

## **Standardized proportion of private vessel trips with catches of goliath grouper from the Marine Recreational Fisheries Statistics Survey in south Florida, 1991-2009**

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Recreational anglers catch goliath grouper, *Epinephelus itajara*, in the southeast region (North Carolina-Texas) of the U.S. (Table 1) but more often in Florida and particularly in west Florida waters (Table 2). Most catches occur from the Florida Middle Grounds to Cape Canaveral (i.e., chiefly southern Florida) particularly in inshore and nearshore waters and by anglers in private/rental boats (Tables 3 and 4). After the prohibitions placed upon the retention of catch in 1990 by the State of Florida and the federal fishery management councils, all of the catch of this species is required to be released back to the water and practically all of the catch of goliath grouper after 1989 was reported by anglers to have been released alive. The prohibition on retention precludes verifiable shore-side or dockside observations of goliath grouper in angler creels after 1989, so all of the information on the recreational catch of goliath grouper must come from the correct recall of information by anglers during shore-side or dockside interviews. Fortunately, goliath grouper are relatively easy for anglers to identify and the recall of catches of this species during a fishing trip that an angler has just completed would be expected to be reliable. Total catch (including released fish) is reported in the intercepts of the Marine Recreational Fisheries Statistics Survey (MRFSS) and total catch rates and proportions of trips with catch of a species may provide an indication of changes in the underlying population because they are less affected by changes in management regulations (including prohibitions on retention).

In 1991, the MRFSS made several improvements to the survey and one of which was the linking of ancillary intercepts from the same fishing trip together and recording the total number of anglers in the party. MRFSS also improved the training of field samplers that year.

The MRFSS tallies fish observed by the interviewer or reported caught by an angler into 3 categories: fish observed by the interviewer in the angler's creel (catch Type A), fish reported by the angler as harvested but unavailable for measurement (Type B1- fish which may have been released dead, or fish that were used for bait, or headed, filleted, etc. and therefore not suitable for length or weight measurement), and fish reported by the angler as released alive (catch Type B2). Catches by anglers that are part of a group catch are linked to a common record where catches were recorded, and beginning in 1991, anglers that are part of the same fishing trip are also linked to a common record allowing all interviews from a given fishing trip to be examined if needed.

It is likely that the catches of anglers on the same fishing trip are correlated because they are probably fishing similarly and in the same habitats as other anglers on that trip. Consequently, when examining the proportion of fishing trips successful in catching a

particular species it may be better to combine the angler interviews from a fishing trip to use as samples rather than to use the individual angler interviews as samples. The catches of anglers interviewed from the same fishing trip were combined for this analysis and the number of goliath grouper caught on a trip (the sum of A, B1, and B2 fish) was totaled. A binary score of one if there was a catch of goliath grouper on a trip and zero otherwise was added to the trip record to examine the proportion of fishing trips through time reporting catches of goliath grouper. The other variables retained on the trip record for this analysis included the number of anglers on the trip, the number of hours fished, mode of fishing, general area fished (estuarine/river, nearshore, or federal waters), coast (Atlantic or Gulf), MRFSS For-Hire Survey region, year, and wave (a 2-month survey period).

Most recreational catches of goliath grouper occur in southwest and southeast Florida from private/rental (PR mode) recreational vessels, and most are caught in estuarine and nearshore waters (Tables 3 and 4). There are some catches reported in the shore (SH) and charter boat and guide fishing (CH) modes in the MRFSS, and from federal waters in the PR and CH modes. Overall, there was a total of 369,334 trips in all fishing modes (SH, PR, and CH) in Florida represented in the MRFSS intercept data from 1991-2009 (Table 5). Of these intercepted trips, 794 had reported catches (including released fish) of 1,330 goliath grouper (Tables 6 and 7, respectively) chiefly from counties in southern Florida. The PR mode of fishing in the MRFSS intercept data accounts for approximately 72% of the estimated catches (and releases) of goliath grouper in Florida from 1991-2009 (Tables 3 and 4), approximately 42% of the intercepted fishing trips (Tables 5 and 8), 57% of the intercepted trips reporting catches of goliath grouper (Tables 6 and 9), and 58% of the number of goliath grouper reported caught (Tables 7 and 10) on intercepted trips. Fishing trips on which there was no reported catch of any species of fish (about 4-10% of PR trips in Florida annually) were included in the analysis.

To provide a more homogeneous data set for this analysis, the data were limited to MRFSS intercepts from the 1991-2009 period in the PR mode in estuarine, nearshore and offshore waters from southwest Florida (Levy to Collier counties, MRFSS For-Hire Survey Region 2) on the Gulf coast and from southeast Florida (Indian River to Miami-Dade counties, MRFSS For-Hire Survey Region 4) on the Atlantic coast of Florida (Figure 1). These two regions account for about 73% of intercepted PR fishing trips reporting catches of goliath grouper and 74% of goliath grouper caught on intercepted PR fishing trips from 1991-2009. The number of PR trips intercepted with reported catches of goliath grouper was quite low (403) compared to the total number of PR trips in these two regions (103,351) from 1991-2009. The few PR Trips (n=17; Table 9) with reported catches of goliath grouper intercepted by MRFSS samplers in Monroe County (MRFSS FHS Region 3) could have been included in this analysis. The chances of overlap of the MRFSS sampling in Monroe County with the Everglades National Park Angler Creel Survey should be negligible, but this area should be adequately covered by the Everglades National Park Angler Creel Survey index (Cass-Calay 2010) and it was excluded from the analysis.

The fit of the proportion positive model was reasonable (Figure 2) and the model reduced deviance by 7.6% (Table 11) with most of that reduction due to year (5.7%) and water body (1.9%). Stepwise selection of variables ceased when the reduction in deviance

fell below 1%. The fit of the proportion of trips with catches of goliath grouper for the 403 trips (Table 9) with positive catches was also reasonable; however, year was not a significant factor and the results are not presented here. The catch rates on positive trips would not have contributed to annual index values in a hurdle (or delta) model, so the index was constructed solely from the binomial model of the proportion of positive trips by year and water body. The catch rates (proportion positive trips with catches of goliath grouper) estimated by the GLM increased slowly during the late 1990s reaching a peak in 2007 and then declined to levels slightly above those observed in 2003 (Table 12, Figure 3).

The ages to which this proposed index should apply are those ages likely to be encountered by recreational anglers. However, data on age or size frequencies of goliath grouper in recreational catches are few. It may be likely that any angler, even those anglers fishing from shore [see newspaper accounts of large goliath grouper caught from shore in McClenachan (2009)] may encounter a goliath grouper of any age if the population of goliath groupers was relatively lightly fished. Since this is not the case with goliath grouper in the southeastern US at the present time even though harvest of goliath grouper has been prohibited since 1990, it may be preferable to assume that this index applies to younger fish (perhaps up to 6 years of age) such as observed in the ENP Angler Creel Survey (see discussion in the recreational fishery section of SEDAR23-DW). The trajectories of the ENP index (Cass-Calay 2010), the REEF index for Southeast Florida and the Florida Keys (Porch 2010), and this MRFSS index are strikingly similar (Fig. 4), and all may be measuring similar aspects of the rebuilding of goliath grouper populations in south Florida.

**Literature Cited**

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- McClenachan, L. 2009. Historical declines of goliath grouper populations in South Florida, USA. *Endangered Species Research* 7: 175-181.
- Porch, C. 2010. Standardized visual counts of goliath grouper off South Florida. SEDAR23-AW-01.

## TABLES

Table 1. Total recreational catch (in numbers of fish, including releases) of goliath grouper in the southeast region of the United States, 1981-2009\*.

Year	Texas	Louisiana	Mississippi	Alabama	West Florida	East Florida	Georgia	South Carolina	North Carolina	Grand Total	Florida Total	Florida % of total
1981	0	0	0	0	22,871	1,173	0	0	0	24,044	24,044	100.0
1982	0	1,774	0	0	7,869	0	0	0	0	9,643	7,869	81.6
1983	0	0	0	0	0	120	0	0	0	120	120	100.0
1984	1,516	629	0	1,289	0	5,350	0	0	0	8,784	5,350	60.9
1985	0	0	0	0	8,992	0	0	0	0	8,992	8,992	100.0
1986	**	4,988	0	0	1,339	0	0	0	0	6,327	1,339	21.2
1987	**	120	0	0	3,090	1,260	0	0	0	4,469	4,349	97.3
1988	**	0	0	0	2,316	896	0	0	0	3,212	3,212	100.0
1989	**	0	0	0	7,977	403	0	0	0	8,380	8,380	100.0
1990	**	0	0	0	1,928	0	0	0	0	1,928	1,928	100.0
1991	**	0	0	0	4,426	1,296	0	0	0	5,722	5,722	100.0
1992	**	0	0	0	3,062	0	0	0	0	3,062	3,062	100.0
1993	**	0	0	0	5,316	0	0	0	0	5,316	5,316	100.0
1994	**	0	0	0	4,404	0	0	0	0	4,404	4,404	100.0
1995	**	0	0	0	12,979	904	0	0	0	13,883	13,883	100.0
1996	**	159	0	0	1,752	690	0	0	0	2,601	2,442	93.9
1997	**	0	0	0	4,879	3,363	0	0	0	8,242	8,242	100.0
1998	**	0	0	0	6,245	1,622	0	438	0	8,305	7,867	94.7
1999	**	0	0	171	5,417	2,638	0	0	0	8,226	8,055	97.9
2000	**	0	0	0	22,663	10,630	0	0	0	33,294	33,294	100.0
2001	**	0	0	0	31,443	9,951	0	0	0	41,393	41,393	100.0
2002	**	0	0	0	14,861	16,034	0	0	87	30,982	30,895	99.7
2003	**	0	0	0	38,705	10,649	0	0	0	49,354	49,354	100.0
2004	**	0	0	0	42,185	12,532	964	0	0	55,680	54,716	98.3
2005	**	0	0	734	83,185	17,734	0	0	0	101,653	100,919	99.3
2006	**	0	0	0	95,809	26,584	0	0	0	122,394	122,394	100.0
2007	**	0	0	0	114,534	40,329	0	0	0	154,863	154,863	100.0
2008	**	0	0	0	35,805	14,991	0	0	0	50,796	50,796	100.0
2009	**	0	0	0	31,013	15,098	0	0	0	46,111	46,111	100.0
Total	**	7,670	0	2,194	615,065	194,247	964	438	87	822,180	809,311	98.4

\* source: Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division, April 26, 2010.

Marine Recreational Fishery Statistics Survey, catch types "a" (inspected, harvested catch), "b1" (unavailable for measurement or fish released dead), "b2" (caught, released alive).

\*\* Texas recreational catch no longer included in the MRFSS. Texas Parks and Wildlife Division's recreational catch estimates do not include released fish.

<http://www.st.nmfs.noaa.gov/st1/recreational/queries/index.html>

Table 2. Estimated total recreational catch (numbers of fish including releases) of goliath grouper by coast in Florida, and proportional standard errors (PSE) from the Marine Recreational Fisheries Statistics Survey (MRFSS), 1981-2009.\*

Year	West Florida		East Florida		Florida	
	Total Catch	PSE	Total Catch	PSE	Total Catch	PSE
1981	22,871	96.3	1,173	50	24,044	91.7
1982	7,869	65.9	0	0	7,869	65.9
1983	0	0	120	100.1	120	100.1
1984	0	0	5,350	72.4	5,350	72.4
1985	8,992	82.8	0	0	8,992	82.8
1986	1,339	76.4	0	0	1,339	76.4
1987	3,090	52.5	1,260	100	4,349	47.2
1988	2,316	57.6	896	100	3,212	50
1989	7,977	67.7	403	57.7	8,380	64.5
1990	1,928	100	0	0	1,928	100
1991	4,426	88.9	1,296	100	5,722	72.4
1992	3,062	78.4	0	0	3,062	78.4
1993	5,316	52.2	0	0	5,316	52.2
1994	4,404	41.8	0	0	4,404	41.8
1995	12,979	41.3	904	100.1	13,883	39.2
1996	1,752	70.8	690	100	2,442	58.1
1997	4,879	42.9	3,363	79.9	8,242	41.3
1998	6,245	26.6	1,622	63.6	7,867	24.8
1999	5,417	28.8	2,638	41.7	8,055	23.7
2000	22,663	24.8	10,630	29.8	33,294	19.4
2001	31,443	29.7	9,951	38.2	41,393	24.4
2002	14,861	26.6	16,034	31.1	30,895	20.6
2003	38,705	22.3	10,649	34.5	49,354	19
2004	42,185	17.3	12,532	28.3	54,716	14.8
2005	83,185	13.8	17,734	31.2	100,919	12.6
2006	95,809	12.4	26,584	28.5	122,394	11.5
2007	114,534	13.4	40,329	29.3	154,863	12.5
2008	35,805	22.6	14,991	26.2	50,796	17.7
2009	31,013	20	15,098	24.7	46,111	15.7
Total	615,065		194,247		809,312	

\* source: Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division, April 26, 2010.

Marine Recreational Fishery Statistics Survey, catch types "a" (inspected, harvested catch), "b1" (unavailable for measurement or fish released dead), "b2" (caught, released alive).

Table 3. Estimated total recreational catch (numbers of fish including releases) of goliath grouper on the West coast of Florida (Monroe - Escambia counties) by water body and by mode of fishing from the MRFSS, 1981-2009.

**a. by Water Body**

Year	Estuarine/River (Inland)	Nearshore		Total
		(Ocean ≤ 10 miles)	Federal Waters (Ocean > 10 mi)	
1981	0	22,871	0	22,871
1982	0	7,869	0	7,869
1983	0	0	0	0
1984	0	0	0	0
1985	0	1,754	7,238	8,992
1986	0	0	1,339	1,339
1987	0	1,193	1,897	3,090
1988	0	0	2,316	2,316
1989	6,260	0	1,717	7,977
1990	0	0	1,928	1,928
1991	0	3,897	528	4,425
1992	799	2,263	0	3,062
1993	2,135	3,181	0	5,316
1994	539	2,406	1,459	4,404
1995	10,297	811	1,871	12,979
1996	1,752	0	0	1,752
1997	1,716	1,316	1,847	4,879
1998	2,427	2,243	1,576	6,246
1999	4,404	611	402	5,417
2000	18,826	2,918	920	22,664
2001	26,953	4,425	66	31,444
2002	11,927	2,144	790	14,861
2003	24,892	13,479	334	38,705
2004	32,593	5,264	4,328	42,185
2005	45,523	33,064	4,599	83,186
2006	71,984	20,241	3,583	95,808
2007	94,040	16,791	3,703	114,534
2008	21,873	5,626	8,305	35,804
2009	23,523	3,771	3,719	31,013
<b>Total</b>	<b>402,463</b>	<b>158,138</b>	<b>54,465</b>	<b>615,066</b>

**b. by Mode of Fishing**

Year	Charter (CH)	Private/Rental (PR)	Shore (SH)	Total
1982	0	7,869	0	7,869
1983	0	0	0	0
1984	0	0	0	0
1985	0	8,992	0	8,992
1986	395	944	0	1,339
1987	1,193	1,897	0	3,090
1988	2,316	0	0	2,316
1989	0	3,025	4,952	7,977
1990	0	1,928	0	1,928
1991	528	0	3,897	4,425
1992	0	799	2,263	3,062
1993	341	4,975	0	5,316
1994	1,840	2,564	0	4,404
1995	0	12,979	0	12,979
1996	0	1,752	0	1,752
1997	2,389	2,490	0	4,879
1998	2,041	4,205	0	6,246
1999	790	3,777	850	5,417
2000	1,325	7,434	13,905	22,664
2001	1,820	27,210	2,414	31,444
2002	876	12,998	987	14,861
2003	2,423	31,345	4,937	38,705
2004	5,750	33,524	2,911	42,185
2005	5,270	61,819	16,097	83,186
2006	9,123	70,266	16,419	95,808
2007	10,307	90,072	14,155	114,534
2008	6,277	26,606	2,921	35,804
2009	3,368	16,135	11,510	31,013
<b>Total</b>	<b>58,372</b>	<b>458,476</b>	<b>98,218</b>	<b>615,066</b>

Table 4. Estimated total recreational catch (numbers of fish including releases) of goliath grouper on the East coast of Florida (Nassau – Miami-Dade counties) by water body and by mode of fishing from the MRFSS, 1981-2009.

**b. by Water Body**

Year	Estuarine/River (Inland)	Nearshore [Ocean ≤ 10 miles)	Federal Waters (Ocean > 10 mi)	Total
1981	1,173	0	0	1,173
1982	0	0	0	0
1983	0	0	120	120
1984	0	5,350	0	5,350
1985	0	0	0	0
1986	0	0	0	0
1987	0	1,260	0	1,260
1988	0	896	0	896
1989	0	403	0	403
1990	0	0	0	0
1991	0	0	1,296	1,296
1992	0	0	0	0
1993	0	0	0	0
1994	0	0	0	0
1995	904	0	0	904
1996	0	690	0	690
1997	3,363	0	0	3,363
1998	1,622	0	0	1,622
1999	1,617	1,022	0	2,639
2000	5,992	4,639	0	10,631
2001	7,065	2,177	709	9,951
2002	13,202	1,935	896	16,033
2003	9,100	1,549	0	10,649
2004	12,264	268	0	12,532
2005	15,241	1,577	915	17,733
2006	24,560	2,025	0	26,585
2007	37,833	967	1,529	40,329
2008	11,246	2,551	1,193	14,990
2009	13,319	0	1,778	15,097
Total	158,501	27,309	8,436	194,246

**b. by Mode of Fishing**

Year	Charter (CH)	Private/Rental (PR)	Shore (SH)	Total
1981	0	1,173	0	1,173
1982	0	0	0	0
1983	120	0	0	120
1984	0	5,350	0	5,350
1985	0	0	0	0
1986	0	0	0	0
1987	0	1,260	0	1,260
1988	0	896	0	896
1989	403	0	0	403
1990	0	0	0	0
1991	0	1,296	0	1,296
1992	0	0	0	0
1993	0	0	0	0
1994	0	0	0	0
1995	0	904	0	904
1996	0	690	0	690
1997	0	3,363	0	3,363
1998	0	1,622	0	1,622
1999	0	2,639	0	2,639
2000	0	4,197	6,434	10,631
2001	0	1,486	8,465	9,951
2002	0	14,098	1,935	16,033
2003	54	7,994	2,601	10,649
2004	346	12,186	0	12,532
2005	323	8,632	8,778	17,733
2006	394	17,055	9,136	26,585
2007	0	19,198	21,131	40,329
2008	348	8,745	5,897	14,990
2009	455	9,689	4,953	15,097
Total	2,443	122,473	69,330	194,246



Table 5. Total number of recreational fishing trips intercepted (all modes, interviews from same fishing trip combined) annually in Florida by the MRFSS, 1991-2009.

Year	Atlantic Coast of Florida		Gulf Coast of Florida			Florida trips
	Nassau-Brevard	Indian River – Miami-Dade	Monroe	Collier-Levy	Dixie-Escambia	
1991	924	1,744	393	1,805	689	5,555
1992	2,004	2,848	764	4,387	1,076	11,079
1993	2,678	2,865	1,065	3,997	1,900	12,505
1994	6,001	4,372	1,156	6,470	2,840	20,839
1995	5,632	4,108	1,146	6,636	1,707	19,229
1996	3,661	3,201	1,218	5,830	1,348	15,258
1997	3,987	3,073	1,179	6,680	1,076	15,995
1998	3,929	3,913	1,279	8,228	1,232	18,581
1999	6,108	5,684	1,789	10,455	2,614	26,650
2000	5,097	4,933	1,521	7,504	3,393	22,448
2001	5,683	5,096	1,571	7,844	3,328	23,522
2002	4,960	7,159	1,334	9,317	2,954	25,724
2003	3,689	7,101	1,497	9,547	2,897	24,731
2004	3,301	5,523	1,052	9,846	3,061	22,783
2005	4,019	5,008	856	9,358	2,354	21,595
2006	4,407	5,279	648	7,512	3,239	21,085
2007	3,968	5,402	831	7,648	3,323	21,172
2008	3,731	4,159	1,137	8,235	2,775	20,037
2009	3,579	4,440	649	9,156	2,722	20,546
Total	77,358	85,908	21,085	140,455	44,528	369,334

Table 6. Total number of recreational fishing trips intercepted (all modes) annually in Florida by the MRFSS, 1991-2009, with reported catches (includes releases) of goliath grouper.

Year	Atlantic Coast of Florida		Gulf Coast of Florida			Total trips with goliath grouper
	Nassau-Brevard	Indian River- Miami-Dade	Monroe	Collier-Levy	Dixie-Escambia	
1991	0	1	2	0	0	3
1992	0	0	1	1	0	2
1993	0	0	2	1	1	4
1994	0	0	2	3	0	5
1995	0	1	0	7	0	8
1996	0	1	0	2	0	3
1997	0	2	2	4	0	8
1998	2	0	6	9	0	17
1999	2	4	1	16	0	23
2000	8	5	5	18	0	36
2001	7	2	3	17	0	29
2002	6	11	9	15	1	42
2003	3	11	8	29	0	51
2004	3	13	17	46	0	79
2005	5	13	5	82	0	105
2006	2	21	11	72	1	107
2007	5	20	35	71	0	131
2008	5	10	32	27	1	75
2009	5	13	14	31	3	66
Total	53	128	155	451	7	794

Table 7. Number (including releases) of goliath grouper reported by recreational anglers on recreational fishing trips intercepted (all modes, interviews from same fishing trip combined) annually in Florida by the MRFSS, 1991-2009.

Year	Atlantic Coast of Florida		Gulf Coast of Florida			Number of goliath grouper reported on intercepted trips
	Nassau-Brevard	Indian River – Miami-Dade	Monroe	Collier-Levy	Dixie-Escambia	
1991	0	1	2	0	0	3
1992	0	0	1	1	0	2
1993	0	0	2	3	2	7
1994	0	0	2	4	0	6
1995	0	1	0	15	0	16
1996	0	1	0	2	0	3
1997	0	4	7	6	0	17
1998	4	0	12	11	0	27
1999	2	4	2	18	0	26
2000	8	5	14	23	0	50
2001	8	2	3	43	0	56
2002	10	23	10	27	1	71
2003	3	14	8	56	0	81
2004	5	20	27	81	0	133
2005	7	17	7	138	0	169
2006	6	33	19	136	1	195
2007	5	32	47	147	0	231
2008	7	15	65	47	1	135
2009	6	18	36	39	3	102
Total	71	190	264	797	8	1,330

Table 8. Total number of private/rental boat (PR) mode recreational fishing trips (interviews from same fishing trip combined) intercepted annually in Florida by the MRFSS, 1991-2009.

Year	Atlantic Coast of Florida		Gulf Coast of Florida			Florida PR mode trips
	Nassau-Brevard	Indian River – Miami-Dade	Monroe	Collier -Levy	Dixie-Escambia	
1991	496	965	179	1,328	244	3,212
1992	1,135	1,355	343	3,104	388	6,325
1993	973	1,091	397	2,283	423	5,167
1994	1,340	1,118	381	2,575	523	5,937
1995	1,192	1,175	270	2,358	262	5,257
1996	1,347	1,275	350	2,856	439	6,267
1997	1,255	1,317	324	3,247	235	6,378
1998	1,439	1,670	219	3,937	262	7,527
1999	2,878	2,774	243	5,133	619	11,647
2000	2,880	2,085	129	3,675	769	9,538
2001	2,912	2,026	130	4,277	765	10,110
2002	2,618	2,216	103	5,031	767	10,735
2003	1,898	2,489	183	4,331	805	9,706
2004	1,837	2,048	128	4,740	901	9,654
2005	1,995	1,738	42	4,326	763	8,864
2006	2,206	2,293	117	3,806	1,054	9,476
2007	1,833	2,297	174	3,817	1,192	9,313
2008	1,799	1,903	163	4,241	1,029	9,135
2009	1,598	1,763	91	4,688	967	9,107
Total	33,631	33,598	3,966	69,753	12,407	153,355

Table 9. Total number of PR mode recreational fishing trips intercepted annually in Florida by the MRFSS, 1991-2009, with reported catches (includes releases) of goliath grouper.

Year	Atlantic Coast of Florida		Gulf Coast of Florida			Total PR mode trips with goliath grouper
	Nassau-Brevard	Indian River - Miami-Dade	Monroe	Collier-Levy	Dixie-Escambia	
1991	0	1	0	0	0	1
1992	0	0	0	1	0	1
1993	0	0	1	1	1	3
1994	0	0	0	3	0	3
1995	0	1	0	7	0	8
1996	0	1	0	2	0	3
1997	0	2	0	3	0	5
1998	2	0	0	6	0	8
1999	2	4	0	8	0	14
2000	3	4	0	7	0	14
2001	1	2	0	13	0	16
2002	6	9	1	11	1	28
2003	0	10	1	17	0	28
2004	3	11	0	33	0	47
2005	3	8	0	56	0	67
2006	1	14	3	48	0	66
2007	2	16	4	52	0	74
2008	3	6	5	19	1	34
2009	3	8	2	19	2	34
Total	29	97	17	306	5	454

Table 10. Number (including releases) of goliath grouper reported by recreational anglers on PR mode recreational fishing trips intercepted (all modes, interviews from same fishing trip combined) annually in Florida by the MRFSS, 1991-2009.

Year	Atlantic Coast of Florida		Gulf Coast of Florida			Number of goliath grouper reported on intercepted PR mode trips
	Nassau-Brevard	Indian River – Miami-Dade	Monroe	Collier-Levy	Dixie-Escambia	
1991	0	1	0	0	0	1
1992	0	0	0	1	0	1
1993	0	0	1	3	2	6
1994	0	0	0	4	0	4
1995	0	1	0	15	0	16
1996	0	1	0	2	0	3
1997	0	4	0	4	0	8
1998	4	0	0	8	0	12
1999	2	4	0	9	0	15
2000	3	4	0	10	0	17
2001	1	2	0	38	0	41
2002	10	21	1	20	1	53
2003	0	13	1	37	0	51
2004	5	18	0	54	0	77
2005	3	9	0	90	0	102
2006	5	23	7	92	0	127
2007	2	24	4	122	0	152
2008	4	10	6	28	1	49
2009	4	12	2	25	2	45
Total	43	147	22	562	6	780

**Table 11.** Stepwise selection of variables (shaded lines) to include in estimating the proportion of MRFSS PR mode intercepts in FHS regions 2 and 4 with goliath grouper using a GLM (binomial distribution and logit link) based on lowest AICC values. The fields include the variables, the degrees of freedom for that variable (df), the deviance of the model with those variables, the mean deviance (deviance/df), the change in mean deviance ( $\Delta$  mean dev), percent reduction in mean deviance (% change in mean dev), cumulative reduction in mean deviance, log likelihood, the change in log likelihood from previous run, minus two times the change in log-likelihood, chi-square value, the Chi-square degrees of freedom, the probability of the null hypothesis (Prob Ho), and the corrected Akaike Information Criterion (AICC).

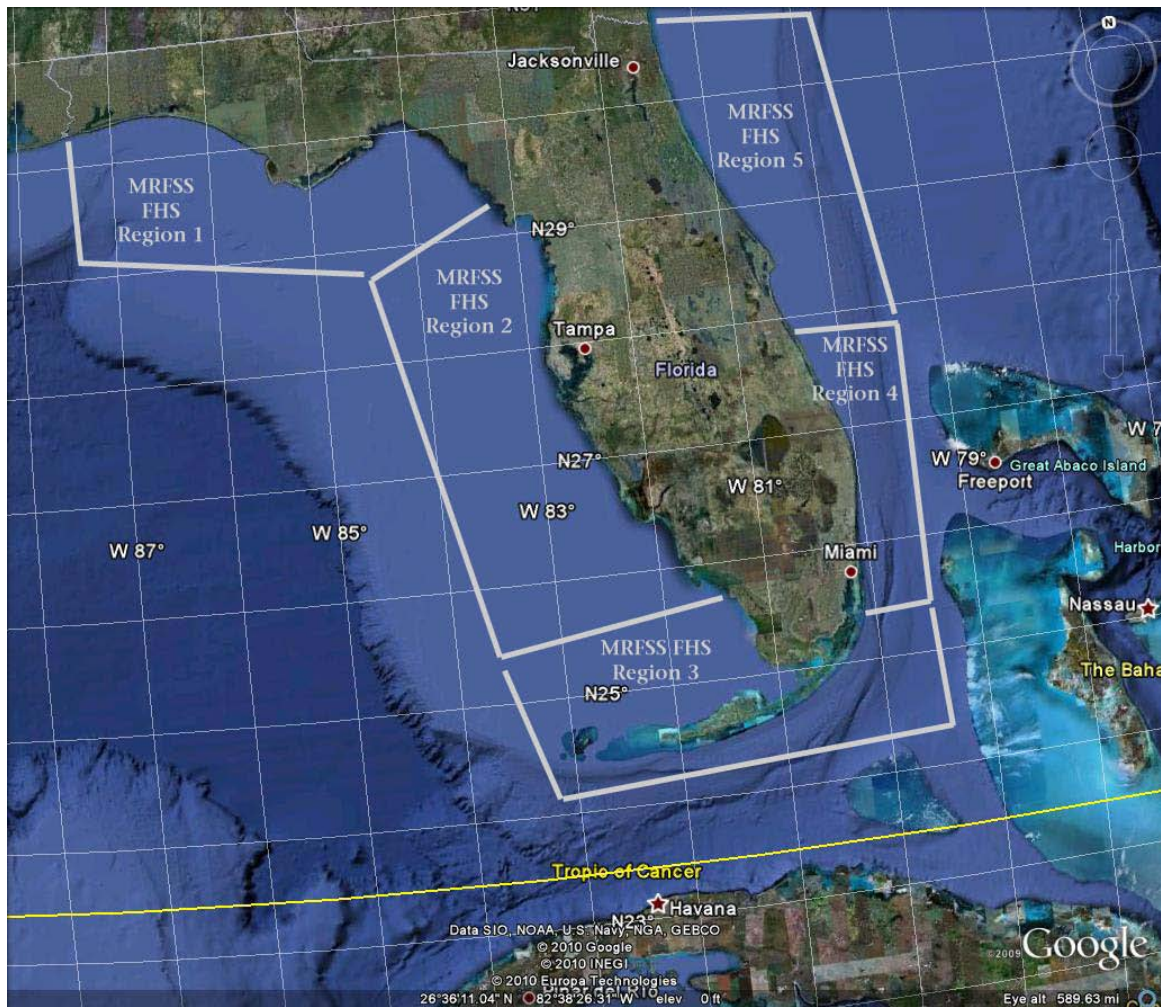
Source	df	log like	$\Delta$ log like	Chi-sq	Chi-sq df	Prob Ho	AICC	$\Delta$ AICC	Deviance	Mean Deviance	$\Delta$ Mean Deviance	% change	cum % change
Null model	103350	-2637.634					5277.27		5275.27	0.05104			
Year	103332	-2486.167	151.4673	302.9346	18	1.20E-53	5010.33	-266.935	4972.33	0.04812	-0.00292	-5.73%	-5.73%
Wave	103345	-2621.100	16.5336	33.0672	5	3.65E-06	5254.20	-23.067	5242.20	0.05073	-0.00032	-0.62%	
Coast	103349	-2630.710	6.9238	13.8476	1	1.98E-04	5265.42	-11.848	5261.42	0.05091	-0.00013	-0.26%	
Water Body	103348	-2583.119	54.5149	109.0298	2	2.11E-24	5172.24	-105.030	5166.24	0.04999	-0.00105	-2.06%	
Num anglers	103345	-2625.351	12.2827	24.5654	5	1.69E-04	5262.70	-14.565	5250.70	0.05081	-0.00024	-0.46%	
Hours fished	103347	-2620.504	17.1299	34.2598	3	1.75E-07	5249.01	-28.260	5241.01	0.05071	-0.00033	-0.65%	
With Year													
Wave	103327	-2469.602	16.5646	33.1292	5	3.55E-06	4987.20	-23.129	4939.20	0.04780	-0.00032	-0.62%	
Coast	103331	-2478.236	7.9311	15.8622	1	6.81E-05	4996.47	-13.862	4956.47	0.04797	-0.00015	-0.30%	
Water Body	103330	-2436.552	49.6151	99.2302	2	2.83E-22	4915.10	-95.230	4873.10	0.04716	-0.00096	-1.88%	-7.61%
Num anglers	103327	-2473.757	12.4100	24.8200	5	1.51E-04	4995.51	-14.820	4947.51	0.04788	-0.00024	-0.47%	
Hours fished	103329	-2468.199	17.9673	35.9346	3	7.73E-08	4980.40	-29.934	4936.40	0.04777	-0.00035	-0.68%	
With Year and Water Body													
Wave	103325	-2416.929	19.6231	39.2462	5	2.12E-07	4885.86	-29.246	4833.86	0.04678	-0.00038	-0.74%	
Coast	103329	-2434.409	2.1426	4.2852	1	3.84E-02	4912.82	-2.285	4868.82	0.04712	-0.00004	-0.08%	
Num anglers	103325	-2420.478	16.0736	32.1472	5	5.56E-06	4892.96	-22.147	4840.96	0.04685	-0.00031	-0.61%	
Hours fished	103327	-2415.990	20.5619	41.1238	3	6.16E-09	4879.98	-35.124	4831.98	0.04676	-0.00040	-0.78%	

**Table 12.** Nominal and standardized proportion of positive trip rates with catches of goliath grouper from private/rental boat MRFSS modes from southwest and southeast Florida (MRFSS FHS regions 2 and 4) using all trips from 1991-2009 even if no catch was reported. Intercepts from the same trip were pooled.

Year	Nominal				GLM (binomial model)			
	Number of Trips	Mean Proportion Positive Trips	Coefficient of Variation	Index (scaled to mean)	Number of Trips	Mean Proportion Positive Trips	Coefficient of Variation	Index (scaled to mean)
1991	2,293	0.00044	1.000	0.0636	2,293	0.00052	1.246	0.1929
1992	4,459	0.00022	1.000	0.0327	4,459	0.00027	1.337	0.0983
1993	3,374	0.00089	1.000	0.1296	3,374	0.00032	1.213	0.1189
1994	3,693	0.00108	0.612	0.1579	3,693	0.00066	0.659	0.2452
1995	3,533	0.00453	0.442	0.6602	3,533	0.00177	0.382	0.6564
1996	4,131	0.00073	0.577	0.1058	4,131	0.00060	0.649	0.2225
1997	4,564	0.00175	0.500	0.2555	4,564	0.00081	0.474	0.3022
1998	5,607	0.00143	0.433	0.2080	5,607	0.00078	0.431	0.2905
1999	7,907	0.00164	0.297	0.2397	7,907	0.00111	0.300	0.4130
2000	5,760	0.00243	0.335	0.3544	5,760	0.00141	0.315	0.5224
2001	6,303	0.00635	0.393	0.9251	6,303	0.00171	0.267	0.6360
2002	7,247	0.00566	0.285	0.8248	7,247	0.00193	0.238	0.7178
2003	6,820	0.00733	0.235	1.0687	6,820	0.00270	0.203	1.0023
2004	6,788	0.01061	0.189	1.5462	6,788	0.00443	0.165	1.6434
2005	6,064	0.01633	0.156	2.3799	6,064	0.00698	0.143	2.5899
2006	6,099	0.01886	0.162	2.7487	6,099	0.00718	0.144	2.6651
2007	6,114	0.02388	0.186	3.4810	6,114	0.00743	0.138	2.7569
2008	6,144	0.00619	0.263	0.9016	6,144	0.00277	0.209	1.0281
2009	6,451	0.00574	0.214	0.8362	6,451	0.00264	0.210	0.9780
Total	103,351				103,351			

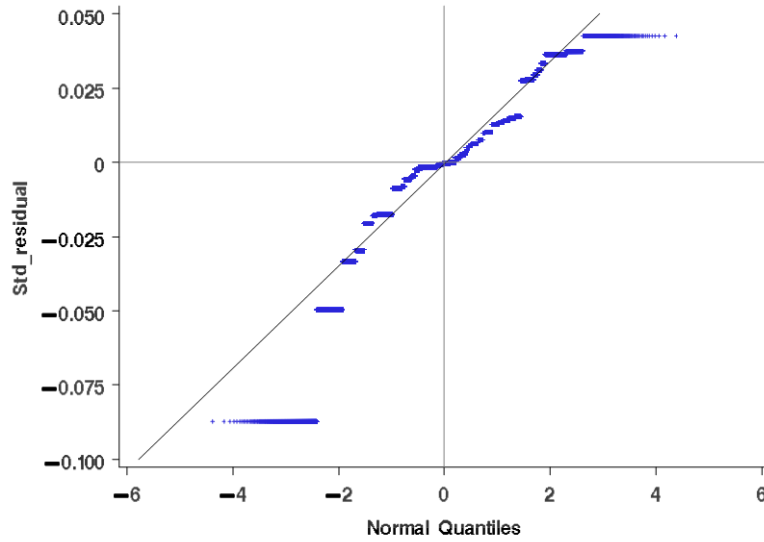
**FIGURES**

**Figure 1.** A map of Florida indicating the MRFSS For-Hire Survey (FHS) regions. Region 1 includes for-hire vessels based from Escambia County to Dixie County, Region 2 ranges from Levy County to Collier County, Region 3 includes vessels from all of Monroe County, Region 4 stretches from Miami-Dade County to Indian River County, and Region 5 extends from Brevard County to Nassau County. Shore (SH) and private/rental boats angler interviews were included in these regions based upon the county where the intercept occurred.

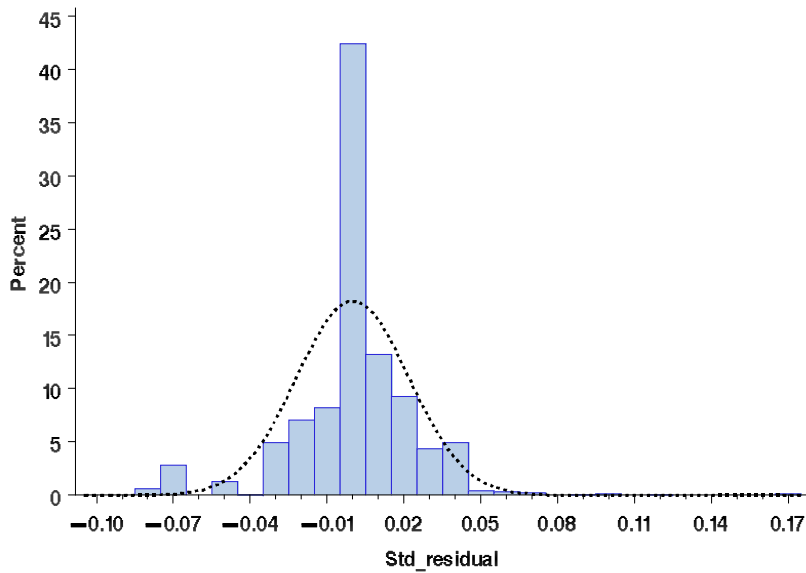


**Figure 2.** Quantiles plot (a) and distribution (b) of standardized residuals for the proportion of positive catches of goliath grouper from the generalized linear model (GLM) with a binomial distribution and a logit link.

a. Quantile plot

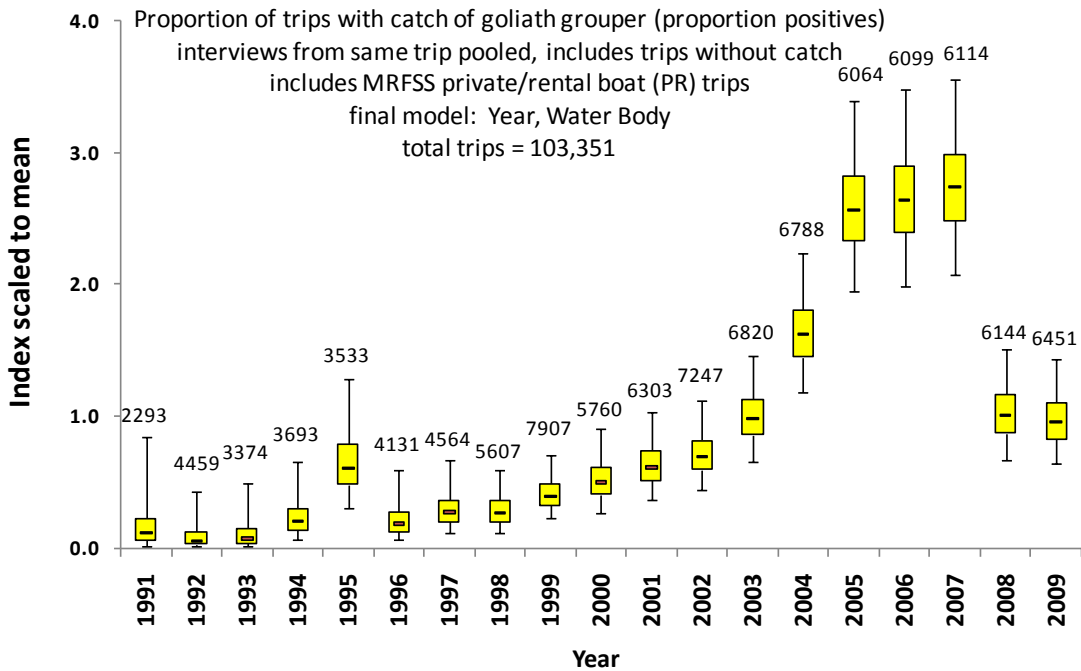


b. Distribution of standardized residuals





**Figure 3.** Standardized catch rate (proportion positive) of goliath grouper per intercept with intercepts from the private/rental boat (PR) mode only and from southwest (MRFSS FHS region 2) and southeast Florida (MRFSS FHS region 4). PR intercepts from the Florida Keys were excluded. Interviews from the same trip were pooled. The vertical lines are the 95% confidence interval, the box is the inter-quartile range, the horizontal line is the median of the outcomes, and the number above the lines are the number of intercepts for the year.



**Figure 4.** Plot of standardized means of the REEF index for southeast Florida (including the Florida Keys), the ENP Angler Creel Survey index, and the MRFSS proportion of trips positive for catches of goliath grouper.

