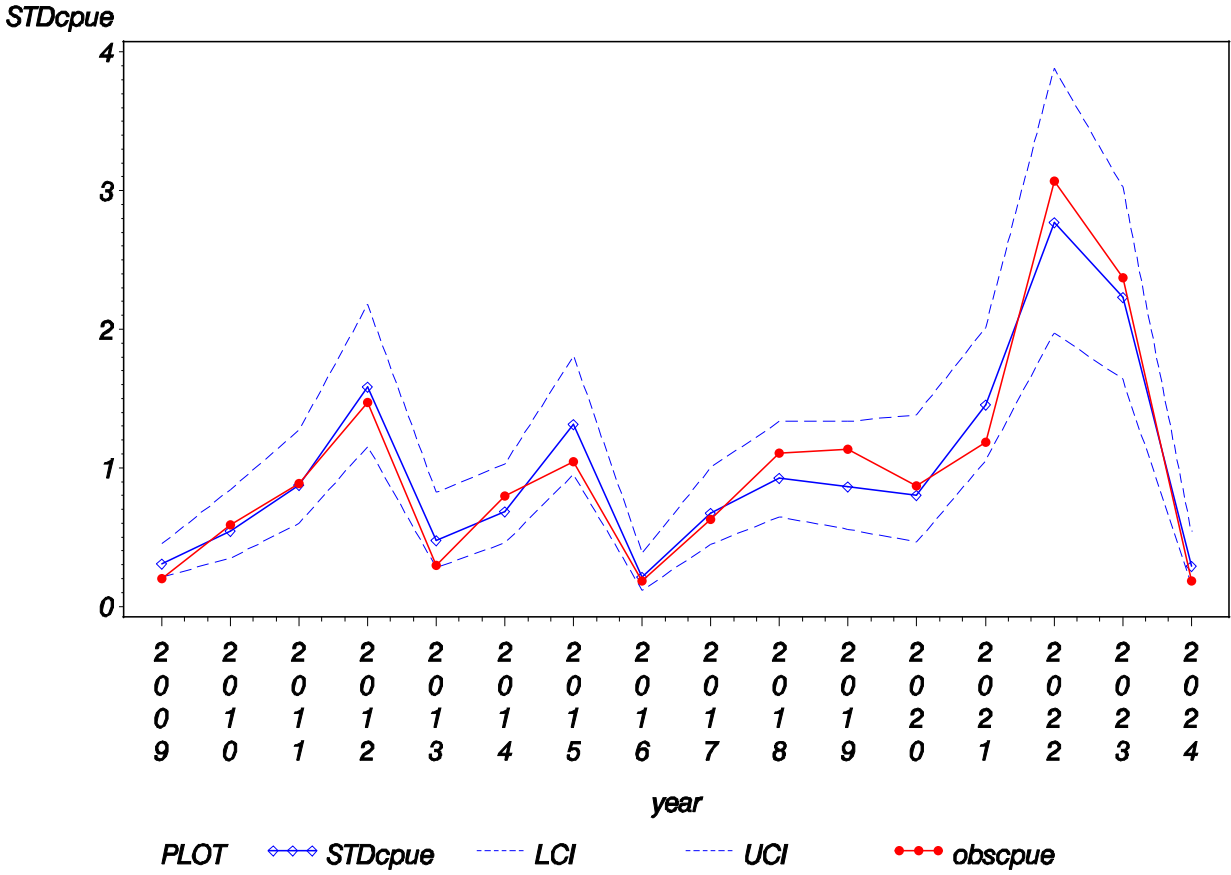
Addendum Figure 1. Annual index of abundance for gray triggerfish from the SEAMAP Summer and Fall Groundfish Survey from 1987 – 2008 (Gulfwide – old design).



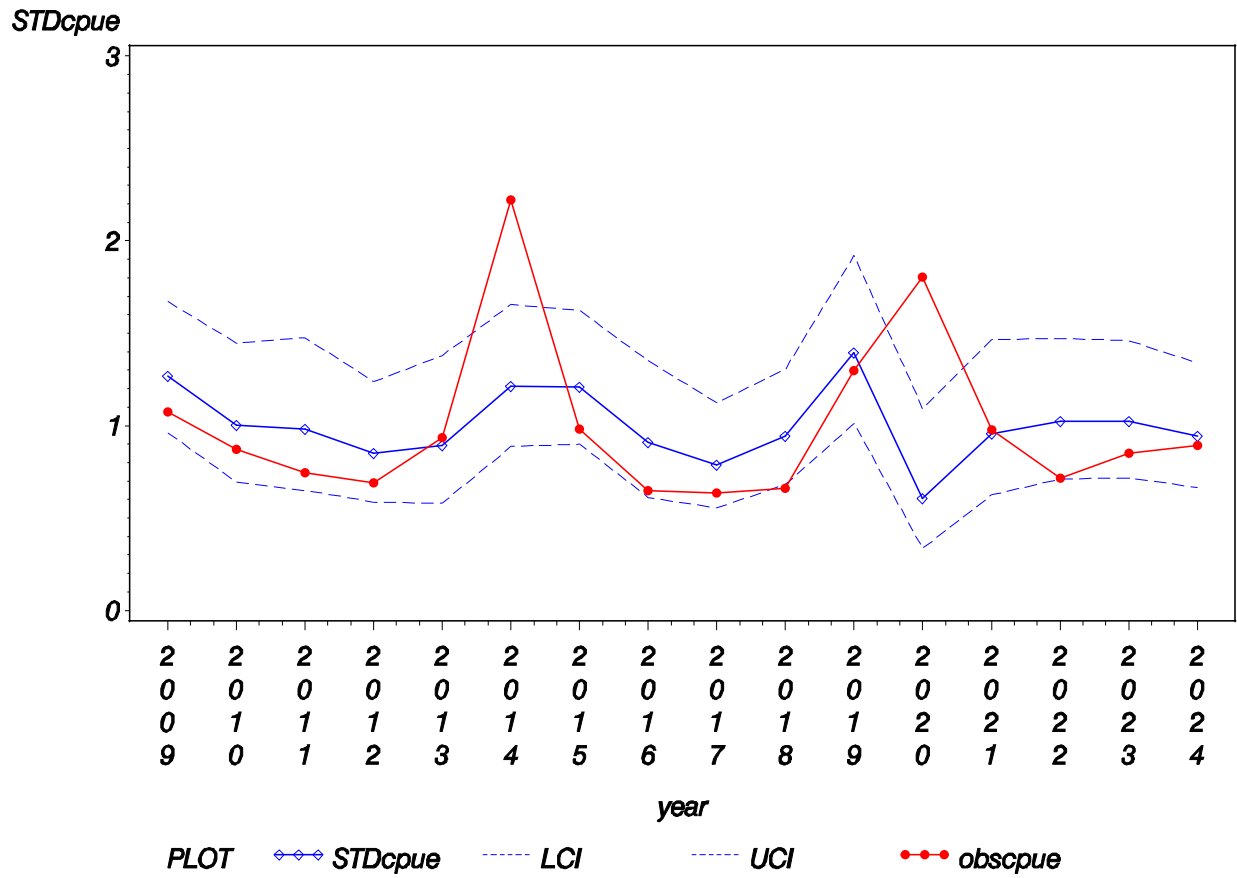
Addendum Figure 2. Annual index of abundance for gray triggerfish from the SEAMAP Summer and Fall Groundfish Survey from 2009 – 2024 (Gulfwide – new design).



Addendum Figure 3. Annual index of abundance for gray triggerfish from the SEAMAP Summer and Fall Groundfish Survey from 1987 – 2008 (West Gulf – old design).



Addendum Figure 4. Annual index of abundance for gray triggerfish from the SEAMAP Summer and Fall Groundfish Survey from 2009 – 2024 (West Gulf – new design).



Addendum Figure 5. Annual index of abundance for gray triggerfish from the SEAMAP Summer and Fall Groundfish Survey from 2009 – 2024 (East Gulf – new design).