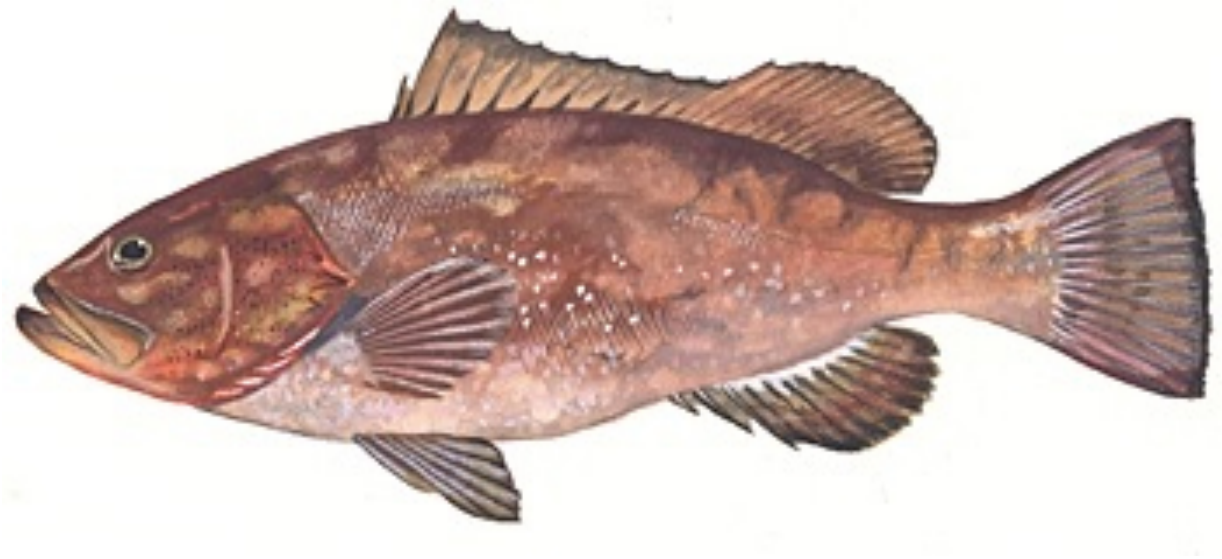
South Atlantic Red Grouper
SAFE REPORT

2016



Contents

DRAFT

List of Tables

List of Figures

1.1. Management History

Table 1 provides a summary of management actions in the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Snapper Grouper FMP) that affect Red Grouper.

Table 1. Summary of Snapper Grouper FMP major amendments.

Document	All Actions Effective By:	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
Snapper-Grouper FMP	08/31/83	-Size limits for red snapper, yellowtail snapper, red grouper, Nassau grouper, black sea bass -4" trawl mesh size -Gear limitations – poisons, explosives, fish traps, trawls -Designated modified habitats or artificial reefs as Special Management Zones
Reg A #1	03/27/87	-Prohibited fishing in SMZs except with hand-held hook-and-line and spearfishing gear. -Prohibited harvest of goliath grouper in SMZs.
A #1	01/12/89	-Prohibited trawl gear to harvest fish south of Cape Hatteras, NC and north of Cape Canaveral, FL.
Reg A #2	03/30/89	-Established 2 artificial reefs off Ft. Pierce, FL as SMZs.
Reg A #3	11/02/90	-Established artificial reef at Key Biscayne, FL as SMZ.
Reg A #5	07/31/93	-Established 8 SMZs off S. Carolina.
A #6	07/27/94	-commercial quotas and limits for snowy grouper, golden tilefish. -prohibited sale of warsaw grouper and speckled hind -100% logbook coverage upon renewal of permit -creation of the *Oculina* Experimental Closed Area
At #7	01/23/95	- size limits, hogfish and mutton snapper - Permit requirements, allowable gear specifications, allowable sale criteria, and modifed framework procedures. Required dealer, charter, and headboat federal permits. -modified management unit for scup to apply south of Cape Hatteras, NC
A #8	12/14/98	-Commercial limited entry and permit requirements
Reg A #7	01/29/99	-Established 10 SMZs at artificial reefs off South Carolina.
A #9	2/24/99	Bag and size limits and seasonal restrictions for red porgy, black sea bass, greater amberjack, vermilion snapper, black grouper, gag. Aggregate recreational limit of 20 snapper grouper per day. Longlines limited to snowy, warsaw, yellowedge, and misty grouper, and golden, blueline and sand tilefish.
Reg A #8	11/15/00	-Established 12 SMZs at artificial reefs off Georgia; revised boundaries of 7 existing SMZs off Georgia to meet CG permit specs; restricted fishing in new and revised SMZs.
A #10	07/14/00	-Identified EFH and established HAPCs for species in the SG FMU.
A #11	12/02/99	-Established SFA criteria for managed stocks (MSY, OY, MFMT, MSST).
A #13A	04/26/04	-Extended for an indefinite period the regulation prohibiting fishing for and possessing snapper grouper spp. within the *Oculina* Experimental Closed Area.
A #14	2/12/09	-Establish eight deepwater Type II marine protected areas (MPAs).
A #15B	2/15/10	- Prohibit the sale of bag-limit caught snapper grouper species. - Bycatch and ESA provisions. - Allocations for snowy grouper and red porgy.
A #16	7/29/09	- Shallow Water Grouper spawning season closure Jan-Apr. - Reduce Aggregate Grouper Bag Limit from 5 to 3.
A #17B	1/31/11	-Specify ACLs, ACTs, and AMs for 9 species undergoing overfishing. -Modify management measures as needed to limit harvest to the ACL or ACT.

Document	All Actions Effective By:	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
A #19 (Comprehensive Ecosystem-Based Amendment 1)	7/22/10	-Provide presentation of spatial information for Essential Fish Habitat (EFH) and EFH-Habitat Areas of Particular Concern (EFH-HAPC) designations under the Snapper Grouper FMP.
A #23 (Comprehensive Ecosystem-Based Amendment 2)	1/30/12	- Designate the deepwater MPAs as EFH-HAPCs. - Limit harvest of snapper grouper species in South Carolina SMZs to the bag limit. - Modify sea turtle release gear.
Amendment #25 (Comprehensive ACL Amendment)	4/16/12	- Establish ABC control rules, ABCs, ACLs, ACTs, and AMs for species not undergoing overfishing. - Remove some species from snapper grouper FMU. - Specify ecosystem component species. - Specify allocations among the commercial and recreational sectors for species not undergoing overfishing. - Limit the total mortality for federally managed species in the South Atlantic to the ACLs.
A #24	7/11/12	- Specify MSY, rebuilding plan (including ACLs, AMs, and OY), and allocations for red grouper.
Reg A #15	9/13/13	- Implement a revised ACL for yellowtail snapper based on the latest stock assessment, modify gag AM.
Generic Dealer Amendment	8/7/14	- Require weekly electronic dealer reporting for snapper grouper and other fisheries.
A #31	1/27/14	- Require weekly electronic reporting on headboats.
Reg A #21	11/6/14	- Modify definition of MSST for species with low M.
A #34	TBD	- Modify AMs for snapper grouper species to create consistency across the regulations.
A #36	TBD	- Spawning SMZs to enhance protection for snapper grouper species, including speckled hind and warsaw grouper.
Comp Allocation	TBD	- Commercial/Recreation allocations and AMs for snapper grouper and other fisheries.
For Hire Logbook Amendment	TBD	- Establish a logbook reporting requirement for all federally permitted charterboats.
Joint Commercial Logbook Amendment	TBD	- Modify timing of reporting requirements for commercial logbooks. - Allow for electronic submission of commercial logbooks.
Joint South Florida Amendment	TBD	- Establish common management regulations for species that overlap Council jurisdictions in the South FL area, including yellowtail snapper, mutton snapper, and black grouper.

Management Goal: Red grouper are currently in a rebuilding plan, with a rebuilding goal of 2020.

1.1.1. Accountability Measures

Accountability measures (AMs) are applied to prevent overfishing and maintain rebuilding progress of overfished species. The commercial AMs for Red Grouper are as follows: The commercial sector will be closed when projections indicate the commercial ACL will be met. If the ACL is exceeded in a year, the ACL will be reduced the following year by the amount of the overage if Red Grouper is overfished. Table 2 provides a summary of key commercial AM provisions.

The recreational AMs for Red Grouper include closing the sector when projections indicate the ACL will be met. If the ACL is exceeded in a year, the ACL will be reduced the following year by the amount of the overage (Table 2).

Table 2. Summary of commercial and recreational AM provisions for Red Grouper.

AM	Commercial	Recreational
In-season closure	X	X
Payback	If overfished	X
No sale	X	NA

1.2. Regulations

Regulations are subject to change at any time, and this document is not an official notification of regulations. Up-to-date information on regulations is available from the South Atlantic Council or the Southeast Regional Office (SERO).

The following tables provide a summary of regulations in place at the time this document is prepared.

Table 3. Seasonal closures for snapper grouper stocks.

Stock	Commercial	Recreational
Shallow Water Groupers (gag, black, red, coney, graysby, red hind, rock hind, yellowmouth, yellowfin)	Jan 1 - April 30	Jan 1 - April 30

Table 4. Commercial and recreational minimum size limits and possession limits.

Regulation	Commercial	Recreational	Notes
Size Limit (in TL)	20	20	
Possession Limit	-	3	Possession limit within the Aggregate Grouper Bag Limit.

1.3. Fishery Sampling

Table 5. Length and otolith sampling from TIP, as well as number of commercial trips sampled containing Red Grouper.

Year	Lengths	Otoliths	Trips
1983	79	0	11
1984	353	0	58
1985	912	0	60
1986	170	0	35
1987	455	0	57
1988	446	0	71
1989	505	0	82
1990	904	0	94
1991	1,075	0	106
1992	299	10	83
1993	676	20	127
1994	490	13	89
1995	1,171	2	145
1996	458	0	112
1997	564	20	108
1998	1,065	32	160
1999	1,888	30	236
2000	1,793	30	265
2001	996	66	200
2002	720	81	175
2003	908	44	186
2004	1,583	284	255
2005	1,419	75	280
2006	2,129	632	317
2007	2,954	1,576	453
2008	2,493	1,183	403
2009	1,655	546	320
2010	913	556	223
2011	872	382	224
2012	784	221	190
2013	486	203	135
2014	420	183	141
2015	228	77	90

Table 6. Numbers of fish and ages samples from MRIP and the headboat survey, as well as number of recreational trips sampled containing Red Grouper. Ages are from the headboat survey only.

Year	Trips	Fish	Ages
1983	230	400	39
1984	300	619	45
1985	253	592	6
1986	218	408	14
1987	181	304	13
1988	150	228	20
1989	164	263	14
1990	110	163	11
1991	60	71	18
1992	72	98	7
1993	95	138	4
1994	114	162	10
1995	122	204	1
1996	152	230	2
1997	182	277	11
1998	287	479	5
1999	222	352	0
2000	142	220	0
2001	153	207	0
2002	184	266	1
2003	121	174	9
2004	120	207	31
2005	133	199	68
2006	125	213	54
2007	113	274	59
2008	81	204	25
2009	45	80	10
2010	70	104	34
2011	74	111	63
2012	90	184	144
2013	89	150	120
2014	75	141	115
2015	61	105	85

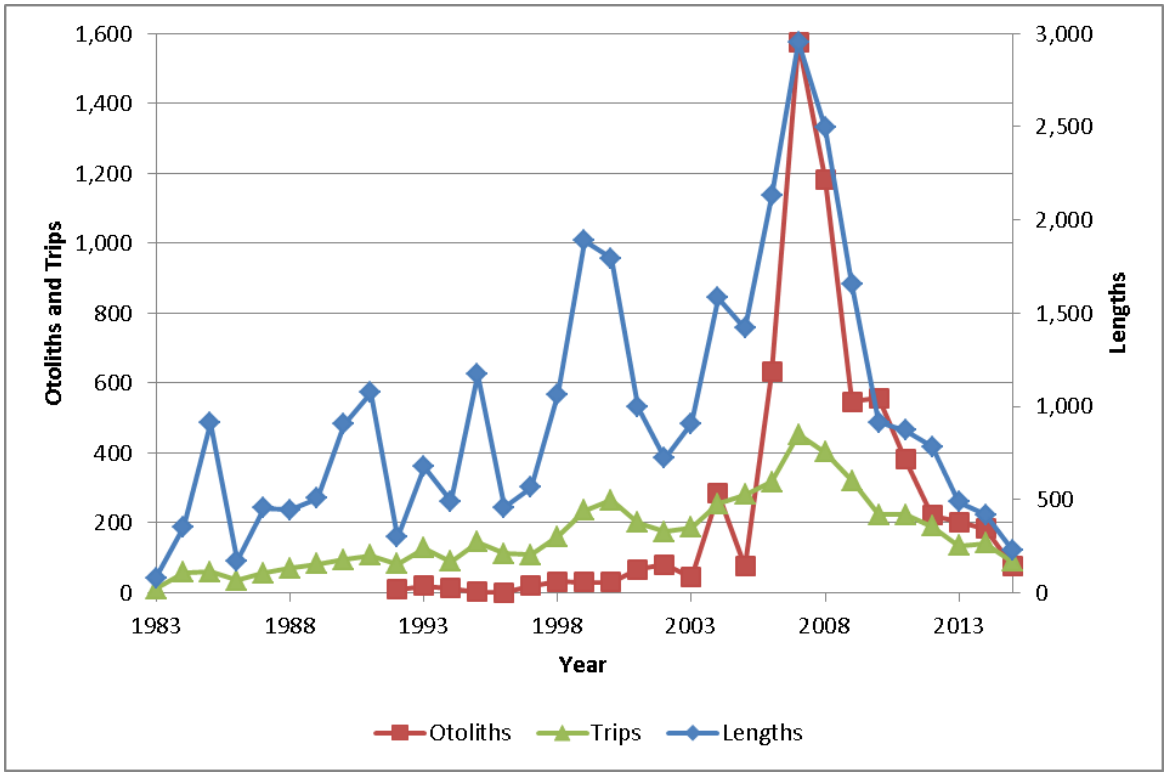


Figure 1. Summary of Red Grouper TIP sampling intensity for otoliths, lengths, and trips.

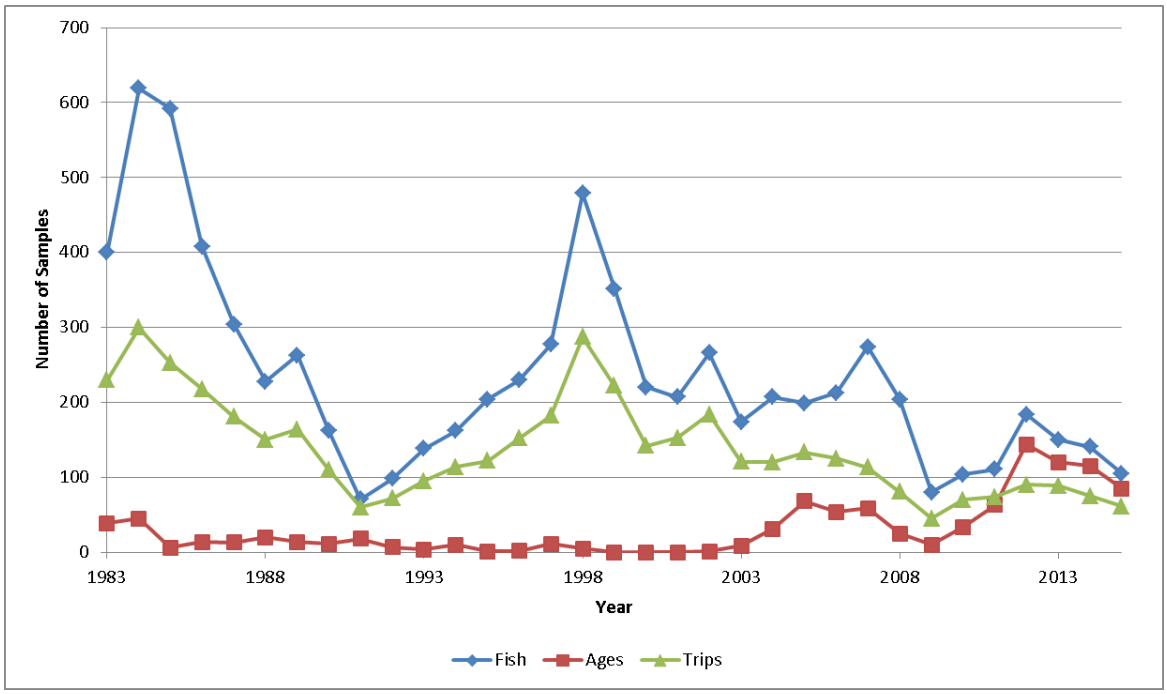


Figure 2. Summary of Red Grouper recreational sampling intensity.

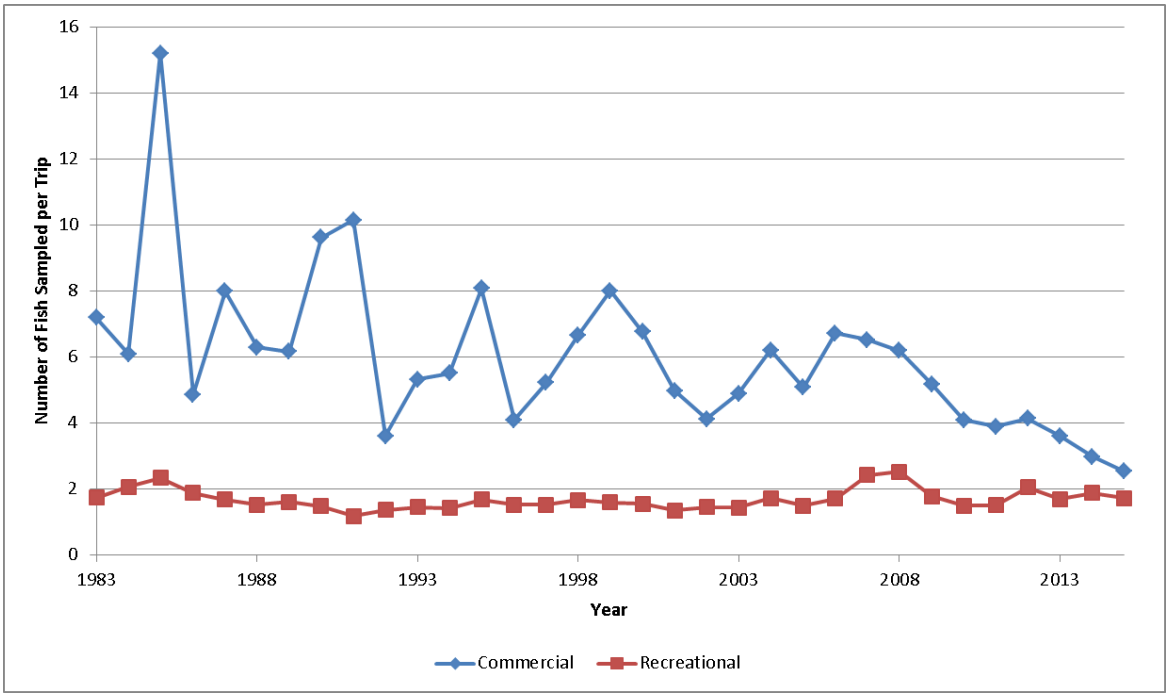


Figure 3. Numbers of Red Grouper sampled per trip for TIP samples and recreational samples.

1.4. Stock Status

SEDAR 19 concluded that red grouper are overfished and overfishing is occurring. The current fishing mortality ($F_{current}$, geometric mean of F from 2006-2008) was found to be about 35% higher than F_{MSY} (F_{2006}/F_{MSY} = 1.35, Table 7). F started above F_{MSY} at the beginning of the assessment time period and exploded in 1981. It remained at these high levels until 1989, when F crashed very quickly and then slowly decreased over time until dipping below F_{MSY} in 2005. However, F has been increasing in the last three years of the assessment to the current value above F_{MSY} (Figure 4). The spawning stock biomass (SSB) in the terminal year of the assessment was found to be just below MSST (SSB_{2008}/MSST = 0.92, Table 7). SSB has shown a steady decline since the beginning of the assessment time period until reaching a minimum value in 1987. Since that time, SSB has steadily increased until the terminal year of the assessment time period (Figure 4).

Assessment Overview

The SEDAR 19 benchmark assessment was the first peer-reviewed assessment of South Atlantic red grouper. This assessment was completed in 2010 using data through 2008. A catch curve analysis was performed by Potts and Brennan (2001) using data through 1999. This analysis was able to estimate full fishing mortality (F) and a proxy for F that yields MSY (F_{MSY}) using static spawning potential ratio (SPR). Potts and Brennan (2001) concluded that red grouper were undergoing overfishing; however the overfished status was unknown since no biomass benchmarks were estimated.

The Beaufort assessment model (BAM), which is a type of statistical catch-at-age model, was used to assess the status of red grouper and estimate management benchmarks. Uncertainty in the model was characterized utilizing several methods. A suite of sensitivity runs were used to investigate the uncertainty around model input parameters. A

mixed Monte Carlo and bootstrap approach (MCB) was used to characterize the uncertainty in the model estimates. A source of uncertainty that was of particular concern to the review panel was the estimate of discard mortality. Very little empirical data existed to base the estimate of discard mortality on. Also, sensitivity runs showed that the model was sensitive to estimates of discard mortality.

The SSC discussed several uncertainties in this assessment. Of particular note is the issue of red grouper's discontinuous distribution between North Carolina and Florida, indicating the possibility of a two-stock structure. The SSC suggested a possible two-stock scenario for the next red grouper assessment. The SSC also discussed several other issues, including: 1) constant vs. time-varying catchability, 2) release mortality estimates from all sectors, and 3) the magnitude and composition of early catches. The SSC accepted the red grouper assessment and ABC was determined by applying the ABC control rule for rebuilding stocks. P* for this stock was determined to be 0.3, so the probability of rebuilding (1-P*) of 0.7 was used to project the ABC. These projections estimated $F_{REBUILD}$ to be 0.181. However, the South Atlantic Council decided to set the ABC based on projections at 75% F_{MSY} (0.166), which is lower than $F_{REBUILD}$ and results in the stock having a 50% probability of being rebuilt by 2016 and an 81% probability of being rebuilt by the end of the rebuilding time period (2020), according to the projections.

Management Program

Table 7. Benchmarks, status parameters, catch limits, and sector allocations for red grouper. Benchmarks and status indicators are estimated from the assessment model used in SEDAR 19 for red grouper. Data are from the SEDAR 19 report for red grouper.

Parameter	Definition	Units	Value
M	Natural Mortality	per year	0.14
$F_{current}$	Geometric Mean of F from last 3 assessment years	per year	0.298
MFMT	Maximum Fishing Mortality Threshold, F_{MSY}	per year	0.221
SSB_{2008}	SSB in final assessment year	1000 lb ww	4,522
SSB_{MSY}	SSB that produces MSY	1000 lb ww	5,714
MSST	Minimum Stock Size Threshold, 75% SSB_{MSY}	1000 lb ww	4,914
B_{MSY}	Biomass at MSY	1000 lb ww	8,113
MSY	Yield at F_{MSY}	1000 lb ww	1,110
OFL	Yield at MFMT = F_{MSY}	1000 lb ww	914
ABC	Yield at 75% F_{MSY}	1000 lb ww	780
ACL	= ABC	1000 lb ww	780
Commercial ACL	44% ACL	1000 lb ww	343
Recreational ACL	56% ACL	1000 lb ww	437
$F_{current}/ F_{MSY}$	Indicates if overfishing is occurring (>1: overfishing)	-	1.35
SSB_{2008}/SSB_{MSY}	If rebuilding, indicates if stock is rebuilt (>1: rebuilt)	-	0.79
SSB_{2008}/MSST	Indicates if the stock is overfished (<1: overfished)	-	0.92

1.5. Species Overview

Red grouper, *Epinephelus morio*, is primarily a continental species, mostly found in broad shelf areas (Jory and Iversen 1989). Distributed in the Western Atlantic, from North Carolina to southeastern Brazil, including the eastern Gulf of Mexico and Bermuda, but can occasionally be found as far north as Massachusetts (Heemstra and Randall 1993). The red grouper is uncommon around coral reefs; it generally occurs over flat rock perforated with solution holes (Bullock and Smith 1991), and is commonly found in the caverns and crevices of limestone reef in the Gulf of Mexico (Moe 1969). It also occurs over rocky reef bottoms (Moe 1969).

Adult red grouper are sedentary fish that are usually found at depths of 5-300 m (16-984 ft). Fishermen off North Carolina commonly catch red grouper at depths of 27-76 m (88-249 ft) for an average of 34 m (111 ft). Fishermen off southeastern Florida also catch red grouper in depths ranging from 27-76 m (88-249 ft) with an average depth of 45 m (148 ft) (Burgos, 2001; McGovern et al., 2002a). Moe (1969) reported that juveniles live in shallow water nearshore reefs until they are 40.0 cm (16 in) and 5 years of age, when they become sexually mature and move offshore. Spawning occurs during February-June, with a peak in April (Burgos 2001). In the eastern Gulf of Mexico, ripe females are found December through June, with a peak during April and May (Moe 1969). Based on the presence of ripe adults (Moe 1996) and larval red grouper (Johnson and Keener 1984) spawning probably occurs offshore. Coleman et al. (1996) found groups of spawning red grouper at depths between 21-110 m (70-360 feet). Red grouper do not appear to form spawning aggregation or spawn at specific sites (Coleman et al. 1996). They are reported to spawn in depths of 30-90 m (98-295 ft) off the Southeast Atlantic coast (Burgos 2001; McGovern et al. 2002a).
Off North Carolina, red grouper first become males at 50.9 cm (20.1 in) TL and males dominate size classes greater than 70.0 cm (27.8 in) TL. Most females transform to males between ages 7 and 14. Burgos (2001) reported that 50% of the females caught off North Carolina are undergoing sexual transition at age 8. Maximum age reported by Heemstra and Randall (1993) was 25 years. Burgos (2001) and McGovern et al. (2002a) indicated that red grouper live for at least 20 years in the Southeast Atlantic and a maximum age of 26 years has been reported for red grouper in the Gulf of Mexico (L. Lombardi, NMFS Panama City, personal communication).

Maximum reported size is 125.0 cm (49.2 in) TL (male) and 23.0 kg (51.1 lb). For fish collected off North Carolina during the late 1990s, age at 50% maturity of females is 2.4 years and size at 50% maturity is 48.7 cm (19.3 in) TL. Off southeastern Florida, age at 50% maturity was 2.1 years and size at 50% maturity was 52.9 cm (21.0 in) TL (Burgos 2001; McGovern et al. 2002a). These fish eat a wide variety of fishes, octopuses, and crustaceans, including shrimp, lobsters, and stomatopods (Bullock and Smith 1991; Heemstra and Randall 1993).

Table 8. Overview of biological attributes for Red Grouper.

Attribute	Value
Max Age	25 years
Max Length	125 cm (49.2 in)

Max Weight	23 kg (51.1 lbs.)
Age at Maturity	2.1-2.4 years
Protogyny	50.9 cm (20.1 in)
Size at Maturity	48.7-59.2 cm (19.3-21 in)
Peak Spawning	Feb-Apr

Table 9. Ecosystem attributes of snapper grouper stocks.

Attribute	Value
Stock Genetic Diff in SA	NS
Home Range or Migration	Small
Depth Effect	Larger Offshore
Area Found	Keys to NC
Dominant Area	Keys and NC
Adult Habitat	Live, Rock, Sand, AR
Juvenile Habitat	Reef, Lesser extent Est with SAV
Female Spawning Season	Dec-Jun
Spawning Depth	30-90 m
Spawning Area	Keys and NC
Mean Depth Caught	30-45 m
Min Depth Caught	20 m
Max Depth Caught	95 m

1.6. Current Outlook

Landings of red grouper from all sectors have been reduced to a level below the ACL set by the rebuilding plan (Table 10, Figure 5). MRIP discards have been almost 5 times higher than landings in recent years, but have still been trending downward since 2000 (Table 11, Figure 6). Commercial discards, although only available from SEDAR 19, also show a downward trend since 2002 (Table 11, Figure 6). Commercial TIP sampling for Red Grouper has seen a decline in the number of fish per trip sampled on trips containing Red Grouper, most sharply and steadily since 2006 (Figure 3). All of this data suggest that Red Grouper is continuing to decline despite SEDAR 19 indicating the SSB has increased in the last few years of the assessment (terminal year 2008, Figure 4). However, the MARMAP Chevron trap index has been declining since 2004 and is currently at its lowest values of the entire time series (Figure 7).

Table 10. Landings of red grouper by sector in lbs ww.

Year	Commercial	For-Hire	Private	Total Recreational	Total Landings
1986	209,063	29,730	42,441	72,171	281,234
1987	239,113	34,616	135,385	170,001	409,114
1988	244,410	27,431	138,988	166,419	410,829
1989	398,029	23,310	38,057	61,368	459,397
1990	172,452	49,533	56,150	105,683	278,135
1991	145,230	19,620	10,548	30,169	175,399
1992	114,045	36,575	62,624	99,199	213,244
1993	148,680	44,908	129,681	174,588	323,268
1994	185,287	45,858	83,084	128,942	314,229
1995	342,739	50,598	31,162	81,760	424,499
1996	335,433	61,815	100,741	162,556	497,989
1997	458,729	108,139	109,518	217,657	676,386
1998	653,572	92,379	142,894	235,273	888,845
1999	570,340	97,304	78,475	175,779	746,119
2000	472,169	42,872	96,586	139,458	611,627
2001	415,990	63,680	105,203	168,883	584,873
2002	438,710	119,249	135,687	254,936	693,646
2003	393,822	83,975	98,517	182,492	576,314
2004	372,907	132,174	213,789	345,962	718,869
2005	237,007	103,000	196,117	299,116	536,123
2006	384,243	86,846	418,393	505,239	889,482
2007	655,338	135,612	498,318	633,930	1,289,268
2008	672,842	90,856	1,008,242	1,099,097	1,771,939
2009	431,604	27,669	254,812	282,481	714,085
2010	329,095	18,042	80,377	98,419	427,514
2011	314,232	19,954	91,362	111,316	425,548
2012	155,890	16,286	83,685	99,971	255,861
2013	118,055	11,229	113,476	124,705	242,760
2014	148,922	22,603	27,065	49,668	198,590
2015	66,610	13,917	114,296	128,213	194,823

Table 11. Discards of Red Grouper in numbers of fish from MRIP (Charterboats and Private anglers) and commercial vertical lines (from SEDAR 19).

Year	MRIP	Comm
1986	12,529	
1987	45,018	
1988	15,995	
1989	4,017	
1990	8,053	
1991	60,029	
1992	52,962	8,915
1993	18,103	8,575
1994	33,580	14,397
1995	26,540	10,489
1996	56,996	11,582
1997	106,403	14,709
1998	27,224	10,461
1999	44,347	12,956
2000	219,727	10,869
2001	104,429	8,423
2002	71,342	21,608
2003	37,106	11,354
2004	93,247	10,850
2005	149,517	9,992
2006	94,846	4,933
2007	40,198	8,571
2008	51,945	1,993
2009	88,040	
2010	85,150	
2011	18,771	
2012	36,061	
2013	62,641	
2014	40,560	
2015	45,942	

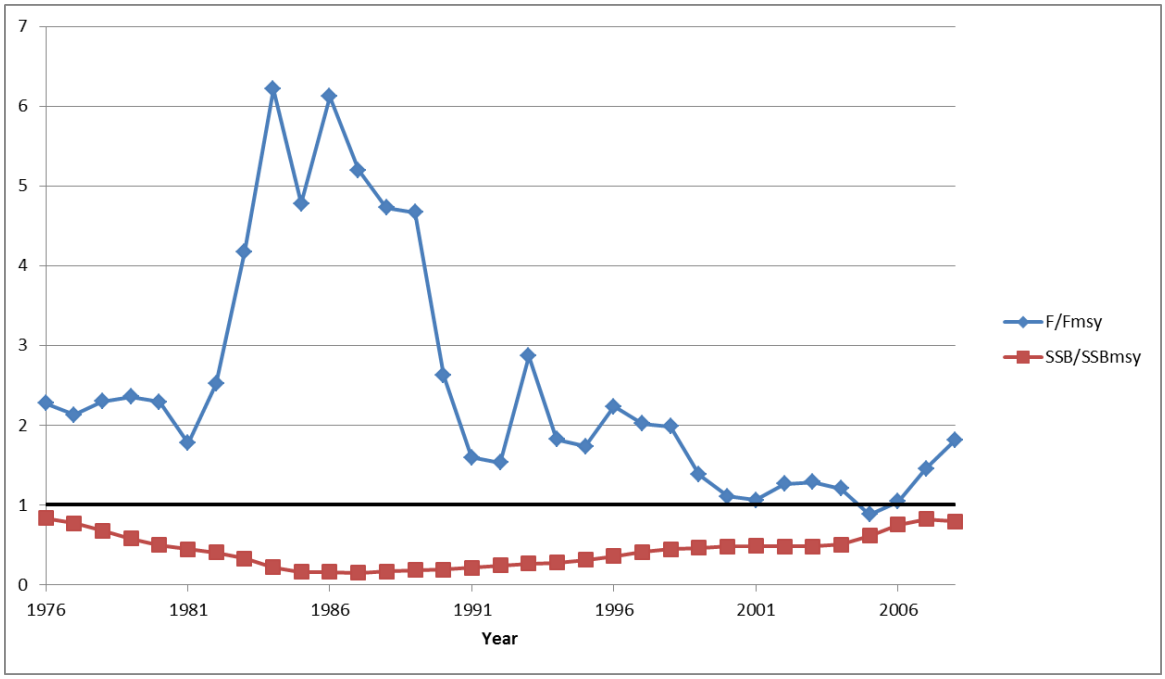


Figure 4. Spawning stock biomass (SSB) and exploitation (F) levels relative to expected conditions of the red grouper stock at MSY. Relative biomass is depicted by SSB/SSB_{MSY} and exploitation by F/F_{MSY}. The index line at 1 represents MSY conditions. Data are from the SEDAR 19 report for red grouper.

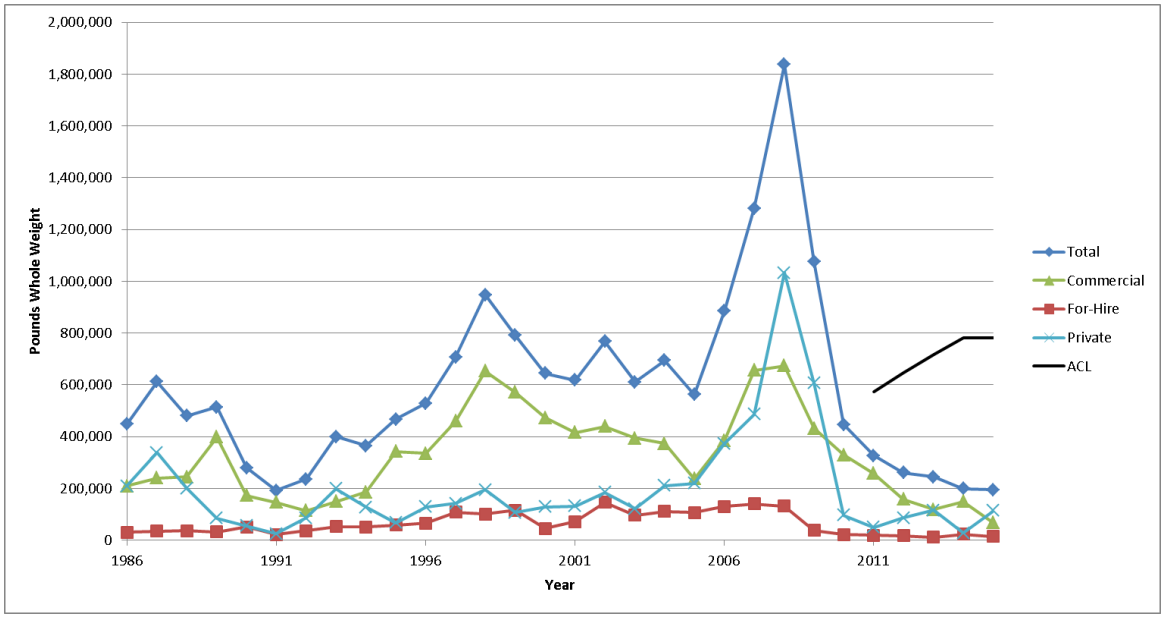


Figure 5. Landings of red grouper (lbs ww) by sector with current total commercial and recreational ACL for reference.

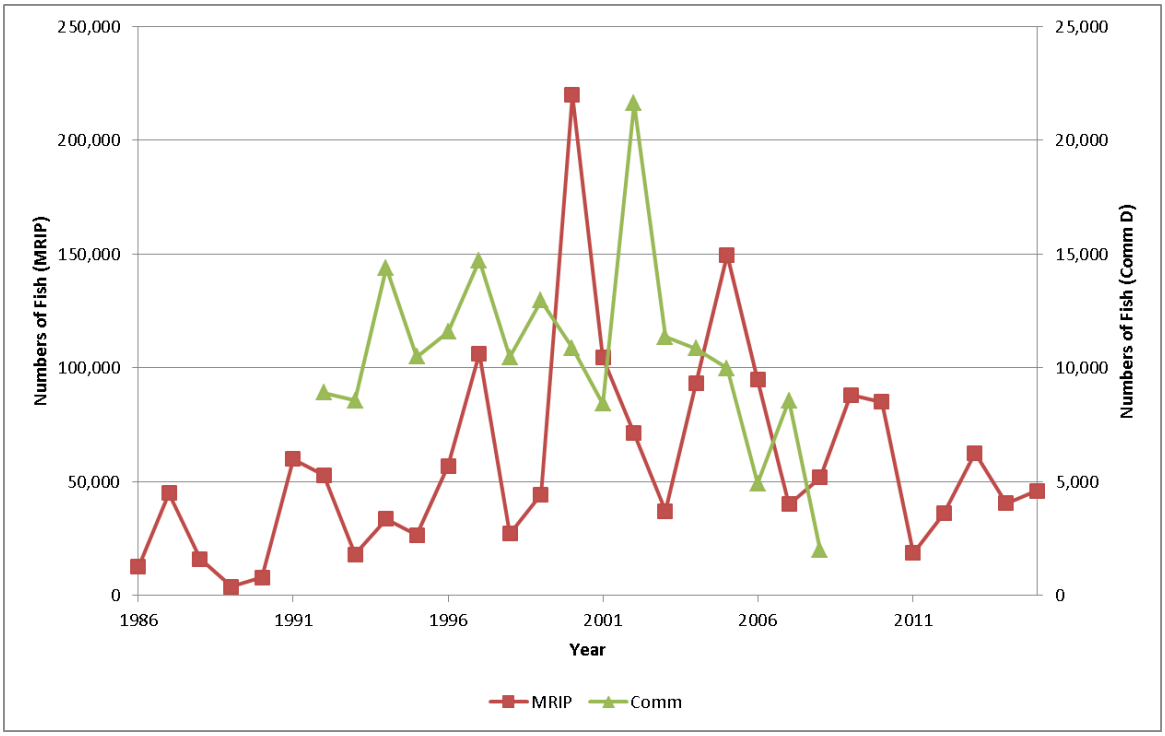


Figure 6. Discards of Red Grouper in numbers of fish from MRIP (Charterboats and Private anglers, SEFSC) and commercial vertical lines (SEDAR 19).

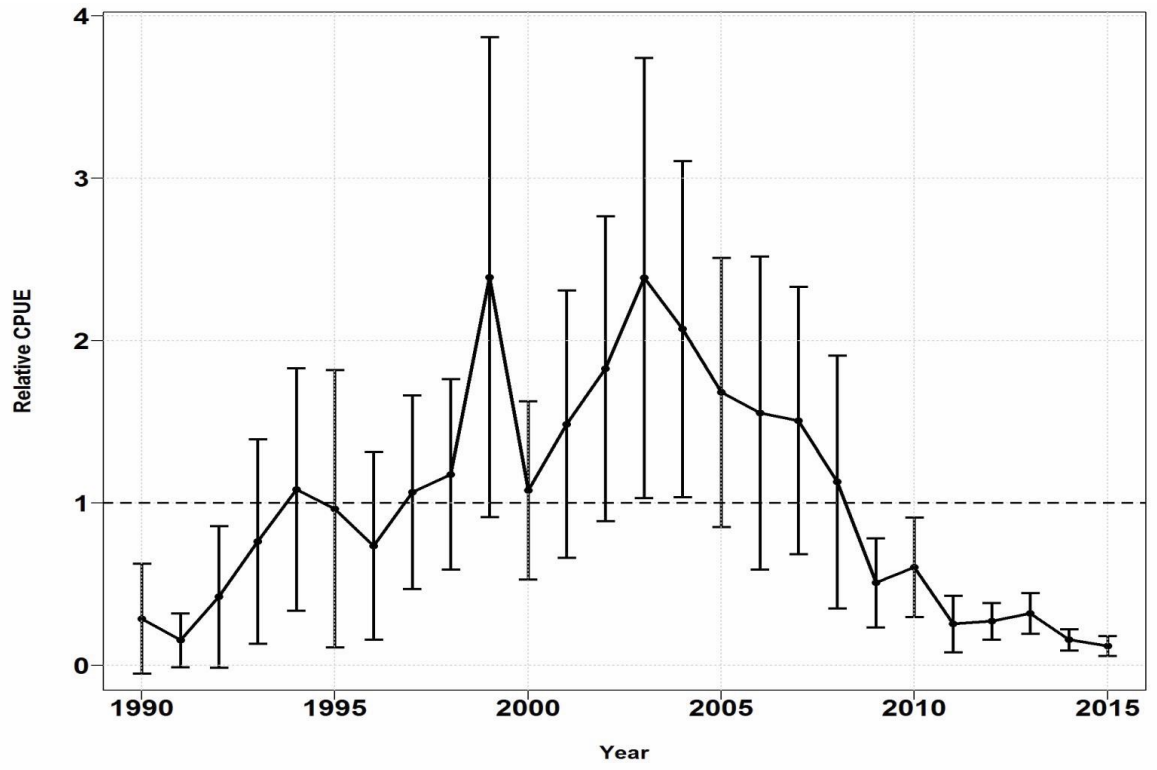


Figure 7. MARMAP Chevron trap normalized delta-GLM standardized CPUE (±SE) for red grouper.