MRIP Recreational Survey Data for Gray triggerfish and Blueline tilefish in the Atlantic

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INTRODUCTION

Recreational survey data for gray triggerfish and blueline tilefish from the Marine Recreational Fisheries Statistics Survey (MRFSS) and the Marine Recreational Information Program (MRIP) in the Atlantic are presented, including summaries of catch estimates and sampling proportions. Issues addressed include the calibration of MRFSS charterboat estimates back in time, 1981-1985 adjustments and substitutions, calibration of MRFSS estimates for 1981-2003 to MRIP estimates, and estimating recreational landings in weight.

MRFSS and MRIP

The MRFSS began in 1981 and provides information on participation, effort, and species-specific catch. Data are collected to provide catch and effort estimates in two-month periods ("waves") for each recreational fishing mode (shore fishing, private/rental boat, charterboat, or headboat/charterboat combined) and area of fishing (inshore, state Territorial Seas, U.S. Exclusive Economic Zone) by state. Starting in 1986, MRFSS stopped covering headboats in the Gulf of Mexico and South Atlantic. In recent years MRIP has re-incorporated headboats in some states, but these headboat estimates are not official. Official headboat estimates for the South Atlantic and Gulf of Mexico come from the Headboat Survey. Before 1986, charterboats and headboats were combined as one mode in the South Atlantic and the Gulf of Mexico. In the mid and North Atlantic, charterboats and headboats remained combined until 2003. Beginning in 2004, the charter and headboat modes in these regions were separated. No survey was conducted in wave 1 of 1981. Catch estimates are made for strata used in the intercepts: fish landed whole and observed by the samplers ("Type A"), fish reported as killed by the fishers ("Type B1") and fish reported as released alive by the fishers ("Type B2").

For Hire Survey and calibration of old method estimates with the new method.
Two surveys within MRFSS provide the information described above: the "traditional" MRFSS and the For-Hire Survey (FHS), or "new charterboat method," discussed below. The traditional MRFSS design is based on an intercept survey of anglers and telephone survey of coastal households and has been used since the inception of the MRFSS. It applies to all fishing modes included in the survey. For 1981-1985 in TX to ME and for 1981-2003 in VA to ME, the traditional MRFSS covered charterboats and headboats as a combined mode.

In 1998, the FHS began providing estimates for charterboats in the Gulf of Mexico. The traditional MRFSS and FHS operate concurrently, but the FHS estimates have been phased in as the "official" charterboat estimates starting with LA through FL West Coast in 2000. (This was expanded to the FL East Coast in 2003 and to GA through ME starting in wave 2 of 2005.) There are also ‘unofficial’ FHS estimates from GA-ME in 2004. This new method was

needed because of the low number of charterboat anglers contacted in the traditional telephone survey of coastal households.
In the FHS, directories of charterboats are developed for each state and are continuously updated. Each week, a sample of 10% of the listed charterboats are surveyed by telephone to ask about their fishing effort during the previous week, including the number of vessel trips, the number of anglers, areas fished and other information. Validation surveys by field samplers directly observe some charterboat effort on the docks to allow correction of over and under-reporting of trips in the telephone survey. The MRFSS intercept survey of anglers at boat access sites is conducted as usual, encountering some charterboats. This allows calculation of a correction factor for charterboat trips on unlisted boats (not in the charterboat directory): (total intercepted cbt angler trips) / (intercepted cbt angler trips on listed boats).

Thus the estimate of total charterboat angler trips for an area of fishing is:

Estimated total charterboat angler trips =

(total charterboat angler trips in on listed boats) * (correction factor for trips on unlisted boats) where the total charterboat angler trips on listed boats is based on the 10% sample in the telephone survey and corrected for over/under reporting by the validation survey.

The FHS estimates of catch then follow in the same manner as for the traditional MRFSS, with the mean catch per trip coming from the MRFSS intercept survey. The pilot study of new charterboat methods in the Gulf of Mexico found that the annual effort at the state and Gulf level were not significantly different between the pilot study and the traditional MRFSS. However, the effort from the new charterboat methods differed from the traditional MRFSS in the distributions of effort by area and season.

Conversion factors have been estimated for the South Atlantic to calibrate the traditional MRFSS charterboat/headboat estimates in 1981-1985 (SEDAR28-DW-12, Matter et.al., 2012) and the traditional MRFSS charterboat estimates in 1986-2003 (SEDAR16-DW-15, Sminkey, 2008) with the FHS. For the Mid-Atlantic calibration factors were developed for 1981-2003 (SEDAR17-Data Workshop Report, 2008). 1986-2003 South Atlantic calibration factors were updated in 2011 (SEDAR25-Data Workshop Report, 2011). The relationship between the old charterboat method estimates of angler trips and the FHS was used to estimate the conversion factors. Since these factors are based on effort, they can be applied to all species' landings. Table 1 shows the conversion factors and standard errors (in parentheses) for the South Atlantic and the Mid-Atlantic.

MRIP estimates and the calibration of MRFSS estimates

The Marine Recreational Information Program (MRIP) was developed to provide more accurate recreational catch estimates by accounting for potential biases such as possible differences in catch rates at high-activity and low-activity fishing sites, or the amount of fishing occurring at different parts of the day. Revised catch and effort estimates, based on this improved estimation method, were released on January 25, 2012. These estimates are available for the Atlantic and Gulf Coasts for 2004 through 2011. To learn more about the peer-reviewed re-estimation process, along with any implications for fisheries science and management, visit **www.countmyfish.noaa.gov**. (NOAA Fisheries, Office of Science and Technology). Table 2 shows the differences between Atlantic gray triggerfish MRIP estimates and the MRFSS estimates for the time period 2004-2011. Table 3 shows the differences between Atlantic blueline tilefish MRIP estimates and the MRFSS estimates for the time period 2004-2011.

Since new MRIP estimates are only available for a portion of the recreational time series that the MRFSS covers, calibration factors between the MRFSS estimates and the MRIP estimates were developed in order to maintain one consistent time series for the recreational estimates. The MRFSS to MRIP calibration process is detailed in SEDAR31-DW25 and SEDAR32-DW02. Tables 4 and 5 show the ratio estimators used in the calibration for gray triggerfish and blueline tilefish, respectively. Figures 1 and 2 show the MRFSS versus MRIP adjusted AB1 estimates for Atlantic gray triggerfish and blueline tilefish, respectively.

Monroe County, Florida

Official MRFSS Florida estimates are divided into two estimates by coasts, Florida east coast (FLE) and Florida west coast (FLW). FLE includes the area from the GA/Florida border to the Miami-Dade/Monroe county line. FLW includes Monroe county through the AL/Florida border. Unofficial post-stratified estimates are available that break up the state in to five regions, including Monroe county (fl_reg=3). Table 6 shows the Monroe county, Florida AB1 estimates by year for gray triggerfish and blueline tilefish.

Gray triggerfish is a reef associated species and Monroe county catches are most likely from the Atlantic side of the Keys. SEDAR 9 (Gulf of Mexico gray triggerfish) included Monroe county landings; however, these landings were low and will have a limited effect if they are excluded from the Gulf stock in the future. Blueline tilefish is a deep-water species and Monroe county catches are most likely from the Atlantic side of the Keys. This species would not be associated with the shallow Gulf waters of Monroe county. Tables and figures in this report (excluding the MRFSS versus MRIP tables and figures) include the Monroe county landings for both species as part of the Atlantic stock.

Calculating landings estimates in weight

The MRFSS and the MRIP surveys use different methodologies to estimate landings in weight. To apply a consistent methodology over the entire recreational time series, the Southeast Fisheries Science Center (SEFSC) implemented a method for calculating average weights for the MRIP (and MRIP adjusted) landings. This method is described in SEDAR32-DW-02. Tables 7 and 8 show the MRIP estimated landings in weight by year for Atlantic gray triggerfish and blueline tilefish, respectively.

Variances

Variances are provided by MRFSS/MRIP for their recreational catch estimates. Variances are adjusted to take into account the variance of the conversion factor when an adjustment to the estimate has been made (FHS and MRIP conversions). However, the variance estimates of the charter and headboat modes in 1981-1985 are missing. This is due to the MRIP calibration procedure, which requires the combined charter/headboat mode to be split in order to apply the MRIP adjustment to the charter mode back to 1981. In addition variance estimates are not available for weight estimates generated through the SEFSC method described above.

Unidentified Balistidae landings

Landings from the Leatherjacket family are shown in Tables 9 and 10. Table 9 shows the unidentified Balistidae landings by year and state. Table 10 shows the Balistidae landings (in number and by percentage) for gray triggerfish, ocean triggerfish, and queen triggerfish. A percentage of the unidentified Balistidae landings should be allocated to gray triggerfish. In SEDAR 9 (Gulf of Mexico gray triggerfish) all the unidentified Balistidae landings were considered gray triggerfish. In the Atlantic, however, ocean triggerfish and queen triggerfish make up a larger percentage of the total landings from the Balistidae family.

1981, wave 1 East Florida estimates

As previously discussed, the MRFSS began in 1981, wave 2. In the East coast of Florida, catch needs to be estimated for 1981, wave 1. The standard method used in other SEDARs (gag, red grouper, Spanish mackerel, cobia) is to fill this gap by determining the proportion of wave 1 to other waves in years 1982-1984 by fishing mode and area. These proportions are then used to estimate AB1 (in numbers and weight) and B2 catch estimates (and variances when available) in wave 1 in 1981 from the estimated catches in other waves of that year. Tables in this report do not include this substitution.

CATCH ESTIMATES and SAMPLING PROPORTIONS

Tables 11-15 show the MRIP catch estimates and CVs by mode and by state for gray triggerfish and blueline tilefish in the Atlantic. In the tables, estimated A+B1 is the catch that was killed and B2 is the catch that was released alive. Tabulated estimates use the new charterboat method (FHS) or are calibrated to the new using the discussed calibration factors. MRIP or MRIP adjusted landings are used for all years (except for headboat mode 1981-1985). Tables 16, 17, and 18 show the number of trips with measured gray triggerfish from the MRFSS/MRIP survey by year, mode and state. Table 19 shows the number of trips with measured blueline tilefish from the MRFSS/MRIP survey by year, mode and state.

References

General overview of the MRFSS has been adapted from the following:
Recreational Survey Data for Gag and Black Grouper in the Gulf of Mexico. Patty Phares, Vivian Matter, and Steve Turner. National Marine Fisheries Service, Southeast Fisheries Science Center, Sustainable Fisheries Division, January, 2006. Sustainable Fisheries Division Contribution No. SFD-2006-008. SEDAR10-DW-26.

Estimated Conversion Factors for Calibrating MRFSS Charterboat Landings and Effort Estimates for the Gulf of Mexico in 1981-1997 with the For Hire Survey Estimates with Application to Red Snapper Landings. Guillermo A. Diaz and Patty Phares. National Marine Fisheries Service, Southeast Fisheries Science Center, Sustainable Fisheries Division, August, 2004. Sustainable Fisheries Division Contribution No. SFD-2004-036. SEDAR7-AW-03

Estimated conversion factors for calibrating MRFSS charterboat landings and effort estimates from the Southeastern US (North Carolina to Florida-east coast) in 1981-2003 with For-Hire Survey estimates with application to King Mackerel landings. Tom Sminkey. National Marine Fisheries Service, Office of Science and Technology, February 2008. SEDAR16-DW-15.

Estimated Recreational Catch in Weight: Method for Filling in Missing Weight Estimates from the Recreational Surveys with Application to Yellowedge Grouper, Tilefish (golden), and Blueline Tilefish. Vivian M. Matter and Stephen C. Turner. National Marine Fisheries Service, Southeast Fisheries Science Center, Sustainable Fisheries Division, March, 2010. Sustainable Fisheries Division Contribution No. SFD-2010-003. SEDAR22-DW-16.

TABLES AND FIGURES

Table 1. Atlantic MRFSS charterboat conversion factors and standard errors (in parentheses).

Table 1a) Apply to 1981-1985 charterboat/headboat mode in the South Atlantic.

	WAVE					
STATE	1	2	3	4	5	6
NC	-	2.151 (0.12)	2.294 (0.12)	1.444 (0.12)	1.763 (0.12)	0.857 (0.12)
SC	-	1.035 (0.04)	1.085 (0.04)	1.437 (0.04)	0.891 (0.04)	0.750 (0.04)
GFE	0.845 (0.02)	0.951 (0.02)	0.985 (0.02)	1.016 (0.02)	0.811 (0.02)	0.696 (0.02)

Table 1b) Apply to 1986- 2002 charterboat mode in FLE
*FHS began in the east coast of Florida in 2003.

	Wave					
Area	1	2	3	4	5	6
INSHORE	1.600 (0.65)	2.786 (0.65)	2.201 (0.65)	2.894 (0.65)	1.630 (0.65)	2.386 (0.65)
OCEAN	0.664 (0.10)	0.852 (0.10)	0.828 (0.10)	1.006 (0.10)	0.478 (0.10)	0.549 (0.10)

Table 1c) Apply to 1986- 2003 charterboat mode in GA and SC

	Wave				
Area	2	3	4	5	6
INSHORE	1.635 (0.90)	3.100 (0.90)	2.092 (0.90)	0.931 (0.90)	0.757 (0.90)
OCEAN	0.939 (0.36)	1.272 (0.33)	2.161 (0.32)	0.835 (0.33)	0.638 (0.36)

Table 1d) Apply to 1986- 2003 charterboat mode in NC

	Wave				
Area	2	3	4	5	6
INSHORE	11.850 (3.48)	10.026 (2.63)	6.616(2.84)	3.766 (2.84)	9.415 (3.11)
OCEAN	2.188 (0.58)	2.504 (0.58)	1.565 (0.60)	2.102 (0.60)	0.661 (0.60)

Table 1e) Apply to 1981-2003 charterboat mode in the mid-Atlantic
*originally only said to apply to 1986-2003 data, but the cbt/hbt combined mode in sub_reg=5 was consistent from 1981-2003 and there is no HBS data providing headboat estimates in this sub-region.

	Wave				
State	2	3	4	5	6
DE / MD	1.294 (0.52)	1.599 (0.54)	1.930 (0.54)	0.861 (0.52)	1.171 (0.56)
NJ	1.289 (0.36)	1.179 (0.34)	1.644 (0.34)	0.809 (0.34)	1.115 (0.36)
NY	1.187 (0.48)	2.048 (0.54)	2.665 (0.48)	1.210 (0.51)	0.617 (0.48)
VA	0.770 (0.25)	0.680 (0.21)	0.761 (0.21)	0.324 (0.22)	0.313 (0.22)

Table 2. Gray triggerfish MRIP vs MRFSS estimates of landings (number of fish) for the Atlantic (sub-regions 4-6) 2004-2011. See accompanying graph below table.

Estimate Status	Year	Fishing Year	Common Name	MRFSS Unweighted Total Harvest (A+B1)	MRIP Weighted Total Harvest (A+B1)	Difference: MRIP - MRFSS	% Change from MRFSS	PSE for MRIP Weighted Total Harvest (A + B1)
FULL YEAR	2004	Calendar Year (Jan 1 - Dec 31)	GRAY TRIGGERFISH	179,020	183,371	4,351	2.43%	23.0
FULL YEAR	2005	Calendar Year (Jan 1 - Dec 31)	GRAY TRIGGERFISH	198,280	111,387	-86,894	-43.8%	18.7
FULL YEAR	2006	Calendar Year (Jan 1 - Dec 31)	GRAY TRIGGERFISH	95,108	90,791	-4,318	-4.54%	17.3
FULL YEAR	2007	Calendar Year (Jan 1 - Dec 31)	GRAY TRIGGERFISH	243,494	240,030	-3,464	-1.42%	15.7
FULL YEAR	2008	Calendar Year (Jan 1 - Dec 31)	GRAY TRIGGERFISH	160,899	206,515	45,616	28.4%	19.1
FULL YEAR	2009	Calendar Year (Jan 1 - Dec 31)	GRAY TRIGGERFISH	266,562	253,420	-13,142	-4.93%	16.1
FULL YEAR	2010	Calendar Year (Jan 1 - Dec 31)	GRAY TRIGGERFISH	179,752	158,446	-21,306	-11.9%	13.6
FULL YEAR	2011	Calendar Year (Jan 1 - Dec 31)	GRAY TRIGGERFISH	130,780	103,351	-27,429	-21.0%	17.7

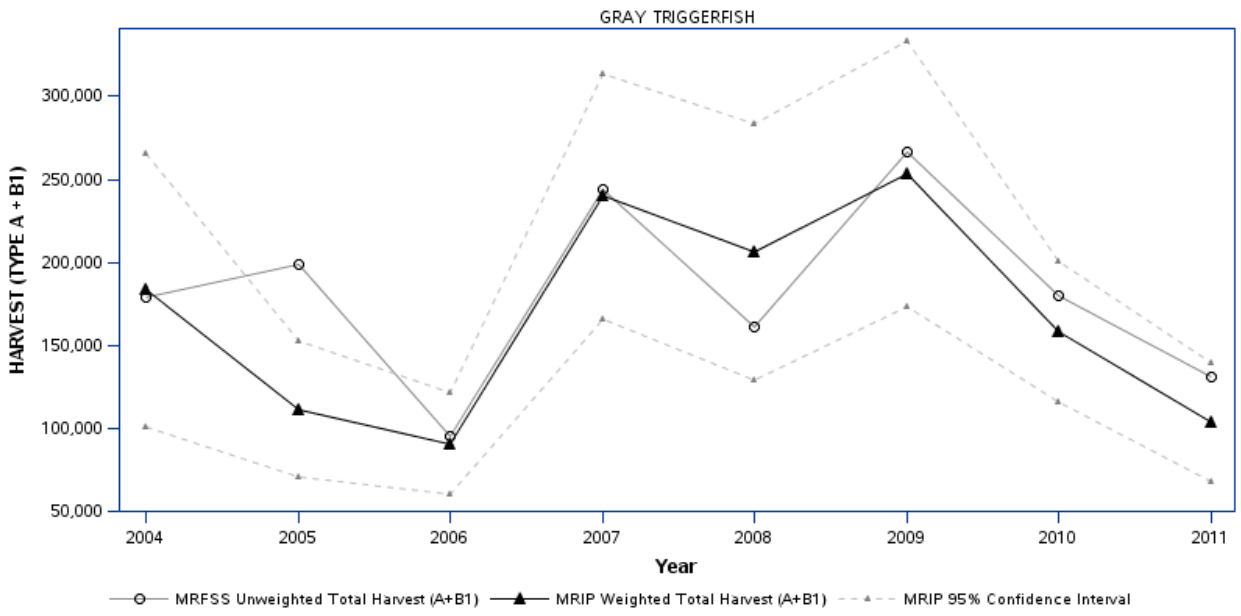

Table 3. Blueline tilefish MRIP vs MRFSS estimates of landings (number of fish) for the Atlantic (sub-regions 4-6) 2004-2011. See accompanying graph below table.

YEAR	MRFSS_ab1	MRIP_ab1
2004	789	1,823
2005	9,306	6,615
2006	65,902	54,991
2007	79,184	80,207
2008	83,274	71,567
2009	22,104	19,924
2010	10,921	8,688
2011	10,523	8,225
Grand Total	**282,003**	**252,041**

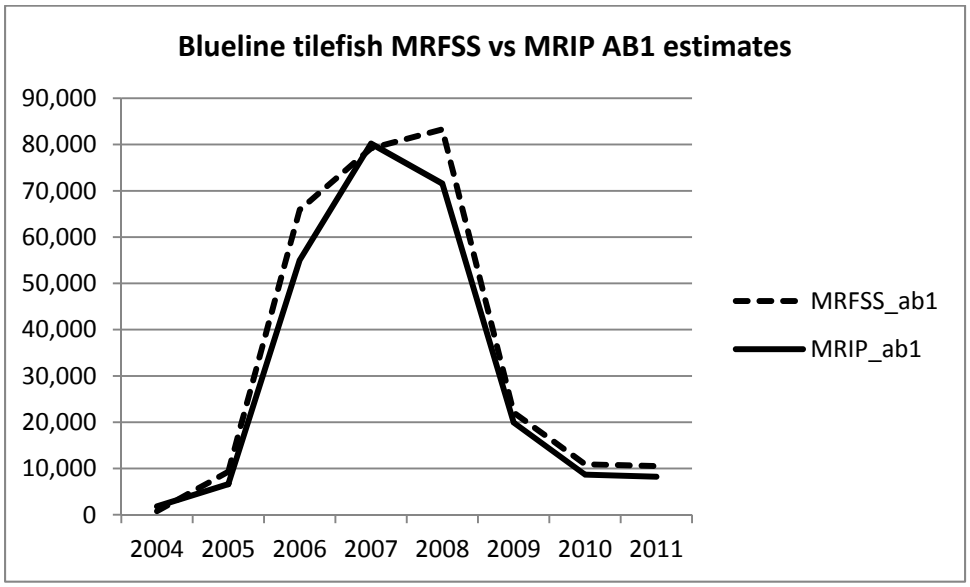

Table 4. Atlantic gray triggerfish ratio estimators for adjusting MRFSS numbers and variance estimates (AB1 and B2) to MRIP numbers and variances for 1981-2003. The variances of the numbers ratio estimators are also shown.

4a) South Atlantic gray triggerfish

	Numbers Ratio Estimator		Variance Ratio Estimator		Variance of Numbers Ratio Estimator	
MODE	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**
Charterboat	1.056788825	0.813218928	2.693635063	1.953466401	0.018505651	0.006452405
Private	0.947015805	0.911165706	1.535883173	2.966602244	0.008591749	0.003592274
Shore	0.548358547	0.532604492	0.334205942	0.500412821	0.001946289	0.005423957

4b) Mid-Atlantic gray triggerfish

	Numbers Ratio Estimator		Variance Ratio Estimator		Variance of Numbers Ratio Estimator	
MODE	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**
Charterboat/Headboat	1.021843616	0.401464718	3.707315149	0.230432502	0.00435919	0.016939357
Private	0.754616217	0.9105585	1.007607038	3.537733437	0.016575618	0.015200483
Shore	0.697249304	0.498368602	0.401640228	0.1998209	0.003767526	0.00207194

4c) North Atlantic gray triggerfish

	Numbers Ratio Estimator		Variance Ratio Estimator		Variance of Numbers Ratio Estimator	
MODE	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**
Charterboat/Headboat	1.384189827	1.492520608	2.535333875	2.218495179	0.010978338	
Private	1.307192489	0.802146593	2.067417525	0.674071113	0.207649243	0.010383869
Shore		0.264659498		0.070287824		
All	1.326858533	0.754169048	2.104508705	0.644742799	0.132017509	0.014817160

Table 5. Atlantic blueline tilefish ratio estimators for adjusting MRFSS numbers and variance estimates (AB1 and B2) to MRIP numbers and variances for 1981-2003. The variances of the numbers ratio estimators are also shown.

5a) South Atlantic blueline tilefish

	Numbers Ratio Estimator		Variance Ratio Estimator		Variance of Numbers Ratio Estimator	
MODE	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**
Charterboat	0.940957836	3.386667186	1.683544932	95.79116016	0.002568455	1.864214942
Private	0.792645875	0.431283037	0.923946375	0.525147161	0.006332209	0.000000718
Shore						
All	0.895581082	1.875209525	1.372706765	17.71744704	0.001784787	0.076967739

5b) Mid-Atlantic blueline tilefish

	Numbers Ratio Estimator		Variance Ratio Estimator		Variance of Numbers Ratio Estimator	
MODE	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**
Charterboat/Headboat	0.518119641	2.733161358	0.442027215	2.522457909	0.003855225	0.518119641
Private						
Shore						
All	0.518119641	2.733161358	0.442027215	2.522457909	0.003855225	0.518119641

5c) blueline tilefish (all regions)

	Numbers Ratio Estimator		Variance Ratio Estimator		Variance of Numbers Ratio Estimator	
MODE	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**
All	0.893555073	1.877208483	1.376589982	17.71666722	0.001882132	0.076914683

Figure 1. MRFSS AB1 estimates (number of fish) versus MRIP adjusted AB1 estimates for Atlantic gray triggerfish 1981-2003.

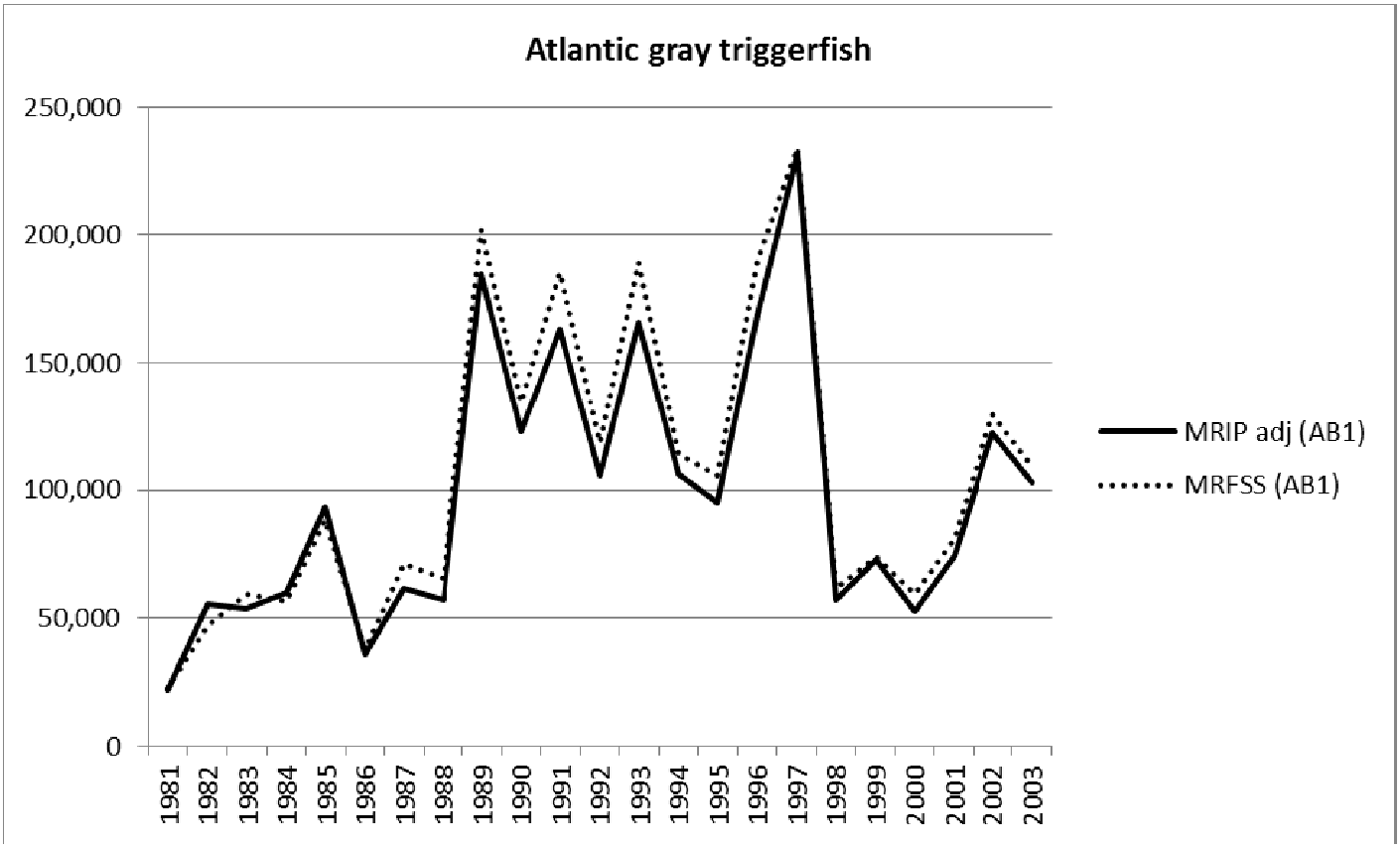

Figure 2. MRFSS AB1 estimates (number of fish) versus MRIP adjusted AB1 estimates for Atlantic blueline tilefish 1981-2003.

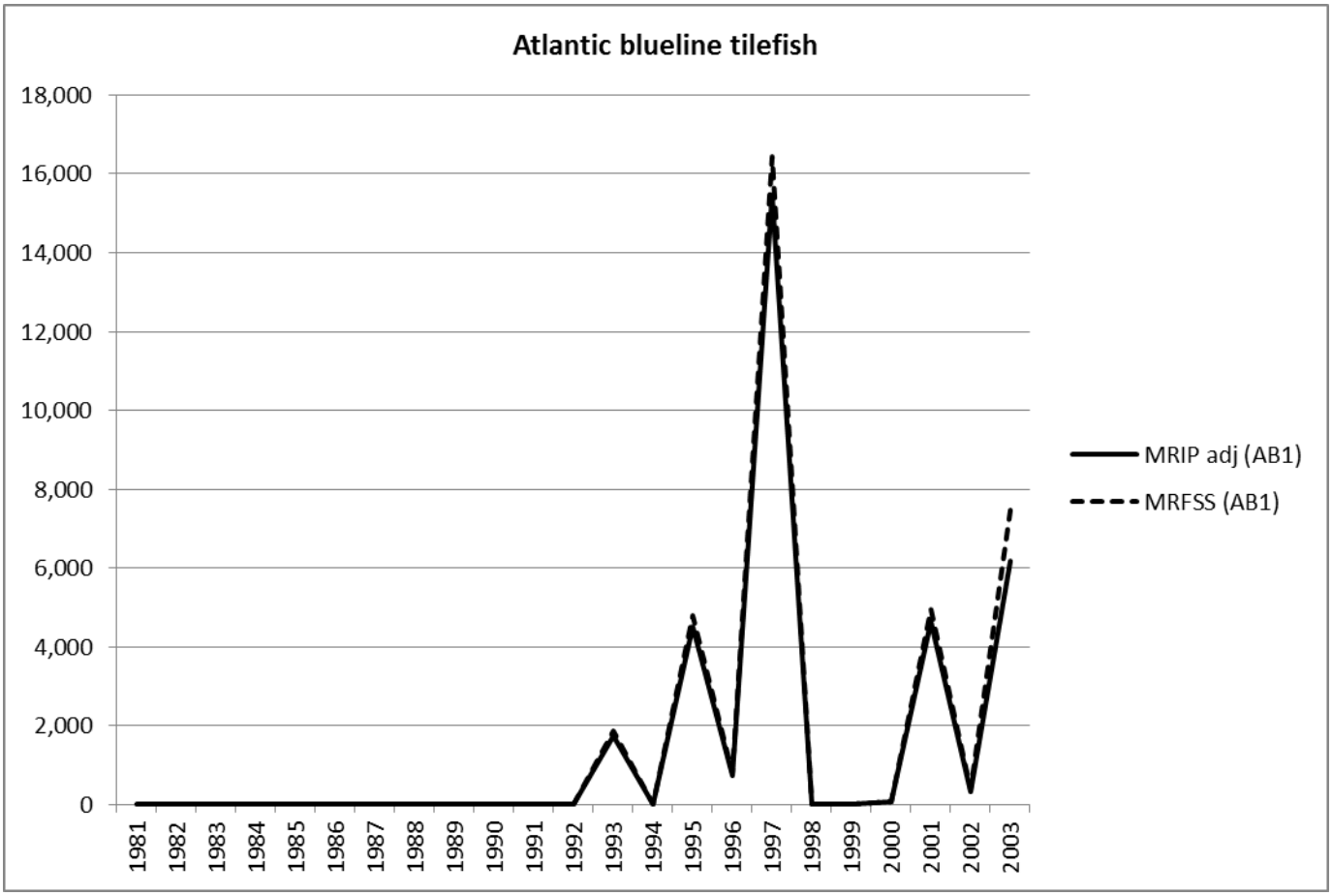

Table 6. Monroe county, Florida MRIP AB1 estimates (number of fish) for gray triggerfish and blueline tilefish.

YEAR	AB1 gray triggerfish	blueline tilefish
1981	19,173	0
1982	4,125	0
1983	360	0
1984	6,167	0
1985	0	0
1986	0	0
1987	0	207
1988	8,122	0
1989	2,517	0
1990	2,461	0
1991	22,631	0
1992	7,600	0
1993	4,693	671
1994	6,218	0
1995	2,000	0
1996	2,501	0
1997	8,242	334
1998	15	0
1999	3,039	776
2000	1,749	23
2001	258	142
2002	238	52
2003	1,844	615
2004	469	246
2005	305	1,175
2006	15,698	136
2007	11,808	2,292
2008	104	2,402
2009	9,024	3,577
2010	5,848	3,025
2011	510	0
Grand Total	**147,719**	**15,673**

Table 7. Atlantic gray triggerfish MRIP estimates of landings (whole weight in pounds) using the SEFSC weight estimation method by year and source.

lbsest_SECwwt	lbsestSEC_source*							
YEAR	s	sr	sry	srys	srysm	srysmw	srysmwa	Grand Total
1981		47,941						47,941
1982		121,343						121,343
1983		117,011						117,011
1984	3,984		25,941	67,703				97,627
1985		204,499						204,499
1986	7,971	69,152						77,123
1987		133,773						133,773
1988		124,257						124,257
1989	2,889		472,368					475,258
1990	1,387	39,332	306,209					346,929
1991	2,293	227,892	141,697					371,882
1992	1,880	29,983	192,964	50,851				275,679
1993	1,140		185,846	45,011	39,430		17,499	288,925
1994	2,343	42,535	77,827	531	46,202	11,353	61,578	242,368
1995		58,561	87,977	5,881	30,233		9,557	192,209
1996	2,964	128,908	78,679	1,372	32,759	51,682	67,365	363,729
1997	1,802		397,356	28,127	60,535			487,820
1998	3,366	21,177	115,461					140,004
1999		8,473	1,554	101,297	43,122	16,018		170,464
2000		28,822	83,842					112,664
2001		41,253	1,695	102,459	15,411		8,802	169,620
2002	1,171		54,318	151,348	66,700			273,537
2003	6,997	21,689	4,746	124,313	63,121			220,866
2004	14,705		189,858	115,728	56,198		6,685	383,174
2005	3		94,433	123,967	15,821			234,224
2006		8,266	2,103	38,404	149,131			197,905
2007	4,211		55,332	118,832	213,223	2,945	87,354	481,896
2008			131,991	129,162	227,042			488,195
2009	585		34,734	222,728	250,317	8,740	3,676	520,781
2010	38		69,893	10,509	269,935	4,774	9,577	364,726
2011		16,545		49,346	145,665	2,189	36,713	250,457
Grand Total	**59,730**	**1,491,412**	**2,806,823**	**1,487,569**	**1,724,845**	**97,701**	**308,805**	**7,976,885**

* The hierarchy used for each estimate of weight is recorded in the variable 'lbsestSEC_source' and uses the first letter of each variable used from the hierarchy (**s**pecies, **r**egion, **y**ear, **s**tate, **m**ode, **w**ave, and **a**rea). For example an estimate with 'lbsestSEC_source'=srys, would have used an average weight from the combined samples in for the strata defined by that species, region, year, and state. All modes, waves, and areas in that stratum would have been included.

Table 8. Atlantic blueline tilefish MRIP estimates of landings (whole weight in pounds) using the SEFSC weight estimation method by year and source.

lbsest_SECwwt	lbsestSEC_source*							
YEAR	s	sr	sry	srys	srysm	srysmw	srysmwa	Grand Total
1981								
1982								
1983								
1984								
1985								
1986								
1987								
1988								
1989								
1990								
1991								
1992								
1993		8,383						8,383
1994								
1995		21,615						21,615
1996		3,531						3,531
1997		74,276						74,276
1998								
1999								
2000		272						272
2001		22,319						22,319
2002		1,499						1,499
2003		29,639						29,639
2004		8,759						8,759
2005					25,960			25,960
2006					58,657	25,328	155,344	239,329
2007	1,656			71,162	9,608		327,867	410,293
2008	430		651	98,691	3,580	7,504	207,282	318,138
2009	1,317		15,887	51,727	43,407		4,103	116,441
2010			15,511	8,223	18,813	12,596		55,142
2011			17,607	2,531	27,429			47,567
Grand Total	**3,403**	**170,293**	**49,656**	**232,335**	**187,453**	**45,428**	**694,596**	**1,383,163**

* The hierarchy used for each estimate of weight is recorded in the variable 'lbsestSEC_source' and uses the first letter of each variable used from the hierarchy (**s**pecies, **r**egion, **y**ear, **s**tate, **m**ode, **w**ave, and **a**rea). For example an estimate with 'lbsestSEC_source'=srys, would have used an average weight from the combined samples in for the strata defined by that species, region, year, and state. All modes, waves, and areas in that stratum would have been included.

Table 9. Unidentified Atlantic Balistidae (leatherjacket family) MRIP AB1 estimates (number of fish) by year and state.

YEAR	FLKEYS	FLE	GA	SC	NC	VA	MD	DE	NJ	NY	RI	MA	G. Total
1981	0	2,507	0	0	0	0	0	0	0	0	0	0	2,507
1982	0	1,437	0	1,351	0	0	0	0	0	0	0	0	2,788
1983	0	4,103	0	0	0	3,970	587	718	0	0	0	1,446	10,823
1984	0	10,964	0	1,788	0	1,940	0	0	0	0	1,052	0	15,745
1985	534	5,196	0	0	3,479	396	0	0	0	0	0	0	9,605
1986	0	0	0	0	0	2,018	0	0	5,244	0	0	0	7,262
1987	1,104	6,522	599	0	1,984	0	0	0	0	0	0	0	10,209
1988	0	0	0	0	138	0	0	0	0	0	0	0	138
1989	0	15,478	0	0	234	0	0	0	11,274	0	0	0	26,986
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	6,820	0	0	0	295	0	0	0	0	0	0	0	7,115
1992	0	3,165	0	0	1,138	0	0	0	0	1,679	0	0	5,982
1993	0	2,282	0	0	644	0	0	0	0	0	0	0	2,927
1994	0	8,673	0	0	0	0	0	0	0	0	0	0	8,673
1995	0	951	0	0	4,557	0	0	0	0	0	0	0	5,508
1996	986	0	0	0	4,122	0	0	0	0	0	0	0	5,108
1997	0	3,951	0	0	451	0	0	0	0	0	0	0	4,402
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	3,703		0	4,138	0	0	0	0	1,732	0	0	9,573
2001	0	30	0	0	0	0	0	0	0	0	0	0	30
2002	0	1,475	0	0	0	0	0	0	0	0	0	0	1,475
2003	0	516		2,507	733	0	0	0	0	0	0	0	3,756
2004	0	6,626	0	0	0	0	0	0	0	0	0	0	6,626
2005	2,004	3,911	0	0	0	0	0	0	0	0	0	0	5,915
2006	0	4,159	0	0	0	0	0	0	0	0	0	0	4,159
2007	7,045	0	0	0	0	0	0	0	0	0	0	0	7,045
2008	0	2,599	0	0	0	0	0	0	0	0	0	0	2,599
2009	63	0	0	0	0	0	0	0	0	0	0	0	63
2010	0	838	0	0	0	0	0	0	0	0	0	0	838
2011	1,497	0	0	0	0	0	0	0	0	0	0	653	2,150
G. Total	**20,054**	**89,086**	**599**	**5,647**	**21,913**	**8,324**	**587**	**718**	**16,518**	**3,411**	**1,052**	**2,099**	**170,007**

Table 10. Atlantic Balistidae family MRIP AB1 estimates (number of fish) by species and percentage of total.

YEAR	gray triggerfish		ocean triggerfish		queen triggerfish		Grand Total
1981	41,118	55%	25,387	34%	8,718	12%	75,223
1982	59,673	49%	29,669	24%	33,675	27%	123,017
1983	53,976	45%	41,203	34%	25,425	21%	120,604
1984	66,015	80%	2,741	3%	14,106	17%	82,863
1985	93,640	38%	1,663	1%	154,062	62%	249,365
1986	35,723	36%	57,873	58%	6,992	7%	100,588
1987	61,377	87%	7,118	10%	2,042	3%	70,537
1988	65,016	55%	48,295	41%	4,957	4%	118,268
1989	187,562	88%	6,117	3%	20,345	10%	214,024
1990	125,600	96%	359	0%	4,515	3%	130,474
1991	185,833	98%	0	0%	2,867	2%	188,700
1992	113,425	85%	6,286	5%	13,557	10%	133,267
1993	170,453	82%	27,310	13%	9,616	5%	207,379
1994	112,662	84%	21,240	16%	863	1%	134,765
1995	97,203	66%	40,314	28%	8,863	6%	146,380
1996	171,338	93%	8,796	5%	4,737	3%	184,870
1997	240,215	85%	37,729	13%	3,036	1%	280,979
1998	57,290	72%	13,657	17%	8,882	11%	79,829
1999	75,580	78%	10,193	11%	10,754	11%	96,527
2000	54,236	78%	9,836	14%	5,795	8%	69,867
2001	74,431	92%	6,222	8%	403	0%	81,057
2002	122,547	86%	14,938	10%	4,813	3%	142,299
2003	105,002	95%	4,114	4%	1,484	1%	110,601
2004	183,840	97%	1,245	1%	4,549	2%	189,633
2005	111,692	93%	2,097	2%	6,466	5%	120,255
2006	106,489	98%	1,284	1%	677	1%	108,450
2007	251,838	98%	4,554	2%	267	0%	256,659
2008	206,618	93%	9,758	4%	6,499	3%	222,875
2009	262,444	93%	18,658	7%	0	0%	281,103
2010	164,294	99%	1,168	1%	589	0%	166,051
2011	103,860	98%	1,108	1%	554	1%	105,522
G. Total	**3,760,990**	**82%**	**460,933**	**10%**	**370,108**	**8%**	**459203118.5%**

Table 11. Estimated MRIP AB1 catch (number landed) and coefficients of variations (CV) by mode for gray triggerfish in the Atlantic. MRIP estimates and FHS charter estimates are used (or calibrated to MRIP and FHS). *CVs for all modes in 1981-1985 only reflect the private and shore mode CVs, since charter and headboat mode CVs are unavailable.

	Cbt		Cbt/Hbt		Hbt		Priv		Shore		G.Total	
YEAR	**AB1**	**CV**	**AB1**	**CV**	**AB1**	**CV**	**AB1**	**CV**	**AB1**	**CV**	**AB1**	**CV**
1981	964		0	0.00	502		38,981	0.60	670	1.02	41,118	0.57*
1982	13,539		745	1.09	11,728		30,624	0.35	3,038	0.36	59,673	0.18*
1983	2,375		0	0.00	1,955		43,232	0.33	6,413	0.48	53,976	0.27*
1984	9,075		0	0.00	6,447		48,297	0.33	2,196	0.43	66,015	0.24*
1985	10,053		5,873	1.76	8,831		68,427	0.44	456	0.58	93,640	0.34*
1986	856	0.83	471	1.46			34,396	0.30	0	0.00	35,723	0.29
1987	2,094	0.65	4,583	1.92			46,896	0.29	7,805	0.43	61,377	0.27
1988	5,011	0.72	0	0.00			53,383	0.29	6,622	0.28	65,016	0.24
1989	3,112	0.55	5,150	0.57			177,567	0.38	1,732	0.38	187,562	0.36
1990	4,340	0.38	2,652	0.86			115,892	0.23	2,716	0.25	125,600	0.22
1991	7,676	0.38	31,340	0.73			123,612	0.19	23,204	0.48	185,833	0.19
1992	25,682	0.27	1,584	0.85			75,011	0.15	11,149	0.22	113,425	0.12
1993	25,942	0.43	29,580	0.86			97,545	0.18	17,385	0.23	170,453	0.19
1994	47,878	0.30	4,918	0.88			47,315	0.18	12,551	0.25	112,662	0.16
1995	38,195	0.37	5,193	1.08			47,994	0.25	5,820	0.23	97,203	0.20
1996	48,015	0.48	3,227	0.87			112,438	0.32	7,658	0.28	171,338	0.25
1997	59,593	0.48	113,080	0.87			60,897	0.32	6,645	0.35	240,215	0.44
1998	13,425	0.44	2,454	0.95			36,360	0.42	5,051	0.38	57,290	0.29
1999	28,357	0.38	3,552	0.90			43,291	0.24	380	0.58	75,580	0.20
2000	8,276	0.67	3,544	1.06			34,300	0.29	8,116	0.38	54,236	0.23
2001	14,787	0.46	2,728	0.86			54,737	0.27	2,179	0.45	74,431	0.22
2002	30,189	0.42	22,206	0.62			63,700	0.20	6,453	0.47	122,547	0.19
2003	30,359	0.47	3,814	0.74			66,511	0.24	4,318	0.32	105,002	0.21
2004	38,252	0.17			12,510	0.50	126,187	0.32	6,891	0.78	183,840	0.23
2005	20,792	0.25			301	0.39	78,647	0.23	11,952	0.71	111,692	0.19
2006	19,544	0.22			353	0.34	85,933	0.18	658	0.72	106,489	0.15
2007	92,554	0.32			14,034	0.53	141,478	0.15	3,771	0.44	251,838	0.15
2008	26,044	0.37			1,186	0.55	177,181	0.22	2,208	0.59	206,618	0.19
2009	31,996	0.19			6,238	0.41	195,764	0.19	28,447	0.46	262,444	0.16
2010	42,639	0.19			1,378	0.43	115,375	0.17	4,902	0.70	164,294	0.13
2011	30,755	0.29			1,566	0.38	69,860	0.23	1,678	0.70	103,860	0.18
G.Total	**732,370**	**0.08**	**246,695**	**0.43**	**67,031**	**0.15**	**2,511,829**	**0.05**	**203,065**	**0.11**	**3,760,990**	**0.05**

Table 12. Estimated MRIP B2 catch (number released alive) and and coefficients of variations (CV) by mode for gray triggerfish in the Atlantic. MRIP estimates and FHS charter estimates are used (or calibrated to MRIP and FHS). *CVs for all modes in 1981-1985 only reflect the private and shore mode CVs, since charter and headboat mode CVs are unavailable.

	Cbt		Cbt/Hbt		Hbt		Priv		Shore		G. Total	
YEAR	**B2**	**CV**	**B2**	**CV**	**B2**	**CV**	**B2**	**CV**	**B2**	**CV**	**B2**	**CV**
1981	139		0	0.00	82		10,971	1.00	627	0.71	11,818	0.93*
1982	984		0	0.00	1,084		0	0.00	3,359	0.56	5,428	0.34*
1983	1,147		0	0.00	852		6,957	1.54	0	0.00	8,955	1.19*
1984	371		0	0.00	374		4,875	1.72	0	0.00	5,619	1.49*
1985	3,204		0	0.00	2,698		39,661	1.24	2,370	0.52	47,933	1.03*
1986	107	1.39	0	0.00			60,646	0.50	22,323	0.38	83,076	0.38
1987	0	0.00	0	0.00			53,214	0.46	1,146	0.45	54,360	0.45
1988	94	1.39	0	0.00			78,569	0.47	986	0.71	79,649	0.46
1989	0	0.00	0	0.00			179,053	0.33	13,396	0.35	192,449	0.31
1990	0	0.00	0	0.00			72,120	0.38	1,613	0.71	73,732	0.37
1991	1,401	1.11	1,457	0.45			191,995	0.24	61,724	0.34	256,577	0.20
1992	1,225	1.64	156	0.56			76,067	0.23	14,837	0.21	92,285	0.20
1993	0	0.00	465	1.49			52,378	0.46	5,252	0.30	58,096	0.42
1994	179	0.87	189	0.49			47,780	0.40	5,461	0.23	53,609	0.36
1995	2,405	0.81	332	0.49			61,361	0.38	3,683	0.31	67,781	0.34
1996	2,515	0.85	55	0.56			59,475	0.40	21,395	0.20	83,440	0.29
1997	13,620	1.22	1,663	0.56			64,767	0.28	4,255	0.30	84,305	0.29
1998	0	0.00	0	0.00			26,233	0.38	1,493	0.43	27,726	0.36
1999	7,223	0.47	224	0.56			41,544	0.31	1,859	0.36	50,849	0.26
2000	1,179	0.75	1,159	0.32			45,844	0.31	3,617	0.41	51,798	0.27
2001	5,060	0.40	78	0.51			52,703	0.32	4,417	0.37	62,257	0.28
2002	4,935	0.36	439	0.53			88,442	0.28	1,060	0.45	94,877	0.26
2003	4,262	0.31	0	0.00			123,920	0.31	3,169	0.38	131,351	0.30
2004	13,333	0.24			8	1.00	127,651	0.22	4,011	0.68	145,003	0.20
2005	11,450	0.30			0	0.00	112,292	0.20	7,164	0.63	130,906	0.17
2006	8,266	0.27			0	0.00	129,792	0.25	235	1.00	138,292	0.23
2007	13,729	0.28			0	0.00	231,864	0.20	9,533	0.57	255,126	0.19
2008	11,351	0.19			0	0.00	140,125	0.17	10,190	0.44	161,665	0.15
2009	11,590	0.41			587	0.57	196,587	0.37	14,841	0.50	223,606	0.33
2010	5,324	0.32			0	0.00	137,495	0.29	8,317	0.55	151,135	0.26
2011	6,951	0.40			51	0.45	60,743	0.23	1,134	0.79	68,879	0.21
G. Total	**132,042**	**0.15**	**6,217**	**0.23**	**5,736**	**0.06**	**2,575,122**	**0.07**	**233,469**	**0.12**	**2,952,586**	**0.06**

Table 13. Estimated **MRIP AB1 (number of fish landed)** by year and state for gray triggerfish in the Atlantic (sub-regions 4-6 and Monroe county, FL). Charterboat estimates use the FHS method or are calibrated to the FHS method. MRIP estimates (or MRFSS estimates adjusted to MRIP estimates) are used.

YEAR	FLKEYS	FLE	GA	SC	NC	VA	MD	DE	NJ	NY	CT	RI	MA	Grand Total
1981	19,173	21,142	0	343	460	0	0	0	0	0	0	0	0	41,118
1982	4,125	42,248	0	12,555	0	0	0	0	745	0	0	0	0	59,673
1983	360	43,197	0	114	0	0	0	0	10,305	0	0	0	0	53,976
1984	6,167	47,129	93	8,581	2,023	0	0	0	0	0	2,022	0	0	66,015
1985	0	71,006	231	15,344	1,186	516	0	0	5,357	0	0	0	0	93,640
1986	0	25,316	107	716	1,095	3,052	0	1,391	0	0	0	4,045	0	35,723
1987	0	30,089	214	811	3,336	1,708	0	0	4,583	20,635	0	0	0	61,377
1988	8,122	48,183	0	2,903	2,933	0	0	0	0	2,875	0	0	0	65,016
1989	2,517	139,364	446	5,287	4,175	613	2,911	587	3,157	27,038	1,251	215	0	187,562
1990	2,461	91,787	4,395	1,021	7,131	4,157	1,389	525	4,146	7,884	704	0	0	125,600
1991	22,631	95,213	1,941	3,750	3,413	3,996	6,668	1,457	42,102	3,498	0	1,163	0	185,833
1992	7,600	61,760	6,864	5,009	17,440	5,933	1,997	1,807	1,814	2,246	0	954	0	113,425
1993	4,693	45,285	16,245	7,614	37,747	22,649	0	1,740	29,110	4,792	0	578	0	170,453
1994	6,218	24,951	5,722	2,345	52,664	978	861	135	0	17,600	0	211	978	112,662
1995	2,000	28,075	14,305	4,066	21,807	1,193	4,395	2,626	8,153	10,583	0	0	0	97,203
1996	2,501	18,949	13,658	4,614	70,789	6,789	31,886	3,517	15,696	1,434	0	1,116	388	171,338
1997	8,242	32,873	11,358	15,738	44,347	2,243	4,228	3,961	114,204	2,106	0	915	0	240,215
1998	15	26,643	4,019	7,650	7,510	1,102	2,943	281	3,357	2,062	0	1,708	0	57,290
1999	3,039	33,596	646	17,919	16,480	35	0	1,160	2,704	0	0	0	0	75,580
2000	1,749	19,457	138	6,217	13,411	2,758	2,236	2,825	4,635	810	0	0	0	54,236
2001	258	21,995	759	6,679	25,756	2,089	0	3,396	6,396	7,104	0	0	0	74,431
2002	238	51,322	2,505	1,631	26,142	9,098	6,382	943	18,302	5,390	0	594	0	122,547
2003	1,844	56,819	5,158	2,362	25,288	2,646	96	897	1,678	4,664	0	3,551	0	105,002
2004	469	65,591	11,430	10,165	15,933	8,686	1,573	6,716	47,776	8,037	0		7,463	183,840
2005	305	55,209	4,769	854	11,476	14,728	7,161	1,260	4,083	11,846	0	2	0	111,692
2006	15,698	64,595	6,139	914	15,339	1,780	223	1,373		429	0	0	0	106,489
2007	11,808	86,618	18,557	11,399	72,582	7,301	768	10,886	23,391	6,391	0	37	2,100	251,838
2008	104	76,804	4,501	48,473	67,297	6,742		1,324	682	691	0	0	0	206,618
2009	9,024	103,410	744	7,728	75,807	3,049	34,449	10,883	10,075	6,978	0	297	0	262,444
2010	5,848	58,941	3,324	4,612	65,180	2,178	108	1,327	14,957	7,800	0	10	9	164,294
2011	510	57,390	1,175	2,236	34,935	31	29	41	6,971	542	0	0	0	103,860
G. Total	**147,719**	**1,644,957**	**139,445**	**219,650**	**743,681**	**116,049**	**110,303**	**61,058**	**384,380**	**163,436**	**3,977**	**15,397**	**10,938**	**3,760,990**

Table 14. Estimated **MRIP B2 (number of fish released alive)** by year and state for gray triggerfish in the Atlantic (sub-regions 4-6 and Monroe county, FL). Charterboat estimates use the FHS method or are calibrated to the FHS method. MRIP estimates (or MRFSS estimates adjusted to MRIP estimates) are used.

YEAR	FLKEYS	FLE	GA	SC	NC	VA	MD	DE	NJ	NY	CT	RI	MA	G.Total
1981	220	11,598	0	0	0	0	0	0	0	0	0	0	0	11,818
1982	0	5,428	0	0	0	0	0	0	0	0	0	0	0	5,428
1983	5,225	3,730	0	0	0	0	0	0	0	0	0	0	0	8,955
1984	107	5,512	0	0	0	0	0	0	0	0	0	0	0	5,619
1985	0	43,264	0	3,642	1,028	0	0	0	0	0	0	0	0	47,933
1986	1,482	80,634	0	0	0	961	0	0	0	0	0	0	0	83,076
1987	0	53,072	142	0	0	0	0	0	0	1,146	0	0	0	54,360
1988	0	79,117	0	532	0	0	0	0	0	0	0	0	0	79,649
1989	0	192,170	0	0	0	0	0	0	0	279	0	0	0	192,449
1990	0	60,594	2,114	0	244	0	8,749	0	1,104	928	0	0	0	73,732
1991	31,728	216,676	0	633	0	4,572	0	0	1,457	896	0	306	310	256,577
1992	3,847	86,228	252	0	69	0	156	182	0	1,550	0	0	0	92,285
1993	2,409	29,433	941	0	3,366	20,071	0	0	1,056	354	0	0	465	58,096
1994	10,264	37,323	0	0	390	1,977	0	0	0	3,344	0	0	310	53,609
1995	1,163	62,832	0	0	2,405	0	1,303	0	0	0	0	79	0	67,781
1996	10,160	48,347	560	0	6,103	3,731	0	494	9,877	4,169	0	0	0	83,440
1997	10,355	62,116	0	2,225	3,439	0	0	203	1,663	2,325	0	0	1,979	84,305
1998	942	19,291	0	0	4,694	0	0	516	2,284	0	0	0	0	27,726
1999	4,426	39,882	59	880	3,769	1,353	0	0	224	0	0	257	0	50,849
2000	20	37,810	5,132	861	4,836	820	754	429	500	636	0	0	0	51,798
2001	1,468	33,773	0	3,880	11,064	5,514	0	260	3,281	3,017	0	0	0	62,257
2002	92	88,062	552	0	1,151	3,025	0	517	417	1,060	0	0	0	94,877
2003	298	122,849	617	0	2,869	4,418	0	0	0	0	0	300	0	131,351
2004	1,651	124,127	1,988	0	3,518	3,147	8	7,114	1,409	696	1,344	0	0	145,003
2005	120	113,025	7,873	475	6,756	0	0	1,432	1,073	0	0	154	0	130,906
2006	3,620	125,483	359	0	5,754	2,842	0	235	0	0	0	0	0	138,292
2007	10,160	175,007	1,852	116	10,770	17,748	0	1,635	36,893	944	0	0	0	255,126
2008	13,523	139,207	2,582	670	3,728	340	0	487	0	0	0	0	1,128	161,665
2009	1,155	187,320	23	2,897	8,691	13,471	1,590	730	1,114	6,338	0	0	276	223,606
2010	998	113,787	399	447	12,673	196	0	64	15,884	6,688	0	0	0	151,135
2011	153	60,252	0	537	1,217	520	0	1,569	0	4,632	0	0	0	68,879
G. Total	**115,585**	**2,457,949**	**25,445**	**17,792**	**98,535**	**84,706**	**12,561**	**15,866**	**78,234**	**39,003**	**1,344**	**1,096**	**4,469**	**2,952,586**

Table 15. Estimated MRIP AB1 (number of fish landed) and B2 catches (number of fish released alive) by year and state for blueline tilefish in the Atlantic (sub-regions 4-6 and Monroe county, FL). Charterboat estimates use the FHS method or are calibrated to the FHS method.

	FLKEYS		FLE		SC		NC		VA		DE		NJ		G.Total	
YEAR	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**	**AB1**	**B2**
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	207	0	0	0	0	0	0	0	0	0	0	0	0	0	207	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	3,556	0	0	0	0	0	0	0	0	0	0	0	0	0	3,556
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	671	0	1,745	0	0	0	0	0	0	0	0	0	0	0	2,416	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	4,498	0	0	0	0	0	0	0	4,498	0
1996	0	0	0	0	0	0	735	0	0	0	0	0	0	0	735	0
1997	334	0	0	0	0	0	15,457	0	0	0	0	0	0	0	15,791	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	776	0	0	0	0	0	0	0	0	0	0	0	0	0	776	0
2000	23	0	0	0	57	0	0	0	0	0	0	0	0	0	79	0
2001	142	0	0	0	0	0	4,645	0	0	0	0	0	0	0	4,787	0
2002	52	0	312	0	0	0	0	0	0	0	0	0	0	0	364	0
2003	615	135	4,535	746	0	0	1,633	0	0	0	0	0	0	0	6,783	880
2004	246	0	164	0	0	0	1,659	0	0	0	0	0	0	0	2,069	0
2005	1,175	0	0	0	0	0	6,615	1,601	0	0	0	0	0	0	7,791	1,601
2006	136	0	0	0	0	0	54,991	925	0	0	0	0	0	0	55,127	925
2007	2,292	0	0	0	0	0	79,863	37,073	345	142	0	0	0	0	82,500	37,215
2008	2,402	0	143	0	0	0	71,335	0	0	0	0	0	89	0	73,969	0
2009	3,577	0	2,969	38	0	0	16,681	0	0	0	18	0	256	0	23,501	38
2010	3,025	0	2,465	0	0	0	6,222	1,814	0	0	0	0	0	0	11,712	1,814
2011	0	0	3,304	0	0	0	4,922	271	0	0	0	0	0	0	8,225	271
G. Total	**15,673**	**3,691**	**15,637**	**783**	**57**	**0**	**269,255**	**41,684**	**345**	**142**	**18**	**0**	**345**	**0**	**301,330**	**46,300**

Table 16. Number of angler trips with measured gray triggerfish in the Atlantic in the MRFSS by year and state for charter and headboat modes.

	Cbt											Hbt							
YEAR	**FLKEYS**	**FLE**	**GA**	**SC**	**NC**	**VA**	**MD**	**DE**	**NJ**	**NY**	**All**	**VA**	**MD**	**DE**	**NJ**	**NY**	**RI**	**MA**	**All**
1981																			
1982															1				1
1983				1							1								
1984				1							1								
1985			1								1	2							2
1986		1									1	2							2
1987				2							2				1				1
1988				1	2						3								
1989	1	1		3	3			1	1		10	1	2	1	1	5			10
1990	2			1	8				1		12			1					1
1991	1	1		1	8						11		1		8				9
1992			2	1	16	1	1				21		1	1					2
1993	1		4	1	9						15	1			3				4
1994	1		8		28						37	3				2			5
1995	1	1	3	1	20	1		1			28	2							2
1996			3	2	16	1					22	2			1				3
1997		1	8		11				1		21	1			10				11
1998	1	2	5	4	4						16								
1999	1	11	2	13	8	1					36			1	3				4
2000	4	4	1	5	1						15	1							1
2001	3	19	4	6	9				1		42	5			2				7
2002	4	41	4	5	13	2					69	7	1		15				23
2003	4	41	17	1	8						71	1		1		6			8
2004	2	43	17	16	7			1	1		87		4	1	6	4		2	17
2005	2	27	14	1	5			2			51	1	5		1				7
2006		20	13	5	5						43	2	6	2					10
2007	2	23	17	1	8	1		6	2		60	7	23	2	16	8	1		57
2008	2	23	10	1	14	3		3		1	57	6		1	3	2			12
2009	2	23	12	3	11	1	1	13	1		67	15	17	1	18	2	2		55
2010		38	15	4	25	1		4			87		4	1	1	3		1	10
2011	2	12	7		22			3			46	3	2	3	7	2			17
G.Tot	**36**	**332**	**167**	**80**	**261**	**12**	**2**	**34**	**8**	**1**	**933**	**62**	**66**	**16**	**97**	**34**	**3**	**3**	**281**

Table 17. Number of angler trips with measured gray triggerfish in the Atlantic in the MRFSS by year and state for private mode.

YEAR	FLKEYS	FLE	GA	SC	NC	VA	Priv MD	DE	NJ	NY	CT	RI	MA	All
1981		5												5
1982		5												5
1983		3							1					4
1984	1	4									1			6
1985		11	1		1									13
1986		12			2	6		1				1		22
1987	2	8	1		3	1				1				16
1988	2	13								2				17
1989	1	15			7	1	1		1	6	1			33
1990	1	4	1		4	3		2	2	4	1			22
1991	3	5	1		3	1	2	3		5		2		25
1992	1	9		6	3	3	1	3	1	1				28
1993	1	10	1	2	10	6		1		4		2		37
1994	3	4		1	8	1		1		3		1	1	23
1995	2	5			1	2			6					16
1996		3		2	11	4		5		2			1	28
1997	3	4			6			2		1				16
1998		5	1	1	2	2	1		1			1		14
1999	2	19		2	5			1						29
2000		5			5	2								12
2001		8	1		3	1		5	2	2				22
2002		16			6	2	1	1	4					30
2003		15		1	1	1		1	1			1		21
2004		12	1	2	4	2		2	1	1				25
2005		15			1	2		2	1	1				22
2006		32	2	1	1	1		2		1				40
2007	2	21	2	1	2	7		4	3	1			1	44
2008		24	2		5	5		2						38
2009	1	32		3	7		1	1	1					46
2010	1	27			11	1		3	3	2				48
2011		20		1	6				1					28
G.Tot	**26**	**371**	**14**	**23**	**118**	**54**	**7**	**42**	**29**	**37**	**3**	**8**	**3**	**735**

Table 18. Number of angler trips with measured gray triggerfish in the Atlantic in the MRFSS by year and state for shore mode.

					Shore					
YEAR	**FLKEYS**	**FLE**	**NC**	**VA**	**MD**	**DE**	**NJ**	**NY**	**RI**	**All**
1981	1									1
1982		2								2
1983		1								1
1984		3								3
1985		1								1
1986										
1987								2		2
1988		3								3
1989								2		2
1990			2					2		4
1991	2	1	1							4
1992		1	4					1	1	7
1993		1	3			1		1		6
1994		1	1		1			5		8
1995		1	4		1					6
1996		1	2	1			2		1	7
1997			1		2		1			4
1998			2							2
1999										
2000		1	1				1			3
2001		1				1				2
2002								1		1
2003		1	2							3
2004				1						1
2005		1	1			1				3
2006		1								1
2007		4				1				5
2008										
2009			4		1	1	1	1		8
2010		1	2					1		4
2011		1								1
G.Tot	**3**	**27**	**30**	**2**	**5**	**5**	**5**	**16**	**2**	**95**

Table 19. Number of angler trips with measured blueline tilefish in the Atlantic in the MRFSS by year, mode, and state.

				Cbt					Hbt			Priv				
Year	**FLKEYS**	**FLE**	**SC**	**NC**	**VA**	**DE**	**All**	**NJ**	**All**	**FLKEYS**	**FLE**	**NC**	**All**	**G.Tot**
1981														
1982														
1983														
1984														
1985														
1986														
1987														
1988														
1989														
1990														
1991														
1992														
1993		1					1				1		1	2
1994														
1995				1			1							1
1996				1			1							1
1997	1			1			2							2
1998														
1999	8						8							8
2000	1		1				2							2
2001	2			1			3							3
2002	1	1					2							2
2003	6			1			7				1		1	8
2004	2	1		1			4							4
2005	2			2			4							4
2006	1			11			12					5	5	17
2007	8			20	2		30					4	4	34
2008	3	2		36			41	1	1			2	2	44
2009	1	4		13		1	19	7	7	1		1	2	28
2010	2	2		18			22					1	1	23
2011		3		7			10				1	1	2	12
G.Tot	**38**	**14**	**1**	**113**	**2**	**1**	**169**	**8**	**8**	**2**	**2**	**14**	**18**	**195**

Estimated conversion factors for calibrating MRFSS charterboat landings and effort estimates for the South Atlantic and Gulf of Mexico in 1981-1985 with For Hire Survey estimates with application to Spanish mackerel and cobia landings

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SEDAR28-DW12

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SEDAR28 - DW12

Estimated conversion factors for calibrating MRFSS charterboat landings and effort estimates for the South Atlantic and Gulf of Mexico in 1981-1985 with For Hire Survey estimates with application to Spanish mackerel and cobia landings

by

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INTRODUCTION

The Marine Recreational Fishery Statistics Survey (MRFSS) was implemented to provide regional based catch and effort estimates of marine finfish in the U.S. recreational fishery (http://www.st.nmfs.gov/st1/recreational/survey/overview.html). Fishing pressure (effort) data are collected by a telephone survey of households in coastal counties and by interviewing anglers at fishing access sites. MRFSS acknowledged that the estimation of effort for the charterboat sector is difficult due to the low incidence of this type of fishing trips by households contacted in the telephone survey. To reduce the effect of small sample sizes on charterboat effort estimation, data from a 5 year period are combined for estimates using the traditional MRFSS method. Pooling data across years provides a larger data set to produce more reliable estimates of effort. However, this approach tends to mask effort trends in the fishery, annual weather patterns, etc.

To improve the effort estimation procedure for the charterboat mode, in 1995 MRFSS started testing a new survey protocol named For Hire Survey (FHS) (http://www.st.nmfs.gov/st1/recreational/pubs/charter_method.pdf). To implement the new FHS, charterboat vessel directories were created by NMFS and participating state agencies and are maintained by the Gulf States Marine Fisheries Commission. Approximately 10% of the charterboat operators in the directory are randomly contacted by phone and asked relevant information regarding their fishing activities (e.g., number of trips and anglers, area of fishing, etc.). MRFSS concluded that the FHS produced significantly 'more efficient, precise, and credible charter angler effort estimates than the traditional MRFSS method' (http://www.st.nmfs.noaa.gov/st1/recreational/queries/charter_method_test.html).

Previous Catch and Effort Calibration Analyses
Conversion factors exist to calibrate the traditional MRFSS charterboat estimates with the FHS in the Gulf of Mexico (SEDAR7-AW-03, Diaz and Phares, 2004) and the South Atlantic (SEDAR25-Data Workshop Report, 2011). For the years 1986+, the methods used in both regions are consistent and are based on effort calibrations. The period of 1981-1985 could not be calibrated with the same ratios developed for 1986+ because in the earlier 1981-1985 time period, MRFSS considered charterboat and headboat as a single combined mode in both regions. Thus, in order to properly calibrate the estimates from 1981-1985, headboat data from the Southeast Region Headboat Survey (SRHS) must be included in the analysis. In the Gulf of Mexico, the calibration analysis for 1981-1985 was based on effort estimates from both surveys (SRHS and MRFSS) and assumed that angler trips and angler days are equivalent (SEDAR7-AW-03). In the South Atlantic, a different approach based on landings estimates from both surveys (SRHS and MRFSS) was used (SEDAR 16- Data Workshop Report, 2008). The landings for each species in number of fish were used to generate ratios, resulting in species-specific calibration factors.

METHODS

The following text outlines the approach used to develop calibration factors for 1981-1985 for both the South Atlantic and the Gulf of Mexico. These calibration factors are based on equivalent units of effort and consistent methodologies across both sub regions.

The SRHS uses angler days as the official measure of fishing effort in the headboat fishery. Vessel personnel provide the number of anglers for each trip on the logbook form. These numbers are standardized, by trip type (length in hours), by converting number of anglers to “angler days” (e.g., 40 anglers on a half-day trip would yield 40 * 0.5 = 20 angler days, or a full day 40 * 1.0 = 40 angler days). Angler days are then totaled by month for individual vessels.

In order to use SRHS effort in the calibration work, a measure of angler trips is required in order to properly match the effort units used in the MRFSS, which are angler trips. Staff of the SRHS calculated estimated angler trips for 1986 to 1990 for the South Atlantic and Gulf of Mexico. An angler trip is defined as the number of anglers participating in a single headboat trip (e.g., 40 anglers on a trip = 40 angler trips). The estimated number of total trips were summed by month and then divided by total reported trips by month, which results in a correction factor. The correction factor was multiplied by the reported number of anglers by month, which generates the monthly estimated angler trips. These new angler trip estimates were used as the SRHS effort data in the new calibration work.

To calibrate the MRFSS combined charterboat and headboat mode effort estimates in 1981-1985, conversion factors were estimated using 1986-1990 effort estimates from both modes, in equivalent effort units, an angler trip. SRHS and traditional MRFSS charterboat effort estimates were combined (summed) into one estimate for each year, wave, and state. The same procedure was done with the same headboat estimates and the calibrated (FHS) charterboat estimates (estimates obtained after applying currently approved conversion factors- SEDAR28-DW-14). The same modeling approach as used by Diaz and Phares (2004) was used to identify significant factors and to estimate predicted ratios. The factors included in the model were year, wave, state and the interaction terms. If a factor was found non-significant (Pr > 0.05), it was removed and the regression re-run until all (highest order) model terms were significant (Hocking 1976, Draper and Smith 1981). The predicted ratios are then used as the conversion factors.

General results regarding factor significance for the 1981-1985 analyses were:
1) T-tests carried out on each separate state and wave stratum (Appendices 1-2 for GOM; Appendices 5-6 for SATL) for both regions indicated that states were significant in the regression. Therefore, states were retained as separate for developing the calibration factors.
2) Results of Duncan analyses conducted for wave variables in both regions (Appendix 3 for GOM; Appendix 7 for SATL). Gulf of Mexico, indicated that waves 1, 2, 5, and 6 could be pooled together to form a new wave grouping for these winter months (newwave=win). Waves 3 and 4 could be pooled together to form a new wave grouping for these summer months (newwave=sum). South Atlantic, indicated that wave 2 was found not to be significant from waves 3 and 4, however, waves 3 and 4 were found to be significant from each other. No pooling was able to be done.

Final GLM outputs showing predicted ratios and standard errors are found in Appendix 4 for GOM and Appendix 8 for SATL. The South Atlantic and Gulf of Mexico sub-regions were treated separately. For each region, ratios of the combined MRFSS charterboat and headboat estimates to FHS charterboat and headboat were calculated for each year, wave, and state. A similar approach using a generalized linear model analysis as conducted for the South Atlantic data (SEDAR16-DW-15) was used to identify significant variables and to estimate predicted ratios (GLM procedure, lsmeans, SAS Inst.). The factors included in the model were year, wave, and state. The analysis of the charterboat and headboat angler trips estimates (1986-

1990) showed that only wave and state had significant effects on the ratios (Pr<0.0001). Some states needed to be combined (Georgia and East Florida; Alabama and West Florida) due to the geographic areas defined in the headboat data set. In addition there were no HBS estimates for Mississippi in these years.

RESULTS AND DISCUSSION

A ratio greater than 1, the result of the FHS effort estimate being higher than the MRFSS estimate, indicates that the MRFSS effort was underestimated in that particular stratum. Conversely, a ratio less than 1 indicates that the MRFSS effort was overestimated.

Tables 1 and 2 show the estimated ratios and associated standard errors for the South Atlantic and Gulf of Mexico sub regions, respectively.

	WAVE					
STATE	1	2	3	4	5	6
NC	-	2.151 (0.12)	2.294 (0.12)	1.444 (0.12)	1.763 (0.12)	0.857 (0.12)
SC	-	1.035 (0.04)	1.085 (0.04)	1.437 (0.04)	0.891 (0.04)	0.750 (0.04)
GFE	0.845 (0.02)	0.951 (0.02)	0.985 (0.02)	1.016 (0.02)	0.811 (0.02)	0.696 (0.02)

Table 1) South Atlantic predicted ratios and standard errors (in parenthesis) between FHS and traditional MRFSS effort estimates for the combined charterboat and headboat mode. Apply to 1981 – 1985 charterboat/headboat mode in the South Atlantic.

	WAVE					
STATE	1	2	3	4	5	6
AFW	0.883 (0.03)	0.883 (0.03)	1.104 (0.05)	1.104 (0.05)	0.883 (0.03)	0.883 (0.03)
MS	1.155 (0.11)	1.155 (0.11)	2.245 (0.11)	2.245 (0.11)	1.155 (0.11)	1.155 (0.11)
LA	0.962 (0.09)	0.962 (0.09)	2.260 (0.13)	2.260 (0.13)	0.962 (0.09)	0.962 (0.09)

Table 2) Gulf of Mexico predicted ratios and standard errors (in parenthesis) between FHS and traditional MRFSS effort estimates for the combined charterboat and headboat mode. Apply to 1981 – 1985 charterboat/headboat mode in the Gulf of Mexico.

Cobia and spanish mackerel traditional MRFSS charterboat/headboat landings (A+B1) were calibrated into the corresponding FHS levels by multiplying the original landings by the predicted FHS/MRFSS effort ratios from Tables 1 and 2. These results are shown in tables 3 (cobia) and 4 (spanish mackerel). The underestimation of effort by the traditional MRFSS (most notibly in LA and MS during the summer months in the Gulf of Mexico and in NC in the South Atlantic) for the combined charterboat/ headboat mode translated into larger landings when the estimated ratios in tables 1 and 2 were applied.

COBIA			Cbt/Hbt	
YEAR	new_st	new_sta	Sum of ab1	Sum of oldab1
1981	2	LA	14,810	6,553
	3	MS	869	387
	4	AL	28	25
	5	FLW	558	505
1981 Total			16,264	7,470
1982	2	LA	6,647	2,941
	3	MS	2,111	940
	4	AL	2,874	2,604
	5	FLW	3,666	4,152
1982 Total			15,299	10,637
1983	2	LA	15,051	9,065
	3	MS	1,368	1,185
	4	AL	3,353	3,225
	6	FLE	587	596
1983 Total			20,359	14,070
1984	2	LA	13,558	7,157
	3	MS	0	0
	5	FLW	953	1,011
	6	FLE	1,590	1,648
	8	SC	663	628
1984 Total			16,764	10,445
1985	2	LA	5,654	3,415
	3	MS	0	0
	4	AL	720	652
	5	FLW	5,008	5,465
	6	FLE	1,192	1,264
	8	SC	1,725	1,882
1985 Total			14,298	12,677

Table 3) Cobia landings (number of fish) for the South Atlantic and Gulf of Mexico 1981-1985 by state. ‘oldab1’ is the traditional MRFSS estimate and ‘ab1’ is the newly calibrated FHS estimate using the ratios in tables 1 and 2.

SPANISH MACKEREL			Cbt/Hbt	
YEAR	new_st	new_sta	Sum of ab1	Sum of oldab1
1981	3	MS	861,577	403,815
	4	AL	34,835	31,553
	5	FLW	45,759	47,322
	6	FLE	19,351	27,803
	8	SC	16,668	11,599
1981 Total			978,189	522,092
1982	3	MS	1,541,752	723,264
	4	AL	22,930	25,940
	5	FLW	4,807	5,444
	6	FLE	2,444	3,511
	8	SC	6,730	6,202
	9	NC	240,253	163,364
1982 Total			1,818,915	927,725
1983	2	LA	277	122
	3	MS	538,684	256,773
	4	AL	19,260	17,446
	5	FLW	24,333	22,041
	6	FLE	5,283	5,411
	7	GA	274	270
	8	SC	3,995	3,279
	9	NC	1,313	745
1983 Total			593,420	306,086
1984	2	LA	629	471
	3	MS	341,034	177,855
	4	AL	22,001	21,037
	5	FLW	21,473	23,585
	6	FLE	3,984	4,338
	7	GA	1,449	1,563
	8	SC	40,307	31,176
	9	NC	3,846	2,663
1984 Total			434,723	262,690
1985	2	LA	9,861	4,363
	3	MS	338,831	165,725
	4	AL	19,927	18,207
	5	FLW	19,433	22,008
	6	FLE	4,389	4,456
	7	GA	392	391
	8	SC	12,718	10,527
	9	NC	79,874	42,941
1985 Total			485,426	268,618

Table 4) Spanish mackerel landings (number of fish) for the South Atlantic and Gulf of Mexico 1981-1985 by state. ‘oldab1’ is the traditional MRFSS estimate and ‘ab1’ is the newly calibrated FHS estimate using the ratios in tables 1 and 2.

Appendix 1: Gulf of Mexico region output showing T-tests on state variable (GLM, lsmeans, means (lsd), SAS Inst.)

```
        Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                57
                                GULF OF MEXICO SUB-REGION      10:52 Friday, February 3, 2012

                                    The GLM Procedure

                                    Class Level Information

                               Class         Levels    Values

                               new_sta            3    AFW LA MS

                               wave               6    1 2 3 4 5 6


                              Number of Observations Read          85
                              Number of Observations Used          81
                    Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                58
                                GULF OF MEXICO SUB-REGION      10:52 Friday, February 3, 2012

                                    The GLM Procedure

Dependent Variable: ratio

                                             Sum of
        Source                       DF         Squares     Mean Square    F Value    Pr > F

        Model                        16     25.56612027      1.59788252      15.52    <.0001

        Error                        64      6.58918736      0.10295605

        Corrected Total              80     32.15530763


                       R-Square     Coeff Var      Root MSE    ratio Mean

                       0.795082      24.58736      0.320868      1.305011


        Source                       DF       Type I SS     Mean Square    F Value    Pr > F

        new_sta                       2      6.75660514      3.37830257      32.81    <.0001
        wave                          5     13.83109669      2.76621934      26.87    <.0001
        new_sta*wave                  9      4.97841844      0.55315760       5.37    <.0001


        Source                       DF     Type III SS     Mean Square    F Value    Pr > F

        new_sta                       2      4.32774393      2.16387196      21.02    <.0001
        wave                          5     13.59857379      2.71971476      26.42    <.0001
        new_sta*wave                  9      4.97841844      0.55315760       5.37    <.0001
                    Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                59
                                GULF OF MEXICO SUB-REGION      10:52 Friday, February 3, 2012

                                    The GLM Procedure
                                   Least Squares Means

                                                Standard
```

new_sta	ratio LSMEAN	Error	Pr > |t|
AFW	0.95635098	0.05858215	<.0001
LA	1.39504921	0.05858215	<.0001
MS	Non-est	.	.

wave	ratio LSMEAN	Standard Error	Pr > |t|
1	Non-est	.	.
2	1.03854660	0.12655191	<.0001
3	1.88377302	0.08284767	<.0001
4	1.85607323	0.08284767	<.0001
5	1.09112949	0.08284767	<.0001
6	0.90254113	0.08284767	<.0001

new_sta	wave	ratio LSMEAN	Standard Error	Pr > |t|
AFW	1	0.84642210	0.14349638	<.0001
AFW	2	0.99260100	0.14349638	<.0001
AFW	3	1.17683202	0.14349638	<.0001
AFW	4	1.03103229	0.14349638	<.0001
AFW	5	0.74424611	0.14349638	<.0001
AFW	6	0.94697238	0.14349638	<.0001
LA	1	0.93149209	0.14349638	<.0001
LA	2	0.93187214	0.14349638	<.0001
LA	3	2.26001393	0.14349638	<.0001
LA	4	2.26082171	0.14349638	<.0001
LA	5	1.15209490	0.14349638	<.0001
LA	6	0.83400052	0.14349638	<.0001
MS	2	1.19116667	0.32086766	0.0004
MS	3	2.21447311	0.14349638	<.0001
MS	4	2.27636569	0.14349638	<.0001
MS	5	1.37704746	0.14349638	<.0001
MS	6	0.92665050	0.14349638	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 60

GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

The GLM Procedure

t Tests (LSD) for ratio

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	64
Error Mean Square	0.102956
Critical Value of t	1.99773

Comparisons significant at the 0.05 level are indicated by ***.

new_sta Comparison	Difference Between Means	95% Confidence Limits

MS	-	LA	0.27942	0.09704	0.46180	***
MS	-	AFW	0.71812	0.53574	0.90050	***
LA	-	MS	-0.27942	-0.46180	-0.09704	***
LA	-	AFW	0.43870	0.27319	0.60421	***
AFW	-	MS	-0.71812	-0.90050	-0.53574	***
AFW	-	LA	-0.43870	-0.60421	-0.27319	***

Appendix 2: Gulf of Mexico region output showing T-tests on wave variable (GLM, lsmeans, means (lsd), SAS Inst.)

The GLM Procedure

Class Level Information

Class	Levels	Values
new_sta	3	AFW LA MS
wave	6	1 2 3 4 5 6

Number of Observations Read 85
Number of Observations Used 81

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 54
GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	16	25.56612027	1.59788252	15.52	<.0001
Error	64	6.58918736	0.10295605		
Corrected Total	80	32.15530763			

R-Square	Coeff Var	Root MSE	ratio Mean
0.795082	24.58736	0.320868	1.305011

Source	DF	Type I SS	Mean Square	F Value	Pr > F
new_sta	2	6.75660514	3.37830257	32.81	<.0001
wave	5	13.83109669	2.76621934	26.87	<.0001
new_sta*wave	9	4.97841844	0.55315760	5.37	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
new_sta	2	4.32774393	2.16387196	21.02	<.0001
wave	5	13.59857379	2.71971476	26.42	<.0001
new_sta*wave	9	4.97841844	0.55315760	5.37	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 55
GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

The GLM Procedure
Least Squares Means

new_sta	ratio LSMEAN	Standard Error	Pr > |t|
AFW	0.95635098	0.05858215	<.0001

LA	1.39504921	0.05858215	<.0001
MS	Non-est	.	.

wave	ratio LSMEAN	Standard Error	Pr > |t|
1	Non-est	.	.
2	1.03854660	0.12655191	<.0001
3	1.88377302	0.08284767	<.0001
4	1.85607323	0.08284767	<.0001
5	1.09112949	0.08284767	<.0001
6	0.90254113	0.08284767	<.0001

new_sta	wave	ratio LSMEAN	Standard Error	Pr > |t|
AFW	1	0.84642210	0.14349638	<.0001
AFW	2	0.99260100	0.14349638	<.0001
AFW	3	1.17683202	0.14349638	<.0001
AFW	4	1.03103229	0.14349638	<.0001
AFW	5	0.74424611	0.14349638	<.0001
AFW	6	0.94697238	0.14349638	<.0001
LA	1	0.93149209	0.14349638	<.0001
LA	2	0.93187214	0.14349638	<.0001
LA	3	2.26001393	0.14349638	<.0001
LA	4	2.26082171	0.14349638	<.0001
LA	5	1.15209490	0.14349638	<.0001
LA	6	0.83400052	0.14349638	<.0001
MS	2	1.19116667	0.32086766	0.0004
MS	3	2.21447311	0.14349638	<.0001
MS	4	2.27636569	0.14349638	<.0001
MS	5	1.37704746	0.14349638	<.0001
MS	6	0.92665050	0.14349638	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 56
GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

The GLM Procedure

t Tests (LSD) for ratio

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	64
Error Mean Square	0.102956
Critical Value of t	1.99773

Comparisons significant at the 0.05 level are indicated by ***.

wave Comparison	Difference Between Means	95% Confidence Limits		
3 - 4	0.0277	-0.2064	0.2618	
3 - 5	0.7926	0.5586	1.0267	***

3 - 2	0.9007	0.6463	1.1552	***
3 - 6	0.9812	0.7472	1.2153	***
3 - 1	0.9948	0.7331	1.2565	***
4 - 3	-0.0277	-0.2618	0.2064	
4 - 5	0.7649	0.5309	0.9990	***
4 - 2	0.8730	0.6186	1.1275	***
4 - 6	0.9535	0.7195	1.1876	***
4 - 1	0.9671	0.7054	1.2288	***
5 - 3	-0.7926	-1.0267	-0.5586	***
5 - 4	-0.7649	-0.9990	-0.5309	***
5 - 2	0.1081	-0.1464	0.3625	
5 - 6	0.1886	-0.0455	0.4227	
5 - 1	0.2022	-0.0595	0.4639	
2 - 3	-0.9007	-1.1552	-0.6463	***
2 - 4	-0.8730	-1.1275	-0.6186	***
2 - 5	-0.1081	-0.3625	0.1464	
2 - 6	0.0805	-0.1739	0.3350	
2 - 1	0.0941	-0.1860	0.3742	
6 - 3	-0.9812	-1.2153	-0.7472	***
6 - 4	-0.9535	-1.1876	-0.7195	***
6 - 5	-0.1886	-0.4227	0.0455	
6 - 2	-0.0805	-0.3350	0.1739	
6 - 1	0.0136	-0.2481	0.2753	
1 - 3	-0.9948	-1.2565	-0.7331	***
1 - 4	-0.9671	-1.2288	-0.7054	***
1 - 5	-0.2022	-0.4639	0.0595	
1 - 2	-0.0941	-0.3742	0.1860	
1 - 6	-0.0136	-0.2753	0.2481	

Appendix 3: Gulf of Mexico region output showing Duncan Multiple Range Test on wave variable (GLM, lsmeans, means (duncan), SAS Inst.)

```
Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                49
                              GULF OF MEXICO SUB-REGION      10:52 Friday, February 3, 2012

                                  The GLM Procedure

                                  Class Level Information

                           Class         Levels    Values

                           new_sta            3    AFW LA MS

                           wave               6    1 2 3 4 5 6


                          Number of Observations Read          85
                          Number of Observations Used          81
                Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                50
                              GULF OF MEXICO SUB-REGION      10:52 Friday, February 3, 2012

                                  The GLM Procedure

Dependent Variable: ratio

                                          Sum of
       Source                       DF         Squares     Mean Square    F Value    Pr > F

       Model                        16     25.56612027      1.59788252      15.52    <.0001

       Error                        64      6.58918736      0.10295605

       Corrected Total              80     32.15530763


                    R-Square     Coeff Var      Root MSE    ratio Mean

                    0.795082      24.58736      0.320868      1.305011


       Source                       DF       Type I SS     Mean Square    F Value    Pr > F

       new_sta                       2      6.75660514      3.37830257      32.81    <.0001
       wave                          5     13.83109669      2.76621934      26.87    <.0001
       new_sta*wave                  9      4.97841844      0.55315760       5.37    <.0001


       Source                       DF     Type III SS     Mean Square    F Value    Pr > F

       new_sta                       2      4.32774393      2.16387196      21.02    <.0001
       wave                          5     13.59857379      2.71971476      26.42    <.0001
       new_sta*wave                  9      4.97841844      0.55315760       5.37    <.0001
                Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                51
                              GULF OF MEXICO SUB-REGION      10:52 Friday, February 3, 2012

                                  The GLM Procedure
                                 Least Squares Means
```

new_sta	ratio LSMEAN	Standard Error	Pr > |t|
AFW	0.95635098	0.05858215	<.0001
LA	1.39504921	0.05858215	<.0001
MS	Non-est	.	.

wave	ratio LSMEAN	Standard Error	Pr > |t|
1	Non-est	.	.
2	1.03854660	0.12655191	<.0001
3	1.88377302	0.08284767	<.0001
4	1.85607323	0.08284767	<.0001
5	1.09112949	0.08284767	<.0001
6	0.90254113	0.08284767	<.0001

new_sta	wave	ratio LSMEAN	Standard Error	Pr > |t|
AFW	1	0.84642210	0.14349638	<.0001
AFW	2	0.99260100	0.14349638	<.0001
AFW	3	1.17683202	0.14349638	<.0001
AFW	4	1.03103229	0.14349638	<.0001
AFW	5	0.74424611	0.14349638	<.0001
AFW	6	0.94697238	0.14349638	<.0001
LA	1	0.93149209	0.14349638	<.0001
LA	2	0.93187214	0.14349638	<.0001
LA	3	2.26001393	0.14349638	<.0001
LA	4	2.26082171	0.14349638	<.0001
LA	5	1.15209490	0.14349638	<.0001
LA	6	0.83400052	0.14349638	<.0001
MS	2	1.19116667	0.32086766	0.0004
MS	3	2.21447311	0.14349638	<.0001
MS	4	2.27636569	0.14349638	<.0001
MS	5	1.37704746	0.14349638	<.0001
MS	6	0.92665050	0.14349638	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 52
GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

The GLM Procedure

Duncan's Multiple Range Test for ratio

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	64
Error Mean Square	0.102956
Harmonic Mean of Cell Sizes	13.11258

NOTE: Cell sizes are not equal.

Number of Means	2	3	4	5	6
Critical Range	.2503	.2634	.2720	.2782	.2831

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	wave
A	1.8838	15	3
A			
A	1.8561	15	4
B	1.0911	15	5
B			
B	0.9830	11	2
B			
B	0.9025	15	6
B			
B	0.8890	10	1

Appendix 4: Gulf of Mexico region output showing final ratios and standard errors by state and grouped wave variable-newwave (GLM, lsmeans, SAS Inst.)

```
                Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                98
                                     GULF OF MEXICO SUB-REGION      10:52 Friday, February 3, 2012

---------------------------------------- new_sta=AFW ----------------------------------------

                                        The GLM Procedure

                                     Class Level Information

                                  Class         Levels    Values

                                  newwave            2    sum win


                               Number of Observations Read          30
                               Number of Observations Used          30
                Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                99
                                     GULF OF MEXICO SUB-REGION      10:52 Friday, February 3, 2012

---------------------------------------- new_sta=AFW ----------------------------------------

                                        The GLM Procedure

Dependent Variable: ratio

                                              Sum of
        Source                        DF         Squares     Mean Square    F Value    Pr > F

        Model                          1      0.32670302      0.32670302      16.03    0.0004

        Error                         28      0.57077129      0.02038469

        Corrected Total               29      0.89747432


                        R-Square     Coeff Var      Root MSE    ratio Mean

                        0.364025      14.92914      0.142775      0.956351


        Source                        DF       Type I SS     Mean Square    F Value    Pr > F

        newwave                        1      0.32670302      0.32670302      16.03    0.0004


        Source                        DF     Type III SS     Mean Square    F Value    Pr > F

        newwave                        1      0.32670302      0.32670302      16.03    0.0004
                Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90               100
                                     GULF OF MEXICO SUB-REGION      10:52 Friday, February 3, 2012

---------------------------------------- new_sta=AFW ----------------------------------------

                                        The GLM Procedure
                                    Least Squares Means
```

newwave	ratio LSMEAN	Standard Error	Pr > |t|
sum	1.10393215	0.04514941	<.0001
win	0.88256040	0.03192545	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 101
GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

---------- new_sta=LA ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
newwave	2	sum win

Number of Observations Read 30
Number of Observations Used 30

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 102
GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

---------- new_sta=LA ----------

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	11.23294227	11.23294227	68.99	<.0001
Error	28	4.55919214	0.16282829		
Corrected Total	29	15.79213442			

R-Square	Coeff Var	Root MSE	ratio Mean
0.711300	28.92514	0.403520	1.395049

Source	DF	Type I SS	Mean Square	F Value	Pr > F
newwave	1	11.23294227	11.23294227	68.99	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
newwave	1	11.23294227	11.23294227	68.99	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 103
GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

---------- new_sta=LA ----------

The GLM Procedure
Least Squares Means

newwave	ratio LSMEAN	Standard Error	Pr > |t|
sum	2.26041782	0.12760419	<.0001
win	0.96236491	0.09022979	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 104
GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

---------- new_sta=MS ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
newwave	2	sum win

Number of Observations Read 25
Number of Observations Used 21

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 105
GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

---------- new_sta=MS ----------

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	6.22333626	6.22333626	47.57	<.0001
Error	19	2.48575750	0.13082934		
Corrected Total	20	8.70909376			

R-Square	Coeff Var	Root MSE	ratio Mean
0.714579	21.60108	0.361703	1.674469

Source	DF	Type I SS	Mean Square	F Value	Pr > F
newwave	1	6.22333626	6.22333626	47.57	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
newwave	1	6.22333626	6.22333626	47.57	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 106
GULF OF MEXICO SUB-REGION 10:52 Friday, February 3, 2012

---------- new_sta=MS ----------

The GLM Procedure

Least Squares Means

newwave	ratio LSMEAN	Standard Error	Pr > |t|
sum	2.24541940	0.11438065	<.0001
win	1.15542331	0.10905768	<.0001

Appendix 5: South Atlantic region output showing T-tests on state variable (GLM, lsmeans, means (lsd), SAS Inst.)

```
Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                73
                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

                         The GLM Procedure

                     Class Level Information

                Class         Levels    Values

                new_sta            3    GFE NC SC

                wave               6    1 2 3 4 5 6


               Number of Observations Read          90
               Number of Observations Used          89
Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                74
                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

                         The GLM Procedure

Dependent Variable: ratio

                                    Sum of
Source                      DF         Squares     Mean Square    F Value    Pr > F

Model                       17     18.59665547      1.09392091      43.86    <.0001

Error                       71      1.77064499      0.02493866

Corrected Total             88     20.36730045


                R-Square     Coeff Var      Root MSE    ratio Mean

                0.913064      13.50731      0.157920      1.169143


Source                      DF       Type I SS     Mean Square    F Value    Pr > F

new_sta                      2      8.50950569      4.25475284     170.61    <.0001
wave                         5      5.07907013      1.01581403      40.73    <.0001
new_sta*wave                10      5.00807965      0.50080796      20.08    <.0001


Source                      DF     Type III SS     Mean Square    F Value    Pr > F

new_sta                      2      7.97165432      3.98582716     159.83    <.0001
wave                         5      5.22998104      1.04599621      41.94    <.0001
new_sta*wave                10      5.00807965      0.50080796      20.08    <.0001
           Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                75
                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

                         The GLM Procedure
                        Least Squares Means

                                                Standard
```

new_sta	ratio LSMEAN	Error	Pr > |t|
GFE	0.88390667	0.02883208	<.0001
NC	1.58494751	0.02942662	<.0001
SC	1.03293750	0.02883208	<.0001

wave	ratio LSMEAN	Standard Error	Pr > |t|
1	0.94829960	0.04243967	<.0001
2	1.37906155	0.04077472	<.0001
3	1.45450877	0.04077472	<.0001
4	1.29875760	0.04077472	<.0001
5	1.15525850	0.04077472	<.0001
6	0.76769731	0.04077472	<.0001

new_sta	wave	ratio LSMEAN	Standard Error	Pr > |t|
GFE	1	0.84489881	0.07062388	<.0001
GFE	2	0.95056019	0.07062388	<.0001
GFE	3	0.98481154	0.07062388	<.0001
GFE	4	1.01574310	0.07062388	<.0001
GFE	5	0.81149804	0.07062388	<.0001
GFE	6	0.69592832	0.07062388	<.0001
NC	1	1.00000000	0.07895990	<.0001
NC	2	2.15118991	0.07062388	<.0001
NC	3	2.29407820	0.07062388	<.0001
NC	4	1.44382760	0.07062388	<.0001
NC	5	1.76341642	0.07062388	<.0001
NC	6	0.85717289	0.07062388	<.0001
SC	1	1.00000000	0.07062388	<.0001
SC	2	1.03543456	0.07062388	<.0001
SC	3	1.08463658	0.07062388	<.0001
SC	4	1.43670208	0.07062388	<.0001
SC	5	0.89086104	0.07062388	<.0001
SC	6	0.74999073	0.07062388	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 76
SOUTH ATLANTIC SUB-REGION 10:52 Friday, February 3, 2012

The GLM Procedure

t Tests (LSD) for ratio

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	71
Error Mean Square	0.024939
Critical Value of t	1.99394

Comparisons significant at the 0.05 level are indicated by ***.

new_sta	Difference Between	95% Confidence

Comparison	Means	Limits		
NC - SC	0.57218	0.49018	0.65418	***
NC - GFE	0.72121	0.63921	0.80321	***
SC - NC	-0.57218	-0.65418	-0.49018	***
SC - GFE	0.14903	0.06773	0.23033	***
GFE - NC	-0.72121	-0.80321	-0.63921	***
GFE - SC	-0.14903	-0.23033	-0.06773	***

Appendix 6: South Atlantic region output showing T-tests on wave variable (GLM, lsmeans, means (lsd), SAS Inst.)

```
Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                81
                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

                         The GLM Procedure

                     Class Level Information

                Class         Levels    Values

                new_sta            3    GFE NC SC

                wave               6    1 2 3 4 5 6


               Number of Observations Read          90
               Number of Observations Used          89
Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                82
                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

                         The GLM Procedure

Dependent Variable: ratio

                                    Sum of
Source                      DF         Squares     Mean Square    F Value    Pr > F

Model                       17     18.59665547      1.09392091      43.86    <.0001

Error                       71      1.77064499      0.02493866

Corrected Total             88     20.36730045


              R-Square     Coeff Var      Root MSE    ratio Mean

              0.913064      13.50731      0.157920      1.169143


Source                      DF       Type I SS     Mean Square    F Value    Pr > F

new_sta                      2      8.50950569      4.25475284     170.61    <.0001
wave                         5      5.07907013      1.01581403      40.73    <.0001
new_sta*wave                10      5.00807965      0.50080796      20.08    <.0001


Source                      DF     Type III SS     Mean Square    F Value    Pr > F

new_sta                      2      7.97165432      3.98582716     159.83    <.0001
wave                         5      5.22998104      1.04599621      41.94    <.0001
new_sta*wave                10      5.00807965      0.50080796      20.08    <.0001
Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                83
                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

                         The GLM Procedure
                       Least Squares Means

                                              Standard
              new_sta    ratio LSMEAN             Error    Pr > |t|
```

GFE	0.88390667	0.02883208	<.0001
NC	1.58494751	0.02942662	<.0001
SC	1.03293750	0.02883208	<.0001

wave	ratio LSMEAN	Standard Error	Pr > |t|
1	0.94829960	0.04243967	<.0001
2	1.37906155	0.04077472	<.0001
3	1.45450877	0.04077472	<.0001
4	1.29875760	0.04077472	<.0001
5	1.15525850	0.04077472	<.0001
6	0.76769731	0.04077472	<.0001

new_sta	wave	ratio LSMEAN	Standard Error	Pr > |t|
GFE	1	0.84489881	0.07062388	<.0001
GFE	2	0.95056019	0.07062388	<.0001
GFE	3	0.98481154	0.07062388	<.0001
GFE	4	1.01574310	0.07062388	<.0001
GFE	5	0.81149804	0.07062388	<.0001
GFE	6	0.69592832	0.07062388	<.0001
NC	1	1.00000000	0.07895990	<.0001
NC	2	2.15118991	0.07062388	<.0001
NC	3	2.29407820	0.07062388	<.0001
NC	4	1.44382760	0.07062388	<.0001
NC	5	1.76341642	0.07062388	<.0001
NC	6	0.85717289	0.07062388	<.0001
SC	1	1.00000000	0.07062388	<.0001
SC	2	1.03543456	0.07062388	<.0001
SC	3	1.08463658	0.07062388	<.0001
SC	4	1.43670208	0.07062388	<.0001
SC	5	0.89086104	0.07062388	<.0001
SC	6	0.74999073	0.07062388	<.0001

The GLM Procedure

t Tests (LSD) for ratio

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	71
Error Mean Square	0.024939
Critical Value of t	1.99394

Comparisons significant at the 0.05 level are indicated by ***.

wave Comparison	Difference Between Means	95% Confidence Limits

3 - 2	0.07545	-0.03953	0.19043	
3 - 4	0.15575	0.04077	0.27073	***
3 - 5	0.29925	0.18427	0.41423	***
3 - 1	0.50990	0.39289	0.62692	***
3 - 6	0.68681	0.57183	0.80179	***
2 - 3	-0.07545	-0.19043	0.03953	
2 - 4	0.08030	-0.03468	0.19528	
2 - 5	0.22380	0.10882	0.33878	***
2 - 1	0.43445	0.31744	0.55147	***
2 - 6	0.61136	0.49639	0.72634	***
4 - 3	-0.15575	-0.27073	-0.04077	***
4 - 2	-0.08030	-0.19528	0.03468	
4 - 5	0.14350	0.02852	0.25848	***
4 - 1	0.35415	0.23714	0.47117	***
4 - 6	0.53106	0.41608	0.64604	***
5 - 3	-0.29925	-0.41423	-0.18427	***
5 - 2	-0.22380	-0.33878	-0.10882	***
5 - 4	-0.14350	-0.25848	-0.02852	***
5 - 1	0.21065	0.09364	0.32767	***
5 - 6	0.38756	0.27258	0.50254	***
1 - 3	-0.50990	-0.62692	-0.39289	***
1 - 2	-0.43445	-0.55147	-0.31744	***
1 - 4	-0.35415	-0.47117	-0.23714	***
1 - 5	-0.21065	-0.32767	-0.09364	***
1 - 6	0.17691	0.05990	0.29392	***
6 - 3	-0.68681	-0.80179	-0.57183	***
6 - 2	-0.61136	-0.72634	-0.49639	***
6 - 4	-0.53106	-0.64604	-0.41608	***
6 - 5	-0.38756	-0.50254	-0.27258	***
6 - 1	-0.17691	-0.29392	-0.05990	***

Appendix 7: South Atlantic region output showing Duncan Multiple Range Test on wave variable (GLM, lsmeans, means (duncan), SAS Inst.)

```
Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                85
                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

                         The GLM Procedure

                         Class Level Information

                   Class         Levels    Values

                   new_sta            3    GFE NC SC

                   wave               6    1 2 3 4 5 6


                  Number of Observations Read          90
                  Number of Observations Used          89
Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                86
                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

                         The GLM Procedure

Dependent Variable: ratio

                                        Sum of
       Source                     DF         Squares     Mean Square    F Value    Pr > F

       Model                      17     18.59665547      1.09392091      43.86    <.0001

       Error                      71      1.77064499      0.02493866

       Corrected Total            88     20.36730045


                 R-Square     Coeff Var      Root MSE    ratio Mean

                 0.913064      13.50731      0.157920      1.169143


       Source                     DF       Type I SS     Mean Square    F Value    Pr > F

       new_sta                     2      8.50950569      4.25475284     170.61    <.0001
       wave                        5      5.07907013      1.01581403      40.73    <.0001
       new_sta*wave               10      5.00807965      0.50080796      20.08    <.0001


       Source                     DF     Type III SS     Mean Square    F Value    Pr > F

       new_sta                     2      7.97165432      3.98582716     159.83    <.0001
       wave                        5      5.22998104      1.04599621      41.94    <.0001
       new_sta*wave               10      5.00807965      0.50080796      20.08    <.0001
           Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                87
                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

                         The GLM Procedure
                        Least Squares Means
```

new_sta	ratio LSMEAN	Standard Error	Pr > |t|
GFE	0.88390667	0.02883208	<.0001
NC	1.58494751	0.02942662	<.0001
SC	1.03293750	0.02883208	<.0001

wave	ratio LSMEAN	Standard Error	Pr > |t|
1	0.94829960	0.04243967	<.0001
2	1.37906155	0.04077472	<.0001
3	1.45450877	0.04077472	<.0001
4	1.29875760	0.04077472	<.0001
5	1.15525850	0.04077472	<.0001
6	0.76769731	0.04077472	<.0001

new_sta	wave	ratio LSMEAN	Standard Error	Pr > |t|
GFE	1	0.84489881	0.07062388	<.0001
GFE	2	0.95056019	0.07062388	<.0001
GFE	3	0.98481154	0.07062388	<.0001
GFE	4	1.01574310	0.07062388	<.0001
GFE	5	0.81149804	0.07062388	<.0001
GFE	6	0.69592832	0.07062388	<.0001
NC	1	1.00000000	0.07895990	<.0001
NC	2	2.15118991	0.07062388	<.0001
NC	3	2.29407820	0.07062388	<.0001
NC	4	1.44382760	0.07062388	<.0001
NC	5	1.76341642	0.07062388	<.0001
NC	6	0.85717289	0.07062388	<.0001
SC	1	1.00000000	0.07062388	<.0001
SC	2	1.03543456	0.07062388	<.0001
SC	3	1.08463658	0.07062388	<.0001
SC	4	1.43670208	0.07062388	<.0001
SC	5	0.89086104	0.07062388	<.0001
SC	6	0.74999073	0.07062388	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 88
SOUTH ATLANTIC SUB-REGION 10:52 Friday, February 3, 2012

The GLM Procedure

Duncan's Multiple Range Test for ratio

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	71
Error Mean Square	0.024939
Harmonic Mean of Cell Sizes	14.82353

NOTE: Cell sizes are not equal.

Number of Means	2	3	4	5	6
Critical Range	.1157	.1217	.1257	.1286	.1308

Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	wave
	A	1.45451	15	3
	A			
B	A	1.37906	15	2
B				
B		1.29876	15	4
	C	1.15526	15	5
	D	0.94461	14	1
	E	0.76770	15	6

Appendix 8: South Atlantic region output showing final ratios and standard errors by state and wave (GLM, lsmeans, SAS Inst.)

```
                Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                89
                                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

---------------------------------------- new_sta=GFE ----------------------------------------

                                         The GLM Procedure

                                     Class Level Information

                                Class         Levels    Values

                                wave               6    1 2 3 4 5 6


                               Number of Observations Read          30
                               Number of Observations Used          30
                Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                90
                                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

---------------------------------------- new_sta=GFE ----------------------------------------

                                         The GLM Procedure

Dependent Variable: ratio

                                              Sum of
       Source                        DF         Squares     Mean Square    F Value    Pr > F

       Model                          5      0.37052905      0.07410581      43.24    <.0001

       Error                         24      0.04113226      0.00171384

       Corrected Total               29      0.41166131


                         R-Square     Coeff Var      Root MSE    ratio Mean

                         0.900082      4.683594      0.041399      0.883907


       Source                        DF       Type I SS     Mean Square    F Value    Pr > F

       wave                           5      0.37052905      0.07410581      43.24    <.0001


       Source                        DF     Type III SS     Mean Square    F Value    Pr > F

       wave                           5      0.37052905      0.07410581      43.24    <.0001
                Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                91
                                     SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

---------------------------------------- new_sta=GFE ----------------------------------------

                                         The GLM Procedure
                                       Least Squares Means
```

wave	ratio LSMEAN	Standard Error	Pr > |t|
1	0.84489881	0.01851402	<.0001
2	0.95056019	0.01851402	<.0001
3	0.98481154	0.01851402	<.0001
4	1.01574310	0.01851402	<.0001
5	0.81149804	0.01851402	<.0001
6	0.69592832	0.01851402	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 92
SOUTH ATLANTIC SUB-REGION 10:52 Friday, February 3, 2012

---------- new_sta=NC ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
wave	6	1 2 3 4 5 6

Number of Observations Read 30
Number of Observations Used 29

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 93
SOUTH ATLANTIC SUB-REGION 10:52 Friday, February 3, 2012

---------- new_sta=NC ----------

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	8.38144903	1.67628981	24.93	<.0001
Error	23	1.54671197	0.06724835		
Corrected Total	28	9.92816101			

R-Square	Coeff Var	Root MSE	ratio Mean
0.844210	16.15600	0.259323	1.605118

Source	DF	Type I SS	Mean Square	F Value	Pr > F
wave	5	8.38144903	1.67628981	24.93	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
wave	5	8.38144903	1.67628981	24.93	<.0001

Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90 94
SOUTH ATLANTIC SUB-REGION 10:52 Friday, February 3, 2012

```
---------------------------------------- new_sta=NC ----------------------------------------

                                   The GLM Procedure
                                  Least Squares Means

                                                Standard
                        wave    ratio LSMEAN       Error    Pr > |t|

                        1         1.00000000    0.12966143    <.0001
                        2         2.15118991    0.11597271    <.0001
                        3         2.29407820    0.11597271    <.0001
                        4         1.44382760    0.11597271    <.0001
                        5         1.76341642    0.11597271    <.0001
                        6         0.85717289    0.11597271    <.0001
                  Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                95
                                    SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

---------------------------------------- new_sta=SC ----------------------------------------

                                   The GLM Procedure

                                 Class Level Information

                              Class         Levels    Values

                              wave               6    1 2 3 4 5 6


                             Number of Observations Read          30
                             Number of Observations Used          30
                  Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                96
                                    SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

---------------------------------------- new_sta=SC ----------------------------------------

                                   The GLM Procedure

Dependent Variable: ratio

                                          Sum of
       Source                      DF         Squares     Mean Square    F Value    Pr > F

       Model                        5      1.33517170      0.26703434      35.06    <.0001

       Error                       24      0.18280075      0.00761670

       Corrected Total             29      1.51797245


                        R-Square     Coeff Var      Root MSE    ratio Mean

                        0.879576      8.449078      0.087274      1.032937


       Source                      DF       Type I SS     Mean Square    F Value    Pr > F

       wave                         5      1.33517170      0.26703434      35.06    <.0001


       Source                      DF     Type III SS     Mean Square    F Value    Pr > F
```

```
wave                          5      1.33517170      0.26703434      35.06    <.0001
            Proc GLM for Ratio = HBS+MRFSSnewcbt/HBS+MRFSSoldcbt 1986-90                97
                                 SOUTH ATLANTIC SUB-REGION      10:52 Friday, February 3, 2012

---------------------------------------- new_sta=SC ----------------------------------------

                                    The GLM Procedure
                                   Least Squares Means

                                                    Standard
                              wave    ratio LSMEAN           Error    Pr > |t|

                              1         1.00000000      0.03902998      <.0001
                              2         1.03543456      0.03902998      <.0001
                              3         1.08463658      0.03902998      <.0001
                              4         1.43670208      0.03902998      <.0001
                              5         0.89086104      0.03902998      <.0001
                              6         0.74999073      0.03902998      <.0001
```

Estimated conversion factors for calibrating MRFSS charterboat landings and effort estimates from the Southeastern US (North Carolina to Florida-east coast) in 1981-2003 with For-Hire Survey estimates with application to King Mackerel landings

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February 2008

INTRODUCTION (text taken from Diaz and Phares, 2004 and modified for Atlantic Coast)
The Marine Recreational Fishery Statistics Survey (MRFSS) was established to create a reliable data base for estimating catch and effort by the marine recreational fishery (http://www.st.nmfs.gov/st1/recreational/survey/overview.html). In the traditional MRFSS methodology, data are collected by a telephone survey of households in coastal counties and by interviewing anglers at fishing access sites. MRFSS acknowledged that the estimation of effort for the charterboat sector is difficult due to the low incidence of this type of fishing trips by households contacted in the telephone survey. To reduce the effect of small sample sizes on charterboat effort estimation, data from a 5 year period are combined for estimates using the traditional MRFSS method. Pooling data across years provides a larger data set to produce more reliable estimates of effort. However, this approach tends to mask trends in the fishery, annual weather patterns, etc. To improve the effort estimation procedure for the charterboat mode, MRFSS started testing a new survey protocol named For Hire Survey (FHS) in 1995 (http://www.st.nmfs.gov/st1/recreational/pubs/charter_method.pdf). To implement the new FHS, charterboat directories were created by NMFS and participating state agencies and are maintained by the NMFS' Contractor. Approximately 10% of the charterboats in the directory are randomly contacted by phone and asked relevant information regarding their fishing activities (e.g., number of trips and anglers, area of fishing, etc.). MRFSS concluded that the FHS produced significantly 'more efficient, precise, and credible charter angler effort estimates than the traditional MRFSS method'. The FHS was officially adopted as the new charterboat method in the Gulf of Mexico in 2000 and expanded to the Atlantic Coast in 2004. This document provides conversion factors to adjust effort estimates obtained by MRFSS until 2004 along the Atlantic Coast to the FHS effort levels 2004-2007. The adjusted effort levels were applied to landings' CPUEs to produce adjusted historical king mackerel landings from the Southeastern US.

METHODS
From 2004 to 2007, the NMFS estimated charterboat effort using both the MRFSS (old) and FHS (new) protocols. Thus, differences in effort estimates for each stratum between both methodologies can be directly compared only for that period of time. Each stratum is defined by a unique combination of state, year, wave, and fishing-area, where wave corresponds to bimonthly periods starting in January. The MRFSS defined fishing areas for most states as: a) Inshore waters, b) < 3 miles, and c) > 3 miles. For the period 1986-2003, charterboat effort was estimated using only the MRFSS protocol. To calibrate MRFSS charterboat effort estimates (1986-2003) to FHS levels, conversion factors (ratios) between FHS and MRFSS charterboat effort were estimated using 2003-2007 data and applied to the 1986-2003 MRFSS effort estimates. To estimate the conversion factors, a ratio of FHS/MRFSS effort estimates was calculated for each stratum using only the estimates from the period 2003-2007. A generalized linear model (GLM procedure, SAS Inst.) was used to identify significant factors and to estimate predicted ratios. The factors included in the model were year, wave, fishing area, state and the interaction terms. In the event that a factor was found non-significant ($Pr > 0.05$), it was removed and the regression re-run until all (highest order) model terms were significant (Hocking 1976, Draper and Smith 1981). The predicted ratios are used as the conversion factors.

From 1981 to 1985, MRFSS considered charterboat and headboat as part of single mode. Thus, the conversion factors estimated with 2004-2007 charterboat data (used to calibrate 1986-2003 charterboat effort estimates) can not be used to calibrate the 1981-1985 estimates. To calibrate the

1981-1985 combined charterboat and headboat effort estimates, conversion factors will be estimated using 1986-1990 effort estimates instead of 2004-2007 to minimize possible effects of changes in the fishery over time. To do so, headboat (NMFS Headboat Survey) and original (MRFSS) charterboat effort estimates were combined (summed) into one estimate for each year and wave.

RESULTS OF GLM PROCEDURE

Proc GLM for Ratio = FHS-eft/RDD-Rd4 with 2007 added 106
RATIO outliers removed (ratio > 50): NC 2 Inland
09:42 Wednesday, February 13, 2008

The GLM Procedure

Class Level Information

Class	Levels	Values
srg	3	EF NC NN
areaf	2	I O
wave	6	1 2 3 4 5 6

Number of Observations Read 247
Number of Observations Used 247

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	669.248957	83.656120	8.56	<.0001
Error	238	2326.541118	9.775383		
Corrected Total	246	2995.790076			

R-Square	Coeff Var	Root MSE	ratio Mean
0.223396	155.5523	3.126561	2.009974

Source	DF	Type I SS	Mean Square	F Value	Pr > F
srg	2	192.7821297	96.3910649	9.86	<.0001
areaf	1	315.9997273	315.9997273	32.33	<.0001
wave	5	160.4671003	32.0934201	3.28	0.0069

Source	DF	Type III SS	Mean Square	F Value	Pr > F
srg	2	187.8216618	93.9108309	9.61	<.0001
areaf	1	319.8680944	319.8680944	32.72	<.0001
wave	5	160.4671003	32.0934201	3.28	0.0069

Proc GLM for Ratio = FHS-eft/RDD-Rd4 with 2007 added 108
RATIO outliers removed (ratio > 50): NC 2 Inland
09:42 Wednesday, February 13, 2008

The GLM Procedure
Least Squares Means

srg	ratio LSMEAN	Standard Error	Pr > |t|
EF	1.60680634	0.34285212	<.0001
NC	3.99821318	0.46608702	<.0001
NN	2.09140432	0.34299411	<.0001

areaf	ratio LSMEAN	Standard Error	Pr > |t|
I	3.77103722	0.36446772	<.0001
O	1.35991201	0.27032873	<.0001

wave	ratio LSMEAN	Standard Error	Pr > |t|
1	2.49149503	0.86496570	0.0043
2	2.95833242	0.45120221	<.0001
3	3.56495573	0.44793923	<.0001
4	3.23644347	0.45903199	<.0001
5	1.55090958	0.46247577	0.0009
6	1.59071145	0.54220571	0.0037

Proc GLM for Ratio = FHS-eft/RDD-Rd4 with 2007 added 109
RATIO outliers removed (ratio > 50): NC 2 Inland
SRG: EFL, NC or NN (SC & GA) in South Atlantic sub-region
09:42 Wednesday, February 13, 2008

---------- srg=EF areaf=I ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
wave	6	1 2 3 4 5 6

Number of Observations Read 29
Number of Observations Used 29

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	25.21843903	5.04368781	1.89	0.1344
Error	23	61.23693961	2.66247564		
Corrected Total	28	86.45537864			

R-Square	Coeff Var	Root MSE	ratio Mean
0.291693	75.46190	1.631709	2.162296

Source	DF	Type I SS	Mean Square	F Value	Pr > F
wave	5	25.21843903	5.04368781	1.89	0.1344

Source	DF	Type III SS	Mean Square	F Value	Pr > F
wave	5	25.21843903	5.04368781	1.89	0.1344

---------- srg=EF areaf=I ----------

The GLM Procedure
Least Squares Means

wave	ratio LSMEAN	Standard Error	Pr > |t|
1	2.05063839	0.72972264	0.0099
2	3.35726007	0.72972264	0.0001
3	1.91921572	0.72972264	0.0150
4	3.30164110	0.72972264	0.0002
5	0.88738129	0.72972264	0.2363
6	1.28147361	0.81585471	0.1299

Proc GLM for Ratio = FHS-eft/RDD-Rd4 with 2007 added 112
RATIO outliers removed (ratio > 50): NC 2 Inland
SRG: EFL, NC or NN (SC & GA) in South Atlantic sub-region
09:42 Wednesday, February 13, 2008

---------- srg=EF areaf=O ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
wave	6	1 2 3 4 5 6

Number of Observations Read 58
Number of Observations Used 58

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	2.06962571	0.41392514	2.67	0.0322
Error	52	8.07368787	0.15526323		
Corrected Total	57	10.14331358			

R-Square	Coeff Var	Root MSE	ratio Mean
0.204038	50.73194	0.394035	0.776699

Source	DF	Type I SS	Mean Square	F Value	Pr > F
wave	5	2.06962571	0.41392514	2.67	0.0322

Source	DF	Type III SS	Mean Square	F Value	Pr > F
wave	5	2.06962571	0.41392514	2.67	0.0322

---------- srg=EF areaf=O ----------

The GLM Procedure
Least Squares Means

wave	ratio LSMEAN	Standard Error	Pr > |t|
1	0.67113964	0.12460467	<.0001
2	0.97987451	0.12460467	<.0001
3	0.80452634	0.12460467	<.0001
4	1.03616265	0.12460467	<.0001
5	0.51998484	0.12460467	0.0001
6	0.61645857	0.13931225	<.0001

Proc GLM for Ratio = FHS-eft/RDD-Rd4 with 2007 added 115
RATIO outliers removed (ratio > 50): NC 2 Inland
SRG: EFL, NC or NN (SC & GA) in South Atlantic sub-region
09:42 Wednesday, February 13, 2008

---------- srg=NC areaf=I ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
wave	5	2 3 4 5 6

Number of Observations Read 16
Number of Observations Used 16

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	326.5374247	81.6343562	1.51	0.2665
Error	11	595.8705864	54.1700533		
Corrected Total	15	922.4080111			

R-Square	Coeff Var	Root MSE	ratio Mean
0.354005	83.53192	7.360031	8.811040

Source	DF	Type I SS	Mean Square	F Value	Pr > F
wave	4	326.5374247	81.6343562	1.51	0.2665

Source	DF	Type III SS	Mean Square	F Value	Pr > F
wave	4	326.5374247	81.6343562	1.51	0.2665

---------- srg=NC areaf=I ----------

The GLM Procedure
Least Squares Means

wave	ratio LSMEAN	Standard Error	Pr > |t|
2	12.1818928	3.6800154	0.0070
3	13.2911500	3.6800154	0.0041
4	7.9664955	4.2493158	0.0876
5	0.9725798	4.2493158	0.8232
6	6.1336209	5.2043277	0.2634

Proc GLM for Ratio = FHS-eft/RDD-Rd4 with 2007 added 118
RATIO outliers removed (ratio > 50): NC 2 Inland
SRG: EFL, NC or NN (SC & GA) in South Atlantic sub-region
09:42 Wednesday, February 13, 2008

---------- srg=NC areaf=O ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
wave	5	2 3 4 5 6

Number of Observations Read 36
Number of Observations Used 36

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	7.19241242	1.79810310	1.11	0.3689
Error	31	50.15932600	1.61804277		
Corrected Total	35	57.35173842			

R-Square	Coeff Var	Root MSE	ratio Mean
0.125409	94.82254	1.272023	1.341478

Source	DF	Type I SS	Mean Square	F Value	Pr > F
wave	4	7.19241242	1.79810310	1.11	0.3689

Source	DF	Type III SS	Mean Square	F Value	Pr > F
wave	4	7.19241242	1.79810310	1.11	0.3689

The GLM Procedure
Least Squares Means

wave	ratio LSMEAN	Standard Error	Pr > |t|
2	1.66033523	0.44972808	0.0009
3	1.94662655	0.44972808	0.0001
4	1.11552626	0.48077954	0.0271
5	1.07519281	0.48077954	0.0327
6	0.68374440	0.51930126	0.1976

Proc GLM for Ratio = FHS-eft/RDD-Rd4 with 2007 added 121
RATIO outliers removed (ratio > 50): NC 2 Inland
SRG: EFL, NC or NN (SC & GA) in South Atlantic sub-region
09:42 Wednesday, February 13, 2008

---------- srg=NN areaf=I ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
wave	5	2 3 4 5 6

Number of Observations Read 38
Number of Observations Used 38

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	81.4833292	20.3708323	1.05	0.3974
Error	33	641.2270269	19.4311220		
Corrected Total	37	722.7103562			

R-Square	Coeff Var	Root MSE	ratio Mean
0.112747	181.0380	4.408075	2.434890

Source	DF	Type I SS	Mean Square	F Value	Pr > F
wave	4	81.48332923	20.37083231	1.05	0.3974

Source	DF	Type III SS	Mean Square	F Value	Pr > F
wave	4	81.48332923	20.37083231	1.05	0.3974

The GLM Procedure
Least Squares Means

wave	ratio LSMEAN	Standard Error	Pr > |t|
2	2.08319997	1.55848973	0.1905
3	4.88059879	1.55848973	0.0036
4	2.88675805	1.55848973	0.0729
5	1.25184640	1.55848973	0.4276
6	0.61776336	1.79958894	0.7336

Proc GLM for Ratio = FHS-eft/RDD-Rd4 with 2007 added 124
RATIO outliers removed (ratio > 50): NC 2 Inland
SRG: EFL, NC or NN (SC & GA) in South Atlantic sub-region
09:42 Wednesday, February 13, 2008

---------- srg=NN areaf=O ----------

The GLM Procedure

Class Level Information

Class	Levels	Values
wave	5	2 3 4 5 6

Number of Observations Read 70
Number of Observations Used 70

The GLM Procedure

Dependent Variable: ratio

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	42.1071513	10.5267878	2.39	0.0598
Error	65	286.3977031	4.4061185		
Corrected Total	69	328.5048544			

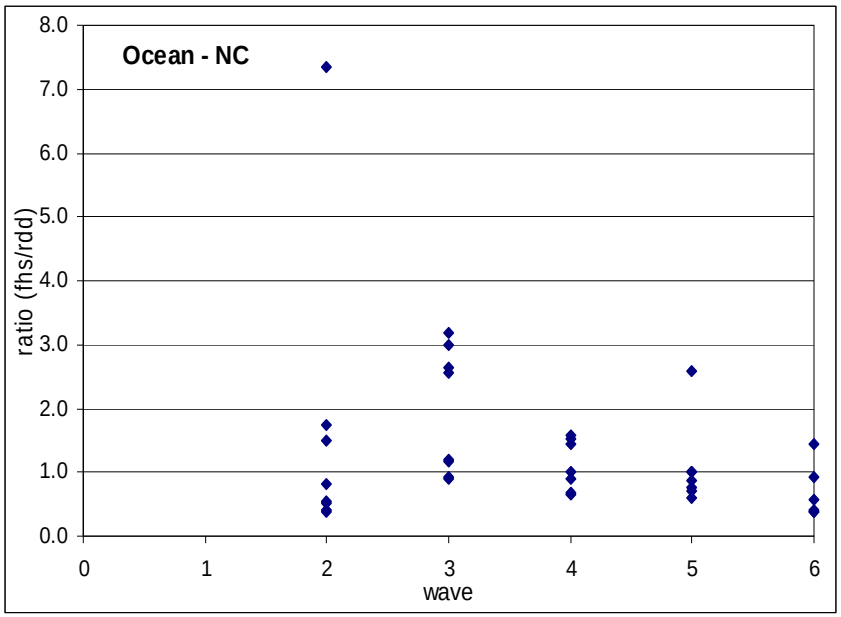
R-Square	Coeff Var	Root MSE	ratio Mean
0.128178	137.4348	2.099076	1.527324

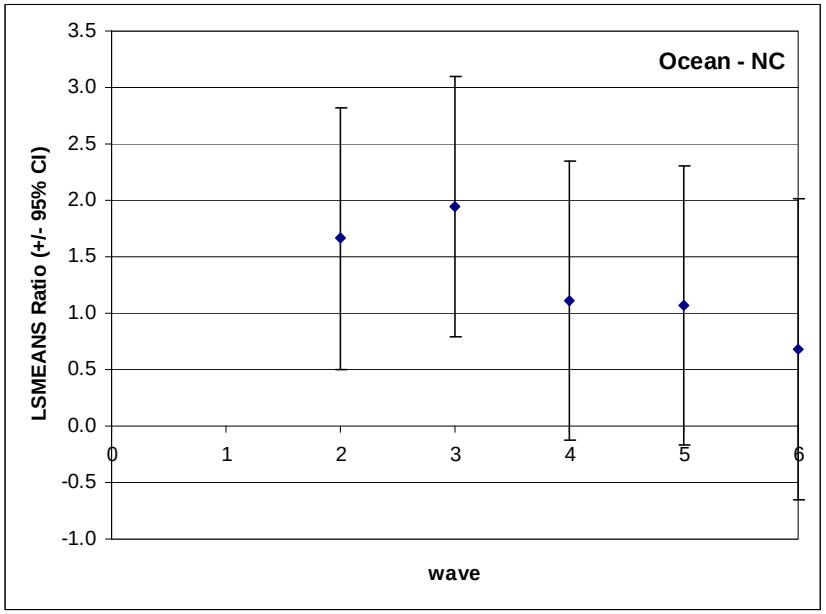
Source	DF	Type I SS	Mean Square	F Value	Pr > F
wave	4	42.10715132	10.52678783	2.39	0.0598

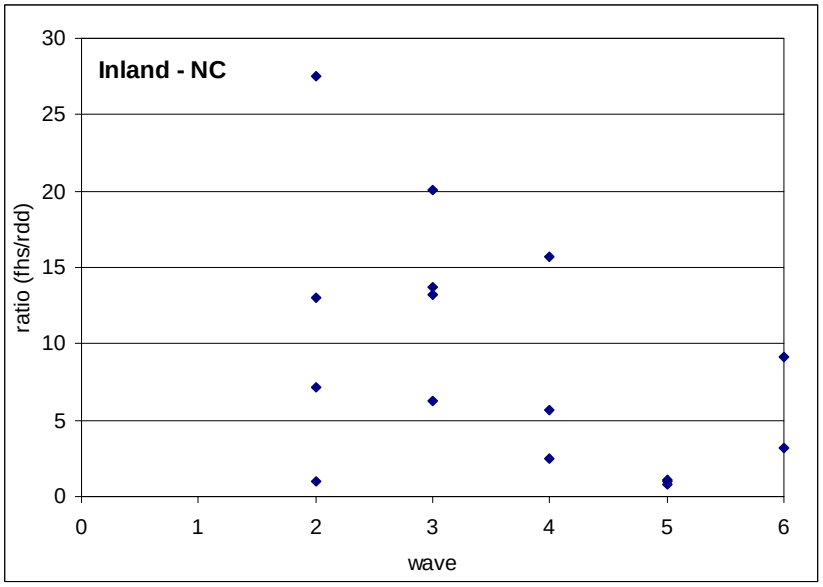
Source	DF	Type III SS	Mean Square	F Value	Pr > F
wave	4	42.10715132	10.52678783	2.39	0.0598

The GLM Procedure
Least Squares Means

wave	ratio LSMEAN	Standard Error	Pr > |t|
2	1.01839621	0.54197900	0.0647
3	1.70809906	0.52476891	0.0018
4	2.81179835	0.52476891	<.0001
5	0.94018586	0.54197900	0.0875
6	0.65195213	0.74213531	0.3829


Ocean - NC
ratio (fhs/rdd)
wave
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
1
2
3
4
5
6


Ocean - NC
LSMEANS Ratio (+/- 95% CI)
wave
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
0
1
2
3
4
5
6


Inland - NC
ratio (fhs/rdd)
wave
30
25
20
15
10
5
0
0
1
2
3
4
5
6

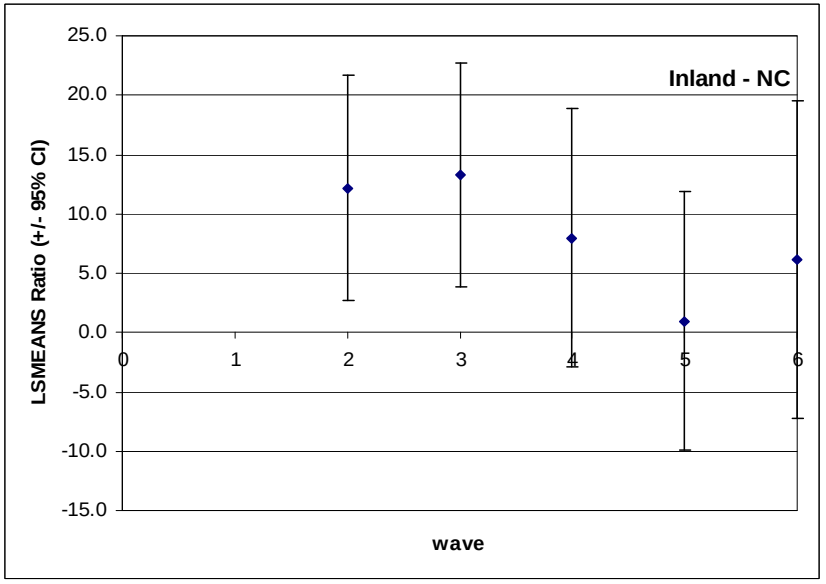
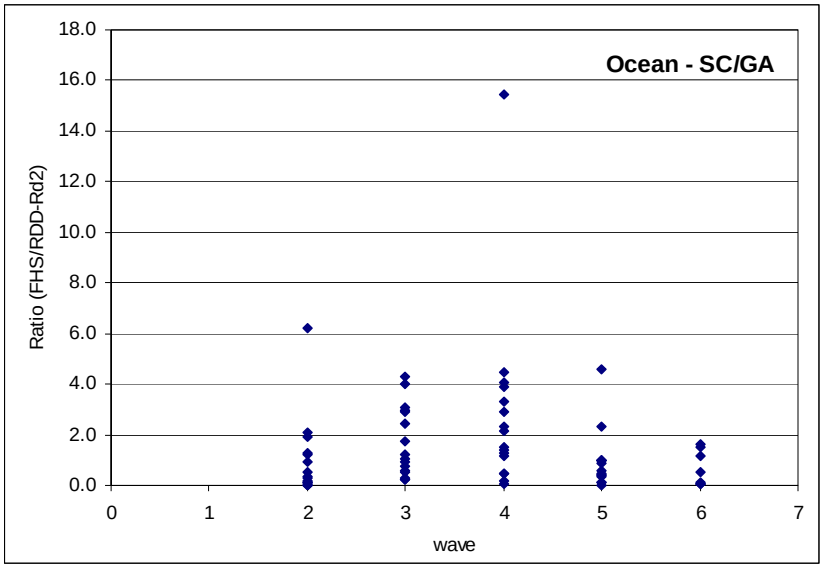
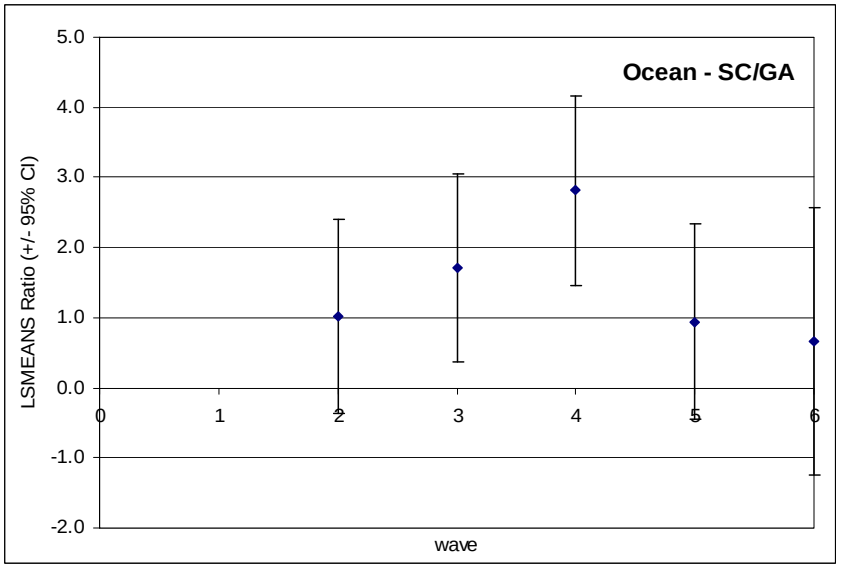
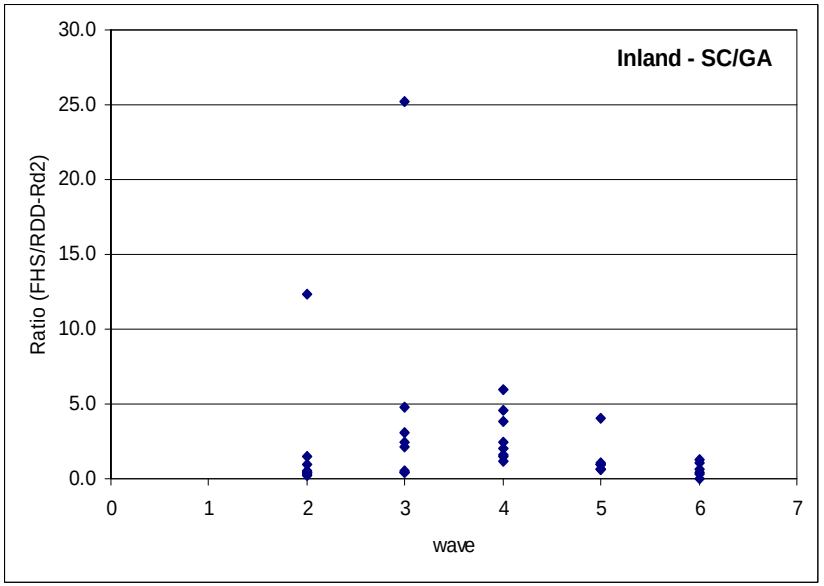

Inland - NC
LSMEANS Ratio (+/- 95% CI)
wave
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
0
1
2
3
4
5
6

Figure 1a. North Carolina Charter boat effort ratios observed (left column) in ocean waters (top) and inland waters (bottom) and estimated mean ratios from GLM model (ocean - top, right; inland - bottom, right).







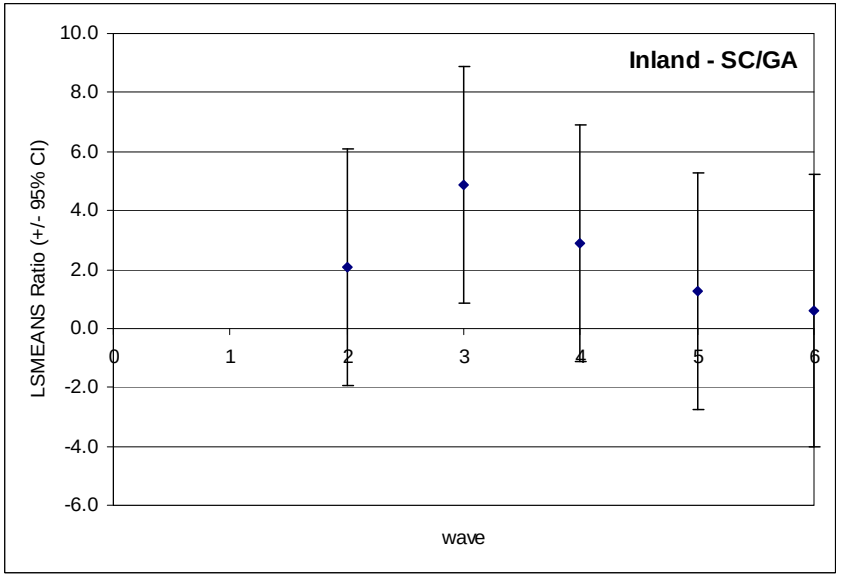


Figure 1b. SC and GA pooled Charter boat effort ratios observed (left column) in ocean waters (top) and inland waters (bottom) and estimated mean ratios from GLM model (ocean - top, right; inland - bottom, right).

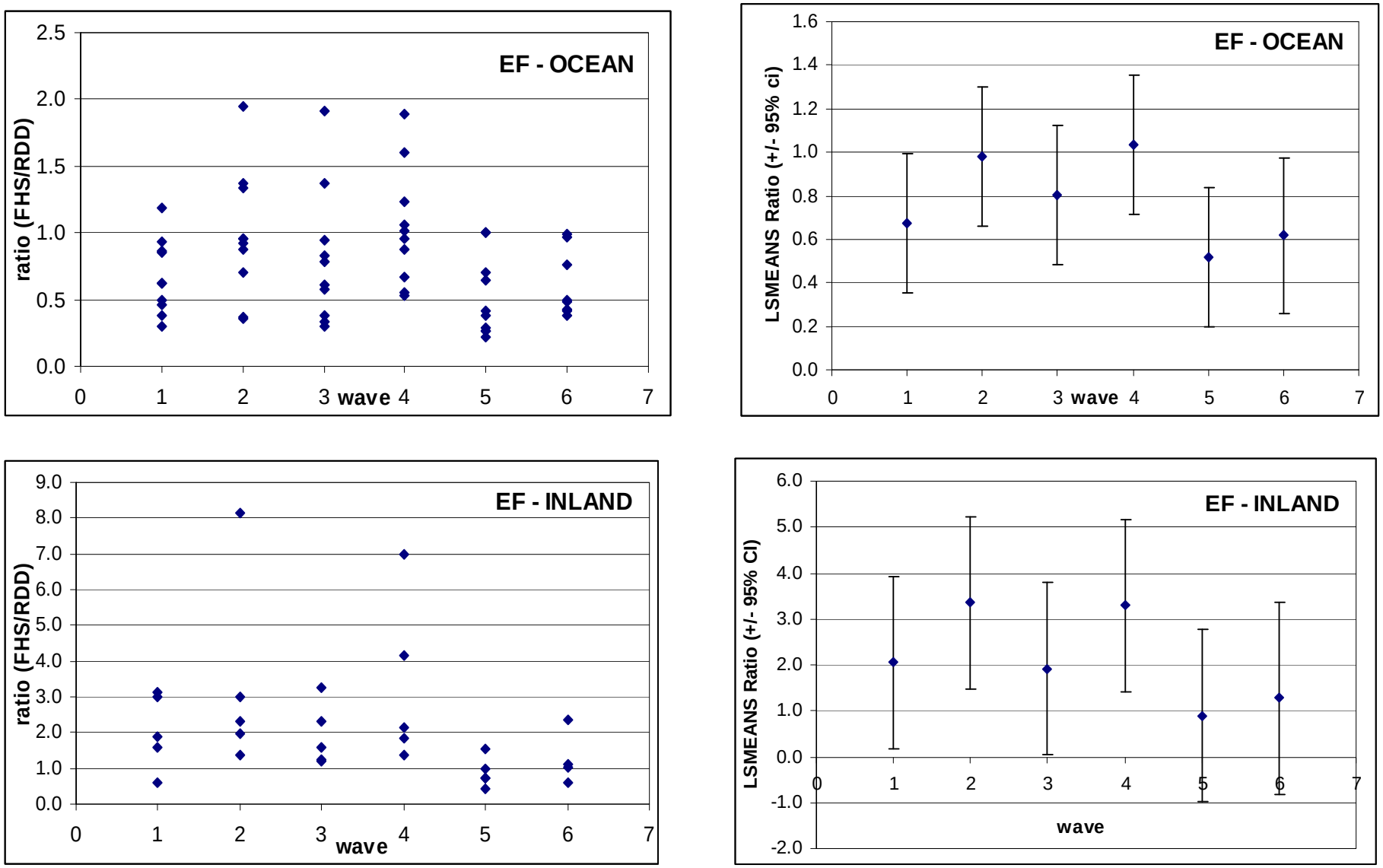
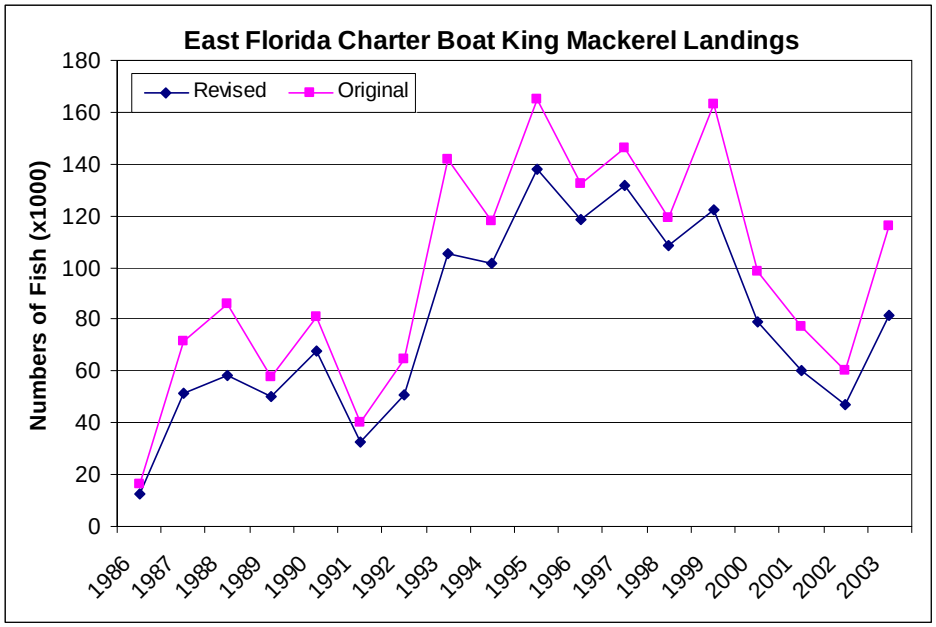
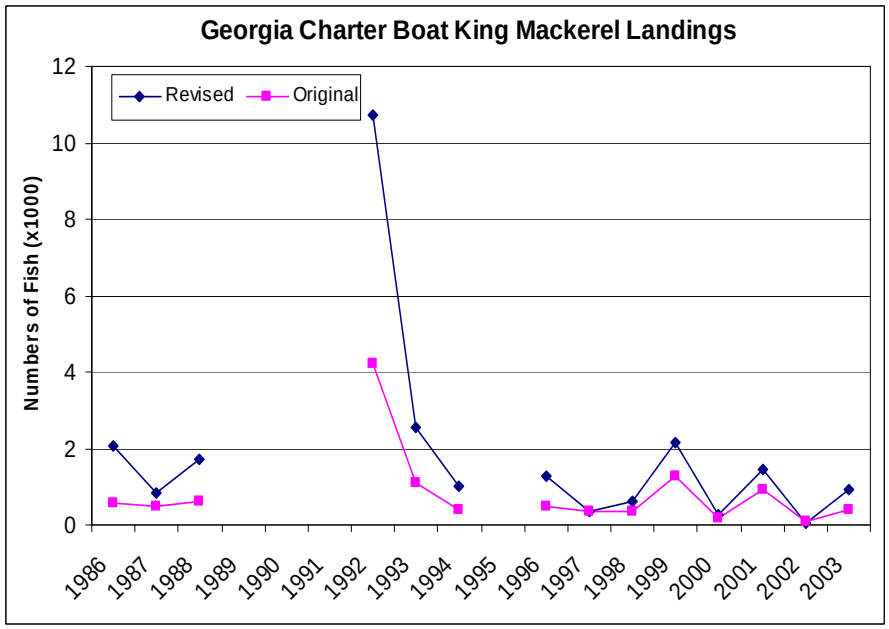
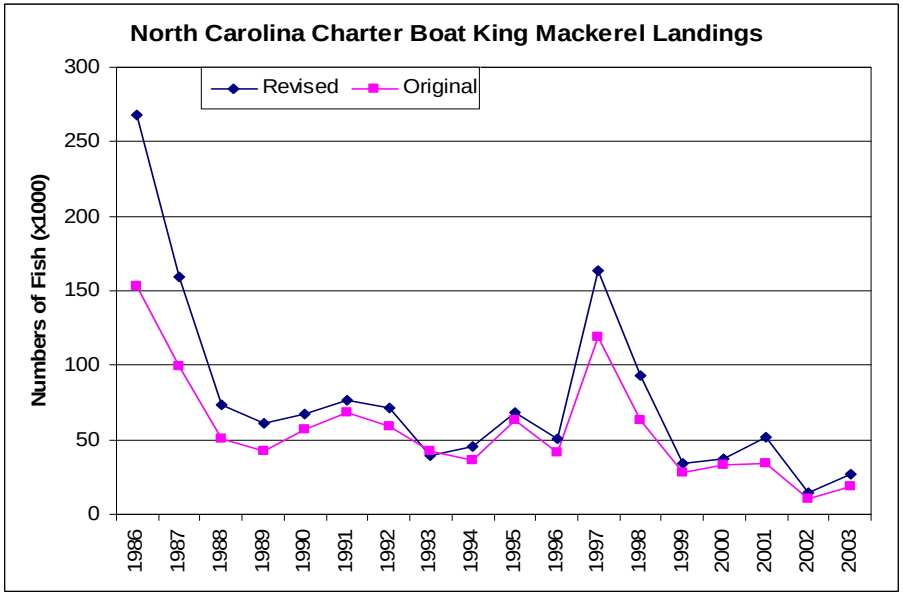


Figure 1c. East Florida only Charter boat effort ratios observed (left column) in ocean waters (top) and inland waters (bottom) and estimated mean ratios from GLM model (ocean - top, right; inland - bottom, right).


East Florida Charter Boat King Mackerel Landings
Revised
Original
Numbers of Fish (x1000)
0
20
40
60
80
100
120
140
160
180
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


Georgia Charter Boat King Mackerel Landings
Revised
Original
Numbers of Fish (x1000)
0
2
4
6
8
10
12
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


North Carolina Charter Boat King Mackerel Landings
Revised
Original
Numbers of Fish (x1000)
0
50
100
150
200
250
300
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003

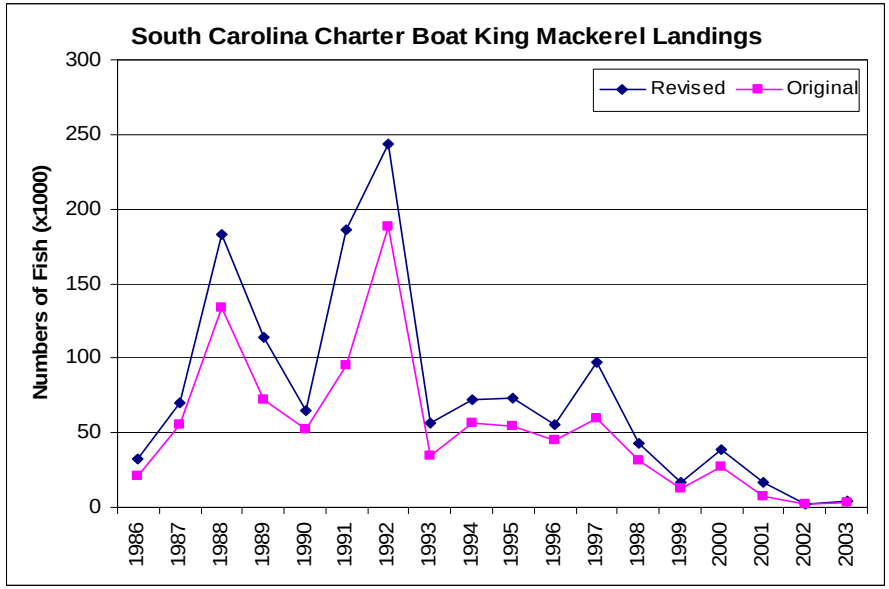

South Carolina Charter Boat King Mackerel Landings
Revised
Original
Numbers of Fish (x1000)
0
50
100
150
200
250
300
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003

Figure 2. King mackerel harvest (landings, Type A+B1) in numbers of fish. Original are estimates from round-4 (3 years pooled data) of Coastal Household Telephone Survey and Revised are produced using GLM model ratios (from CHTS:FHS model) and unpooled estimates.

Table 1. Annual charter boat king mackerel harvest (Type A+B1, numbers of fish) by state.

REVISED HARVEST ESTIMATES
(from FHS-GLM RD4 EFFORT CONVERSION)

YEAR	EFL	GA	NC	SC
1986	12,276	2,066	268,203	32,240
1987	51,290	837	159,590	69,849
1988	58,054	1,724	73,334	182,531
1989	50,219		60,931	114,235
1990	67,479		66,795	65,235
1991	32,757		76,818	185,990
1992	50,637	10,727	71,062	243,805
1993	105,332	2,552	39,636	56,524
1994	101,696	1,013	45,444	71,997
1995	138,015		68,358	73,096
1996	118,526	1,257	51,120	55,912
1997	131,834	367	163,837	97,574
1998	108,705	606	92,991	42,885
1999	122,241	2,145	34,033	16,943
2000	78,863	251	37,531	38,907
2001	60,330	1,444	51,835	17,044
2002	47,010	47	14,724	2,453
2003	81,800	933	26,648	3,918

ORIGINAL HARVEST ESTIMATES
(from RDD RD4 CHTS - POOLED DATA)

	EFL	GA	NC	SC
1986	16,087	563	152,905	21,390
1987	71,745	463	98,842	55,409
1988	86,189	613	50,818	134,176
1989	57,726		42,433	72,577
1990	81,161		56,395	52,615
1991	39,930		68,267	94,626
1992	64,400	4,215	59,138	187,811
1993	141,788	1,101	42,691	34,986
1994	118,169	405	36,274	56,467
1995	164,982		63,497	53,853
1996	132,248	489	41,535	45,170
1997	146,054	351	119,077	59,618
1998	118,866	341	62,901	31,399
1999	163,106	1,261	27,648	12,460
2000	98,390	157	32,879	26,958
2001	76,895	928	33,930	7,755
2002	60,264	72	10,370	2,139
2003	116,183	402	18,762	3,048