Spearfishing in the South Atlantic Snapper Grouper Fishery

Current Concerns Pertaining to Spearfishing in the South Atlantic EEZ

During the March 2018 meeting, the Council heard concerns, primarily from North Carolina, over the impact of spearfishing on grouper populations. Fishermen have requested that the Council consider requiring an endorsement for spearfishing since this component of the fishery appears to be growing. In addition, there are concerns over increasing user conflict between divers using spearfishing gear for commercial harvest of snapper grouper species and commercial hook-and-line fishermen in some areas of North Carolina. The Council requested that the Snapper Grouper Advisory Panel (AP) provide input on the issue.

At their April 2018 meeting, the AP provided the following:

- Free diving is becoming more popular in North Carolina. Classes are offered to improve efficiency when targeting snapper grouper species with spearfishing gear.
- There is mounting concern over the effectiveness of spearfishing resulting in localized depletion of shallow-water groupers. Fishermen are noting an increase in the number of dive boats in some areas.
- Hook-and-line gear is relatively inefficient. However, fishermen maintain that this inefficiency has positive effects on the resource. Spearfishing gear, however, is extremely efficient and there is concern it may be taking its toll on already dwindling grouper populations.
- Hook-and-line fishermen are increasingly frustrated with having to compete with dive operations.
- Similar issues are occurring in south Florida.
- Commercial spearfishing results in very little or no discarding, which has a positive effect on the resource.
- Use of spearfishing among recreational divers in inshore waters has increased sharply in the last 15 years in north Florida.
- Some dealers in the Carolinas depend on commercial dive fishermen for species like hogfish. Diving is an important component of the commercial snapper grouper fishery.
- There is concern over hogfish populations in Georgia and the Carolinas due to the efficiency of commercial spearfishing operations. Fishermen claim that the resource can easily be depleted from an area. Fishermen acknowledge that the annual catch limit that went into place will help protect the resource.
- Some fishermen suggest a gear endorsement that would mainly help managers identify the universe of users. This step would help managers craft possible regulations in the future.
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The AP approved the motions below pertaining to spearfishing gear:

MOTION #6: REQUEST THAT THE COUNCIL CONSIDER A WAY TO IDENTIFY RECREATIONAL USE OF SPEARFISHING GEAR
APPROVED BY AP (UNANIMOUS)

MOTION #7: REQUEST THAT THE COUNCIL CONSIDER CREATING A GEAR ENDORSEMENT FOR SPEARFISHING FOR THE COMMERCIAL SECTOR APPROVED BY AP (7 IN FAVOR/4 OPPOSED/2 ABSTENTIONS)

The Snapper Grouper Committee discussed the use of powerheads in October 2018 as it pertains to Regulatory Amendment 29, which includes an action to address the prohibition of powerheads in the exclusive economic zone (EEZ) off South Carolina. Currently, the use of powerheads in the EEZ off South Carolina is prohibited to harvest snapper grouper species.

The Council directed staff to develop a white paper to investigate extent of use of spearfishing gear in the commercial and recreational sectors of the snapper grouper fishery, existing ways to track its use, potential biological/ecological effects, possible ways to reduce effort by means of a season, and how use of this gear relates to National Standard 5.

During the discussion, the following points were made:

- There has been explosive growth in commercial spearfishing effort in North Carolina (possibly also in South Carolina) mainly on gag, red grouper, and hogfish.
- Small outcroppings off the North Carolina coast are frequently visited by divers who use spearfishing gear to very efficiently target snapper grouper species to the extent that there are noticeable changes in fish behavior.
- This increase in spearfishing effort is causing concern among hook-and-line fishermen who fear the resource will soon no longer be there for them to utilize.
- Fishermen have asked that managers explore the issue to reduce effort, possibly through an endorsement program, gear-specific trip limits, or seasons.
- When harvest of shallow-water groupers opens in May, divers are fishing the grouper spawning aggregations and predictably select the largest individuals. Conflict has arisen between some divers and conservation-minded hook-and-line fishermen who understand that removing large, mature individuals has long-term negative effects on the population.
- There are concerns over impacts to habitat and fish behavior from increased spearfishing effort.
- Spearfishing appears to also have gained popularity among recreational fishermen.
- Some species, such as hogfish, are particularly vulnerable to spearfishing gear due to their natural behavior. Hogfish off South Carolina seem to be getting smaller and perhaps there are fewer of them.
- Some of the spearfishing effort may not be adequately captured because fishermen may be using multiple gear types in the same trip but reporting only one.
- Fisheries managers in North Carolina report numerous calls from concerned commercial, private recreational, and for-hire fishermen stating that spearfishing effort is increasing and possibly having negative ecological effects at the community level.
- National Standard 5 promotes efficiency in managed fisheries to promote profitability.
- There is precedent for employing gear-specific seasons to reduce/control effort in South Atlantic fisheries (i.e., black sea bass).

Spearfishing is listed under allowable gear in the South Atlantic to fish for snapper grouper species. *Spearfishing* is defined in the Code of Federal Regulations (CFR) as "fishing for, attempting to fish for, catching or attempting to catch fish in tidal waters by any person with a spear or a powerhead" (50 CFR 600.1400). In addition, *spear* means a sharp, pointed, or barbed instrument on a shaft. Spears can be operated manually or shot from a gun or sling" (50 CFR 600.10). A *powerhead* is defined as "any device with an explosive charge, usually attached to a speargun, spear, pole, or stick, that fires a projectile upon contact" (50 CFR 622.2). In the South Atlantic exclusive economic zone (EEZ), the following additional regulations apply to spearfishing: "a person using a rebreather may not harvest South Atlantic snapper-grouper with spearfishing gear. The possession of such snapper-grouper while in the water with a rebreather is *prima facie* evidence that such fish was harvested with spearfishing gear while using a rebreather" (50 CFR 622.180).

History of management on the use of spearfishing gear (including powerheads) in the South Atlantic Exclusive Economic Zone

Snapper Grouper FMP (1983): The Council considered a prohibition on the use of powerheads but did not move forward to implement.
Rationale: powerheads increase diver safety.

Amendment 4 (1991): Prohibited the use of powerheads and bangsticks in all Special Management Zones (SMZ) off South Carolina and required snappers and groupers in the South Atlantic EEZ to be landed with head and fins intact.
Rationale:

- Concern over localized depletion and user conflicts. South Carolina requested prohibition.
- Prohibition on possession of mutilated fish intended to aid enforcement.

Amendment 7 (1994): Prohibited the use of explosive charges, including powerheads, to harvest snapper grouper species in the EEZ off South Carolina.
Rationale:

- Difficulty in enforcing prohibition on powerheads in state waters and in federal SMZs when allowed in federal waters.
- Concerns over localized depletion of snapper grouper species from illegal use of powerheads in SMZs off South Carolina.
- User conflict between recreational and commercial fishermen, and within the recreational sector.

Amendment 23 (in Comprehensive Ecosystem-based Amendment 2; 2012): Limited harvest and possession of snapper grouper species (with the use of all non-prohibited fishing gear) in SMZs off South Carolina to the recreational bag limit.
Rationale:

- Concern over efficiency of spearguns used to harvest commercial quantities of snapper grouper species in SMZs. Use of such gear not compatible with the intent of the SMZs.

Spearfishing in the Commercial Snapper Grouper Fishery

Commercial landings were obtained from the Atlantic Coastal Cooperative Statistics Program (ACCSP) for the period 2007 through 2017. Spearfishing is a gear code on commercial logbooks and dealer reports and commercial landings are sampled through the Trip Interview Program (TIP). TIP data were unavailable to include in this report due to the government shutdown. However, length frequency data for commercial hook-and-line and spear catches of select species in North Carolina were obtained from the North Carolina Division of Marine Fisheries and are summarized in **Appendix B**.

From 2007 through 2017, commercial landings (pounds whole weight; lbs ww) of snapper grouper species in the South Atlantic region averaged 7.5 million pounds whereas mean landings attributed to spearfishing gear were just under 298,000 lbs ww, or about 4%. Florida landings from spearfishing were highest among the South Atlantic states overall; however, on average, use of this gear diminished in Florida in 2015-2017 compared to the early years of the time series. By contrast, spearfishing effort increased by 0.7% and 1.7% in South and North Carolina, respectively (**Table 1**). **Tables A1-A3** in **Appendix A** present commercial landings for gag and black grouper (combined), red grouper, and hogfish as these are species of concern that are targeted with this gear type.

The percentage of overall snapper grouper commercial landings attributed to spearfishing in Florida ranged from a high of just over 9% in 2008 to a low of 3.6% in 2016 (**Figure 1**).

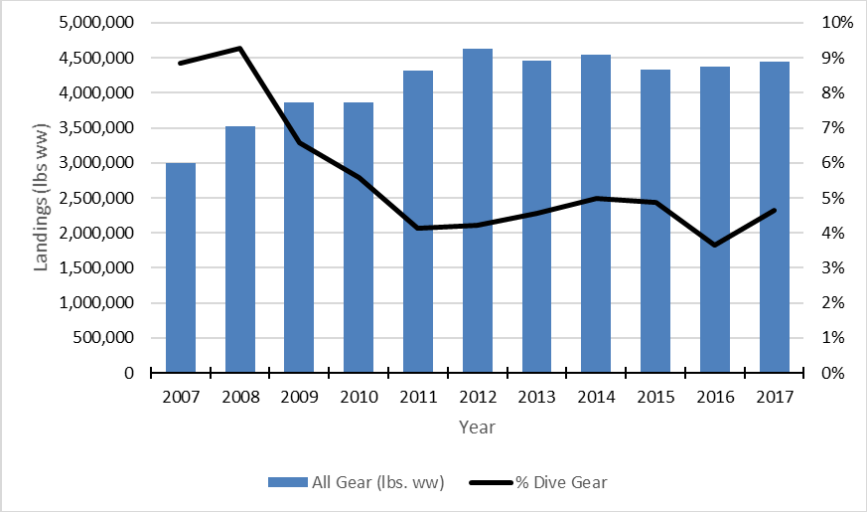


Figure 1. Commercial landings (lbs ww) of snapper grouper species in **Florida** for all gear and percent of landings attributed to spearfishing, 2007-2017. "Dive gear" includes spears and powerheads.

Table 1. Commercial landings (pounds whole weight, lbs ww) of snapper grouper species in the South Atlantic region with all gear and spearfishing gear, by state, 2007-2017.

Year	Dive Gear (lbs. ww)					All Gear (lbs. ww)					% Dive Gear				
	FL	GA	SC	NC	Total	FL	GA	SC	NC	Total	FL	GA	SC	NC	Total
2007	265,305	0	17,519	9,858	292,681	3,002,758	221,988	1,554,715	2,423,752	7,203,213	8.8%	0.0%	1.1%	0.4%	4.1%
2008	327,514	0	21,367	34,409	383,289	3,527,768	201,172	1,472,569	2,853,541	8,055,050	9.3%	0.0%	1.5%	1.2%	4.8%
2009	254,045	1,181	55,290	13,245	323,760	3,857,792	242,574	1,266,632	2,656,897	8,023,896	6.6%	0.5%	4.4%	0.5%	4.0%
2010	215,726	0	67,868	23,249	306,843	3,866,943	81,848	1,447,056	2,219,862	7,615,709	5.6%	0.0%	4.7%	1.0%	4.0%
2011	178,491	0	74,414	17,941	270,846	4,316,301	115,078	1,710,570	1,583,903	7,725,851	4.1%	0.0%	4.4%	1.1%	3.5%
2012	194,942	9,558	44,597	18,903	267,999	4,626,344	53,363	1,372,620	1,696,386	7,748,714	4.2%	17.9%	3.2%	1.1%	3.5%
2013	203,098	34,013	51,881	18,846	307,838	4,455,150	212,943	1,489,518	1,524,534	7,682,145	4.6%	16.0%	3.5%	1.2%	4.0%
2014	227,176	13,916	48,539	27,460	317,090	4,548,220	113,035	1,336,403	1,624,847	7,622,506	5.0%	12.3%	3.6%	1.7%	4.2%
2015	211,769	11,713	33,317	23,363	280,162	4,333,220	93,311	1,204,799	1,386,499	7,017,830	4.9%	12.6%	2.8%	1.7%	4.0%
2016	159,433	1,345	37,070	38,308	236,156	4,373,520	93,557	1,127,902	1,468,299	7,063,278	3.6%	1.4%	3.3%	2.6%	3.3%
2017	206,802	1,579	30,850	46,877	286,109	4,444,092	47,364	1,188,471	1,626,456	7,306,383	4.7%	3.3%	2.6%	2.9%	3.9%
Avg.	**222,209**	**6,664**	**43,883**	**24,769**	**297,525**	**4,122,919**	**134,203**	**1,379,205**	**1,914,998**	**7,551,325**	**5.4%**	**5.0%**	**3.2%**	**1.3%**	**3.9%**
Avg. 07-09	**282,288**	**394**	**31,392**	**19,170**	**333,244**	**3,462,773**	**221,911**	**1,431,306**	**2,644,730**	**7,760,720**	**8.2%**	**0.2%**	**2.2%**	**0.7%**	**4.3%**
Avg. 15-17	**192,668**	**4,879**	**33,746**	**36,183**	**267,476**	**4,383,611**	**78,077**	**1,173,724**	**1,493,752**	**7,129,164**	**4.4%**	**6.2%**	**2.9%**	**2.4%**	**3.8%**

Source: ACCSP

Use of spearfishing gear in the commercial harvest of snapper grouper species in Georgia increased in 2012, contributing between 18% and 12% of snapper grouper landings during 2012-2015, and declined to about 2% in 2016 (**Figure 2**).

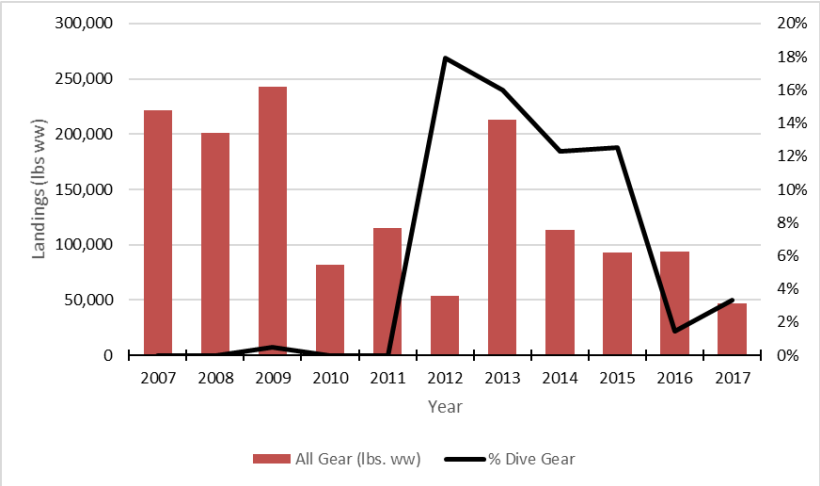


Figure 2. Commercial landings (lbs ww) of snapper grouper species in **Georgia** for all gear and percent of landings attributed to spearfishing, 2007-2017.

In South Carolina, use of spearfishing gear increased relative to commercial landings of snapper grouper species from 2007 to 2010 and declined thereafter. The peak in spearfishing evident in the South Carolina data coincides with an influx of Florida vessels during that time (Amy Dukes, SCDNR, Personal communication) (**Figure 3**).

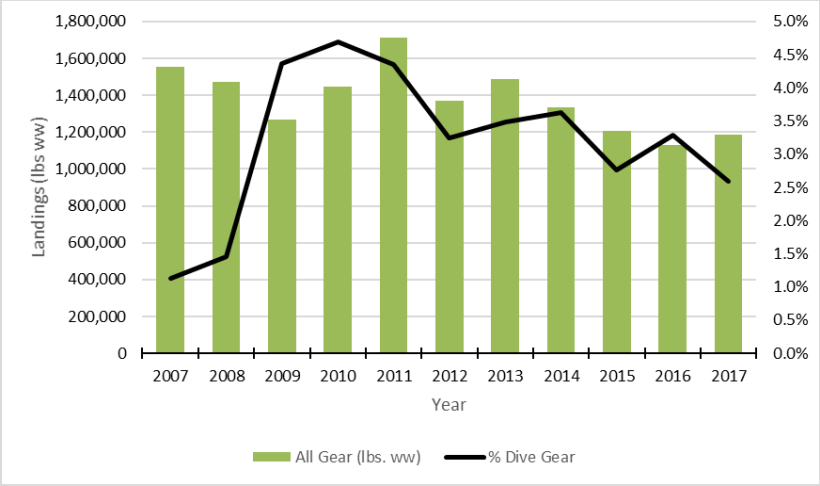


Figure 3. Commercial landings (lbs ww) of snapper grouper species in **South Carolina** for all gear and percent of landings attributed to spearfishing, 2007-2017.

The percentage of commercial landings of snapper grouper species harvested with spearfishing gear relative to landings with all other gear combined in North Carolina has generally increased since 2009 to a high of about 3% in 2017 (**Figure 4**).

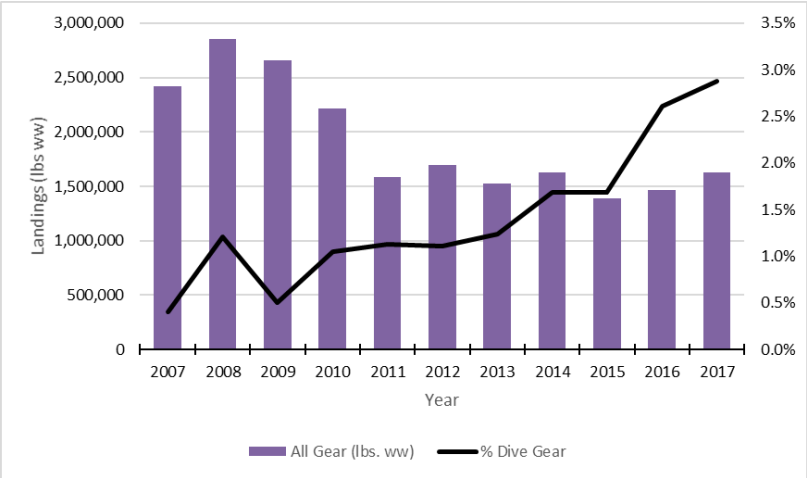


Figure 4. Commercial landings (lbs ww) of snapper grouper species in **North Carolina** for all gear and percent of landings attributed to spearfishing, 2007-2017.

The following sections present summarized information on commercial landings of four species: gag, black grouper, red grouper, and hogfish. These species are of concern as their populations have shown declines in recent years; red grouper and the East Florida/Florida Keys stock of hogfish are overfished and undergoing overfishing.

Landings of gag and back grouper are combined due to known species identification issues. The data are presented by state for Florida and the Carolinas only as landings from spearfishing in Georgia are minimal.

Gag and Black Grouper

Commercial landings of gag and black grouper in Florida declined from 2007 through 2009 and remained between 150,000 to 200,000 lbs ww thereafter. Between 40% and 50% of the commercial landings of these two species in Florida are attributed to spearfishing gear. In 2017, close to 55% of the gag and black grouper landed commercially in Florida were taken by spearfishing (**Figure 5**). South Carolina and North Carolina land a considerably lower percentage of gag and black grouper than Florida; however, annual commercial landings with all gear have declined in both states (**Figures 6** and **7**). The percent of gag and black grouper landings by spearfishing increased rapidly in South Carolina from 2007 through 2010 and remained at about 14% on average for the remainder of the time series. By contrast, between 2% and 4% of annual commercial landings of gag and black grouper in North Carolina were attributed to spearfishing from 2007 through 2011. An upward trend is evident thereafter to a high of about 15% in 2016 (**Figure 7**).

Length information collected by the North Carolina Division of Marine Fisheries as part of their biological sampling program is presented for gag, red grouper, scamp, and hogfish in **Appendix B** for hook-and-line and spearfishing gear.

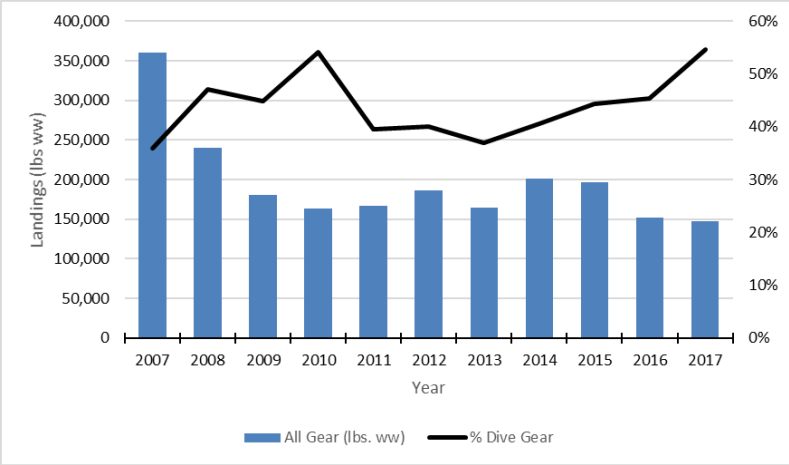


Figure 5. Commercial landings (lbs ww) of **black and gag grouper in Florida** by year and percentage of landings by spearfishing, 2007-2017.

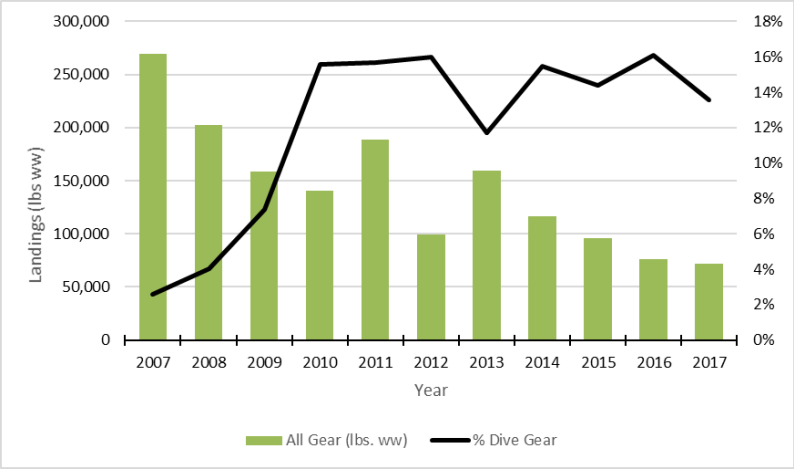


Figure 6. Commercial landings (lbs ww) of **black and gag grouper in South Carolina** by year and percentage of landings by spearfishing, 2007-2017.

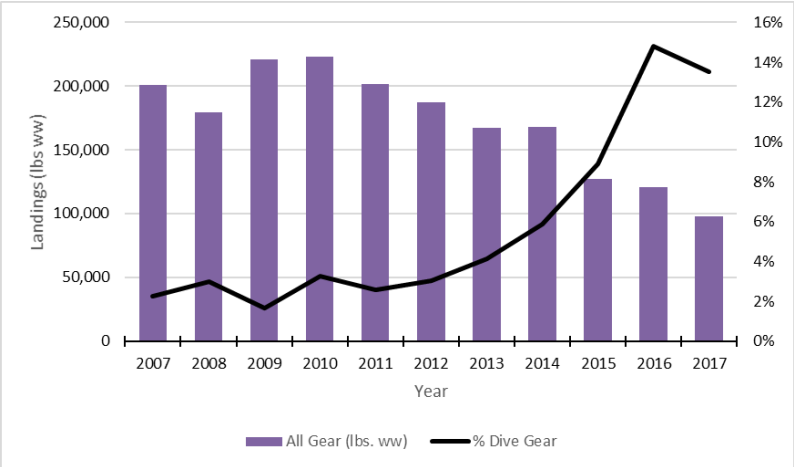


Figure 7. Commercial landings (lbs ww) of **black and gag grouper in North Carolina** by year and percentage of landings by spearfishing, 2007-2017.

Red Grouper

Annual commercial landings of red grouper in all states have declined sharply since around 2008. However, the percentage of landings with spearfishing gear has increased overall since that time in Florida and South Carolina and since about 2014 in North Carolina (**Figures 8-10**).

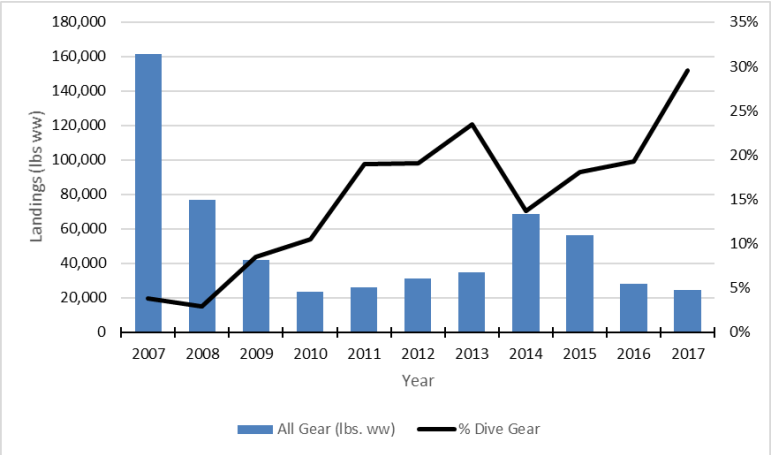


Figure 8. Commercial landings (lbs ww) of **red grouper in Florida** by year and percentage of landings by spearfishing, 2007-2017.

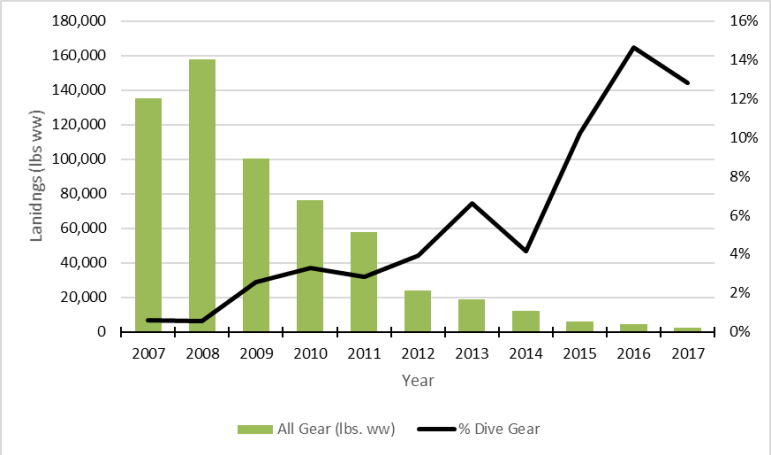


Figure 9. Commercial landings (lbs ww) of **red grouper in South Carolina** by year and percentage of landings by spearfishing, 2007-2017.

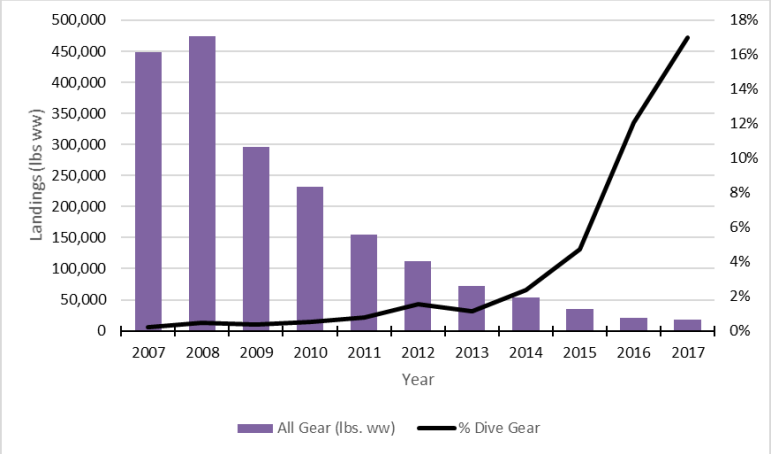


Figure 10. Commercial landings (lbs ww) of **red grouper in North Carolina** by year and percentage of landings by spearfishing, 2007-2017.

Hogfish

Hogfish harvested commercially in the South Atlantic are taken mostly by spearfishing. Overall, the percentage of hogfish landed in the South Atlantic with spearfishing gear has increased by about 14% relative to 2007-2009 levels (see **Table A-3**). In Florida, the percentage of annual commercial landings of hogfish taken by spearfishing increased from 2010 through 2013 and again starting in 2015 (**Figure 11**). However, hogfish landings in Florida have declined over the past three years. The hogfish stock in east Florida and the Florida Keys is overfished and a rebuilding plan was put in place in August 2017.

Hogfish landings in South Carolina peaked in 2010 but have been declining since then (**Figure 12**). The percentage of hogfish harvested commercially with spearfishing gear in South Carolina fluctuated between 83% and 57% from 2010 through 2017 (see **Table A-3**).

In North Carolina, a marked increase is apparent in the percentage of commercial hogfish landings with spearfishing gear between 2007 and 2009 and the last two years of the time series, from 53% to 75%, respectively (see **Table A-3**). Hogfish landings in North Carolina were highest in 2017 with 86% of the landings attributed to spearfishing (**Figure 13**).

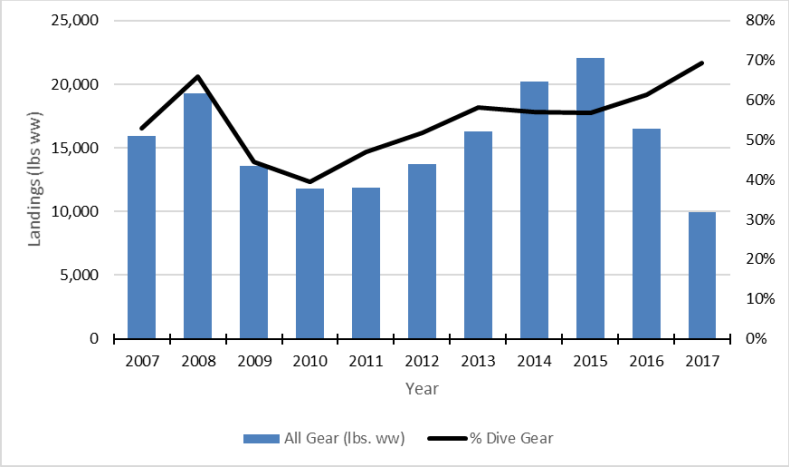


Figure 11. Commercial landings (lbs ww) of **hogfish in Florida** by year and percentage of landings by spearfishing, 2007-2017.

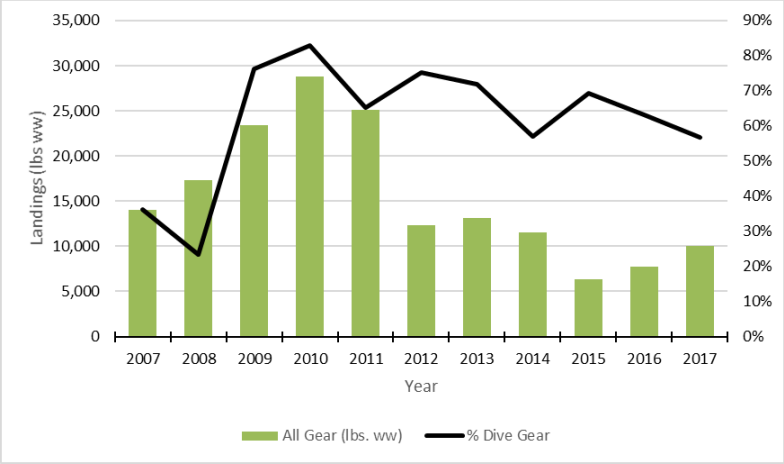


Figure 12. Commercial landings (lbs ww) of **hogfish in South Carolina** by year and percentage of landings by spearfishing, 2007-2017.

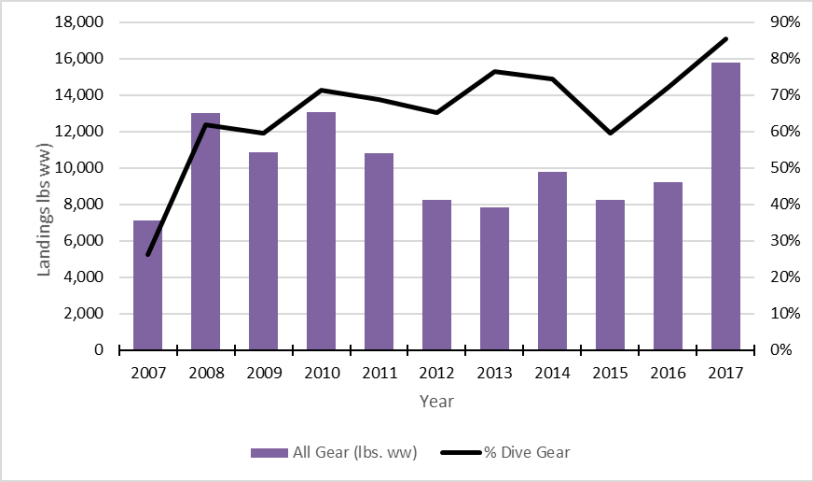


Figure 13. Commercial landings (lbs ww) of **hogfish in North Carolina** by year and percentage of landings by spearfishing, 2007-2017.

Spearfishing in the Recreational Snapper Grouper Fishery

Recreational spearfishing landings estimates were obtained for snapper grouper species from the Marine Recreational Information Program (MRIP) from 1981 through 2017. In the South Atlantic region recreational spearfishing occurs predominantly in Florida; therefore, landings for Georgia, South Carolina, and North Carolina have been combined herein. MRIP collects landings information in numbers of fish, which are expanded based on effort estimates that vary by area and other factors. *Information presented here is based on the revised recreational landings estimates resulting from recent modifications to the MRIP effort survey*.

From 1981 through 2017, Florida reported an average of 611,495 fish harvested with spearfishing gear weighing an estimated 2.1 million lbs ww. By contrast, only about 6,000 fish weighing about 32,000 lbs ww were landed, on average, in the remaining South Atlantic states during the same period (**Table 2** and **Figure 14**). **Table 3** presents the top ten species harvested with spearfishing gear in Florida from 2010 through 2017 and **Table 4** contains the same information for Georgia through North Carolina. Hogfish was by far the most landed species by spearfishing in Florida whereas Atlantic spadefish landings were at the top in Georgia through North Carolina.

Table 2. Recreational landings estimates of snapper grouper species (in numbers and pounds, by state) with spearfishing gear in the South Atlantic region, 1981-2017.

Year	Florida		GA-NC		South Atl.	
	Num	lbs ww	Num	lbs ww	Num	lbs ww
1981	2,437,894	4,445,695	0	0	2,437,894	4,445,695
1982	325,499	1,665,204	0	0	325,499	1,665,204
1983	649,608	2,091,050	6,512	36,386	656,120	2,127,435
1984	1,048,936	1,507,394	0	0	1,048,936	1,507,394
1985			18,926	14,375	18,926	14,375
1986	335,350	1,319,033	0	0	335,350	1,319,033
1987	800,888	3,638,796	1,000	7,691	801,888	3,646,487
1988	174,733	865,504	0	0	174,733	865,504
1989	545,099	2,369,541	4,638	3,107	549,737	2,372,648
1990	391,804	1,082,001	3,823	94,850	395,626	1,176,851
1991	310,750	950,493	13,382	28,066	324,132	978,559
1992	417,994	1,454,543	7,854	47,789	425,849	1,502,333
1993	466,111	1,734,544	2,832	3,771	468,943	1,738,315
1994	583,607	1,701,647	0	0	583,607	1,701,647
1995	396,749	2,197,359	1,552	36,061	398,301	2,233,420
1996	359,231	1,760,690	680	3,117	359,911	1,763,807
1997	268,482	1,135,682	529	18,356	269,011	1,154,038
1998	292,444	1,285,385	2,455	11,260	294,899	1,296,645
1999	557,099	2,561,403	0	0	557,099	2,561,403
2000	251,813	1,677,246	0	0	251,813	1,677,246
2001	346,414	1,573,695	3,650	10,150	350,064	1,583,846
2002	300,777	1,369,185	0	0	300,777	1,369,185
2003	503,221	2,388,019	0	0	503,221	2,388,019
2004	566,625	2,611,652	1,724	10,393	568,350	2,622,045
2005	468,465	1,637,535	24,564	237,463	493,029	1,874,997
2006	408,443	1,601,962	0	0	408,443	1,601,962
2007	539,846	2,444,831	1,431	22,793	541,277	2,467,624
2008	1,058,636	3,611,617	1,255	26,952	1,059,891	3,638,569

2009	660,619	2,081,896	25,950	59,540	686,569	2,141,436
2010	681,275	2,275,994	1,596	9,814	682,871	2,285,808
2011	437,645	1,543,012	5,142	46,166	442,787	1,589,178
2012	963,319	3,435,305	23,401	54,931	986,720	3,490,236
2013	725,358	3,676,871	5,217	6,063	730,575	3,682,934
2014	917,333	3,104,313	20,663	103,294	937,996	3,207,606
2015	1,236,675	3,372,074	6,054	24,877	1,242,729	3,396,951
2016	1,093,686	3,422,745	0	0	1,093,686	3,422,745
2017	491,379	2,108,559	42,652	267,320	534,032	2,375,879

Source: MRIP

Table 3. Total and average recreational landings by spearfishing for the **top ten species in Florida** from 2010 through 2017.

Species	Total lbs	Avg lbs
HOGFISH	6,794,698	849,337
GREATER AMBERJACK	3,788,655	473,582
GRAY SNAPPER	2,554,004	319,251
GAG	2,531,733	316,467
RED GROUPER	2,311,819	288,977
BLACK GROUPER	1,099,072	137,384
MUTTON SNAPPER	864,381	108,048
GRAY TRIGGERFISH	612,214	76,527
COBIA	603,746	75,468
RED SNAPPER	415,295	51,912

Table 4. Total and average landings by spearfishing for the **top ten species in Georgia through North Carolina** from 2010 through 2017.

Species	Total lbs	Avg lbs
ATLANTIC SPADEFISH	216,092	27,012
GAG	128,189	16,024
HOGFISH	45,064	5,633
GRAY TRIGGERFISH	39,702	4,963
COBIA	27,154	3,394
GREATER AMBERJACK	21,308	2,663
BLACK SEA BASS	12,427	1,553
GRAY SNAPPER	10,044	1,255
SPANISH MACKEREL	5,262	658
DOLPHIN	3,909	489

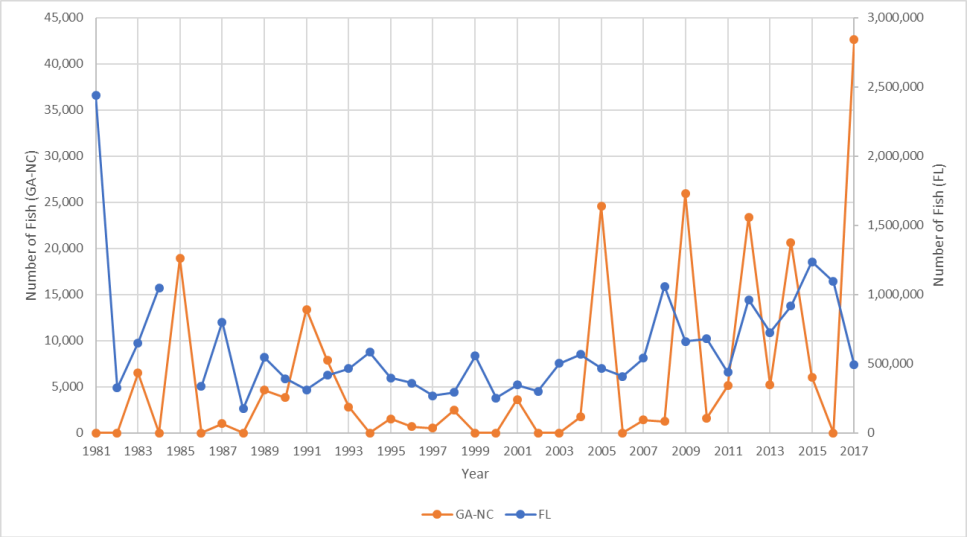


Figure 14. Recreational landings (in numbers of fish) of snapper grouper species caught with spearfishing gear in Florida (blue) and Georgia through North Carolina (orange) from 1981 through 2017.

Gag, black grouper, and red grouper landings in Florida with spearfishing gear show a downward trend (**Figures 15** and **16**) whereas recreational landings of hogfish appear to have increased in recent years (**Figure 17**). Intercepts of red grouper and hogfish took place in GA-NC that resulted in high landings in 2005 and 2017, respectively (**Figures 16** and **17**).

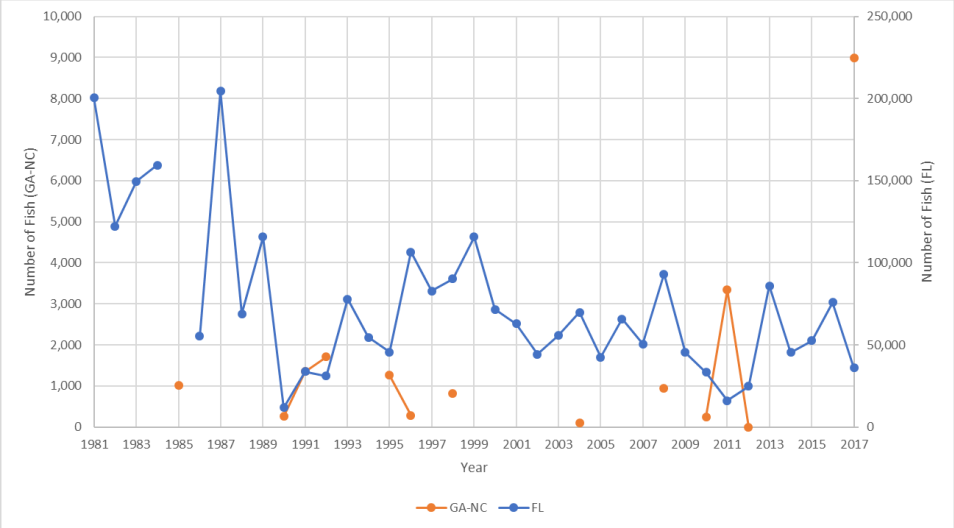


Figure 15. Recreational landings (in numbers of fish) of **gag and black grouper** caught with spearfishing gear in Florida (blue) and Georgia through North Carolina (orange) from 1981 through 2017.

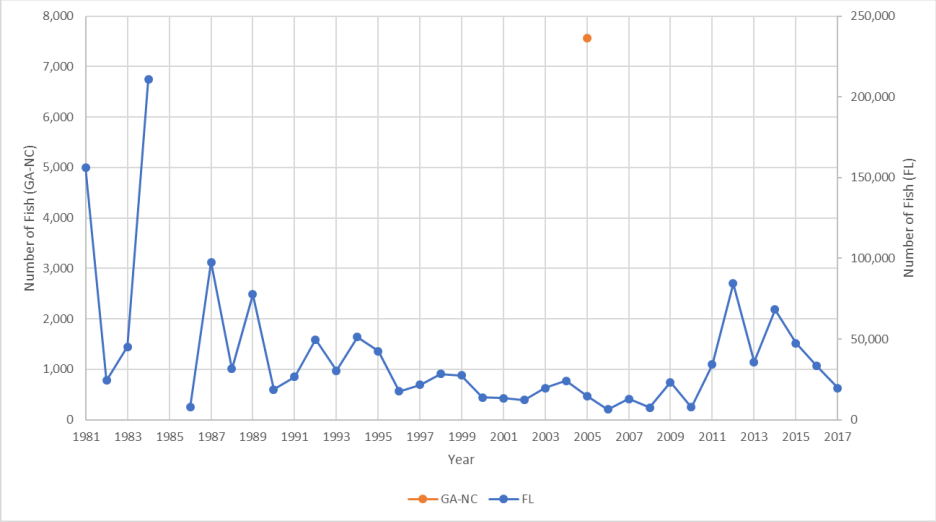


Figure 16. Recreational landings (in numbers of fish) of **red grouper** caught with spearfishing gear in Florida (blue) and Georgia through North Carolina (orange) from 1981 through 2017.

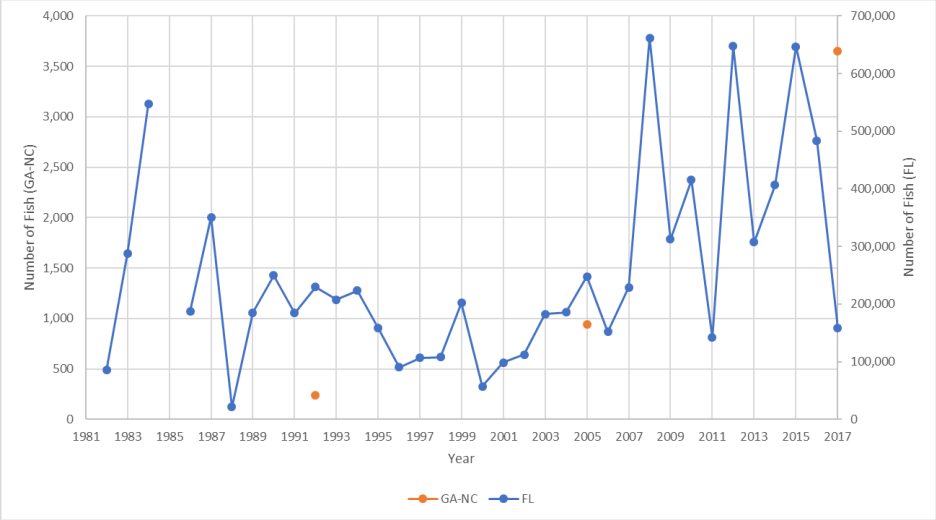


Figure 17. Recreational landings (in numbers of fish) of **hogfish** caught with spearfishing gear in Florida (blue) and Georgia through North Carolina (orange) from 1981 through 2017.

Biological/Ecological Effects of Spearfishing

Spearfishing is highly efficient and has been shown to result in ecological changes in reef fish communities. Among potential biological impacts are:

- Rapid decreases in abundance and mean size of target species.
- Depletion of large individuals in a population affecting reproductive output and possibly leading to recruitment overfishing.
- In protogynous species, alteration of sex ratios and limitation of sperm availability via disproportionate removal of larger, male individuals.
- Lower bycatch of non-target species relative to other fishing gear (i.e., hook-and-line).

- Shifts in catch composition from large carnivorous species to smaller omnivores and herbivores.

Possible Management Approaches in the South Atlantic

The Council requested more information to determine whether specifying a season during which spearfishing would be allowed is a feasible approach. Other possible management measures include gear endorsements or slot size limits. Below are some pros and cons of each approach:

Management measure	Pros	Cons
Season	• Predictability • Focus fishing pressure away from spawning	• Different seasons for Florida and the Carolinas due to fishery seasonality. • May result in effort shifts.
Gear endorsement with reporting	• Allows identification of user group • Allows for better data and more focused management	• Added burden on fishermen and regulatory complexity
Gear endorsement without reporting	• Allows identification of user group	• Added regulatory complexity
Slot limit	• Spearfishing well suited for this type of limit. • Ensures large, mature individuals are not disproportionately removed	• Not been used in snapper grouper fishery • Introduces complexity to regulations
Modify existing reporting requirements (commercial and for-hire) to improve monitoring of spearfishing	• Minimal administrative burden to accomplish • Higher resolution of trip-level data	• Added burden on fishermen

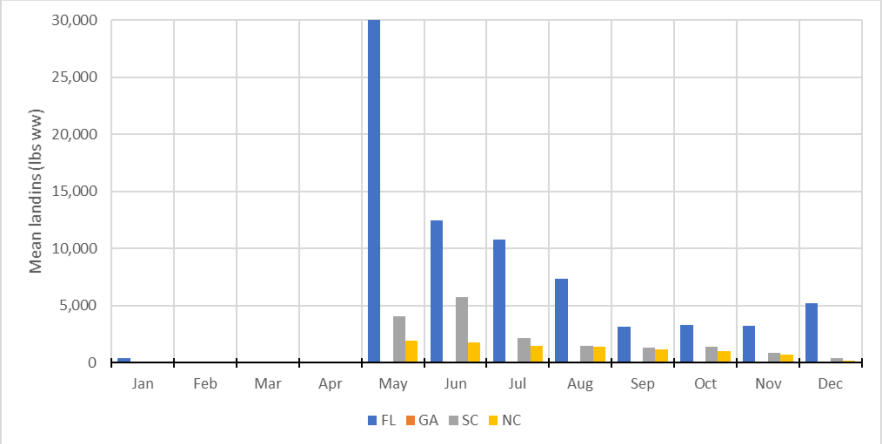
Seasonality

To explore the feasibility of a commercial spearfishing season, average annual landings with spearfishing gear from 2009 through 2017 were summarized by month for the four South Atlantic states. Years prior to 2009 were excluded since the current spawning season closure affecting shallow water groupers was implemented in 2009. Commercial harvest and possession of shallow water groupers is prohibited in the South Atlantic EEZ annually from January 1 through April 30.

Commercial landings of gag and black grouper with spearfishing gear were highest in Florida during May, averaging close to 30,000 pounds (**Figure 18A**). When standardized to annual landings, 32% and 45% of gag and black grouper landings with spearfishing gear in South Carolina occurred in May and June, respectively (**Figure 18B**). The high percentage (94%) of

gag and black grouper landings in Georgia in December is deceptive since it is based on an average of 80 lbs ww landed during September, November and December.

(A)



(B)

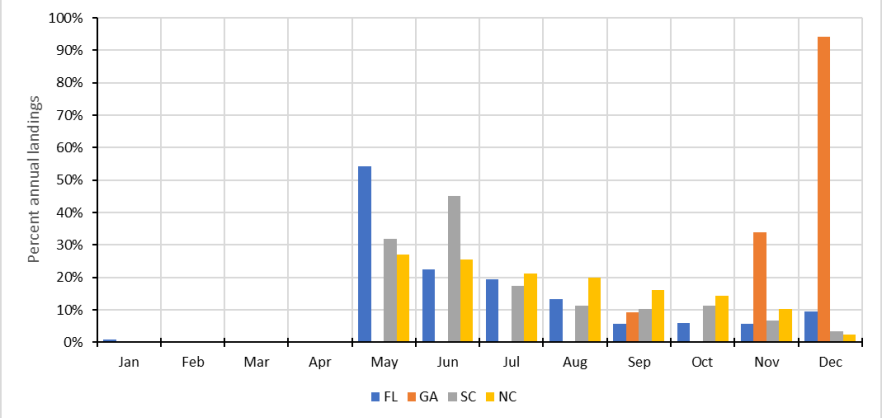
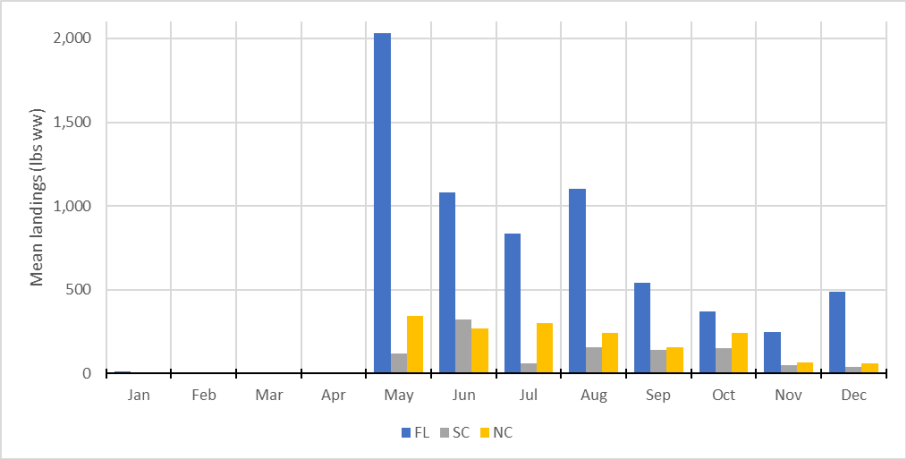


Figure 18. (A) Average monthly commercial landings (lbs ww) of **gag and black grouper** attributed to spearfishing gear by state, 2009-2017. (B) Percent monthly landings of gag and black grouper attributed to spearfishing gear by state, 2009-2017.

Since 2009, most red grouper have been landed with spearfishing gear in Florida during May and during June in South Carolina, although in much lower numbers than gag and black grouper (**Figures 19A** and **19B**).

Hogfish are harvested commercially with spearfishing gear mainly from May through December in the South Atlantic. Average landings have peaked during June in South Carolina (approximately 2,600 lbs ww) and in May in Florida (approximately 1,500 lbs ww) (**Figures 20A** and **20B**).

(A)



(B)

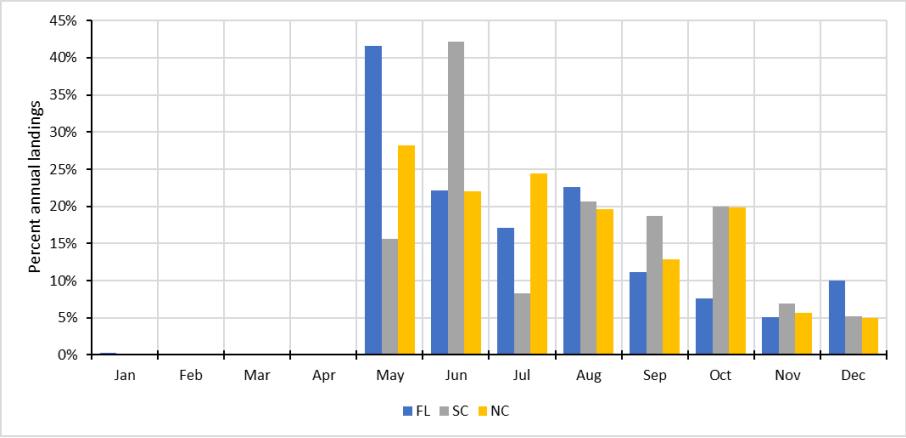
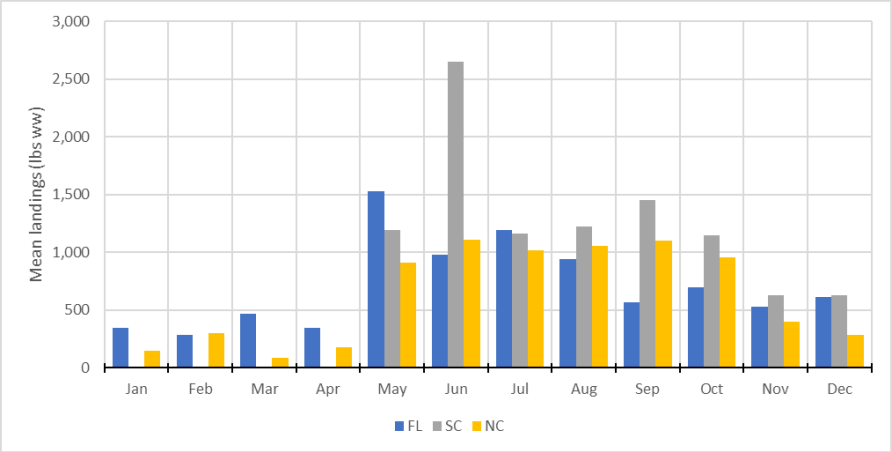


Figure 19. (A) Average monthly commercial landings (lbs ww) of **red grouper** attributed to spearfishing gear by state, 2009-2017. (B) Percent monthly landings of gag and black grouper attributed to spearfishing gear by state, 2009-2017.

(A)



(B)

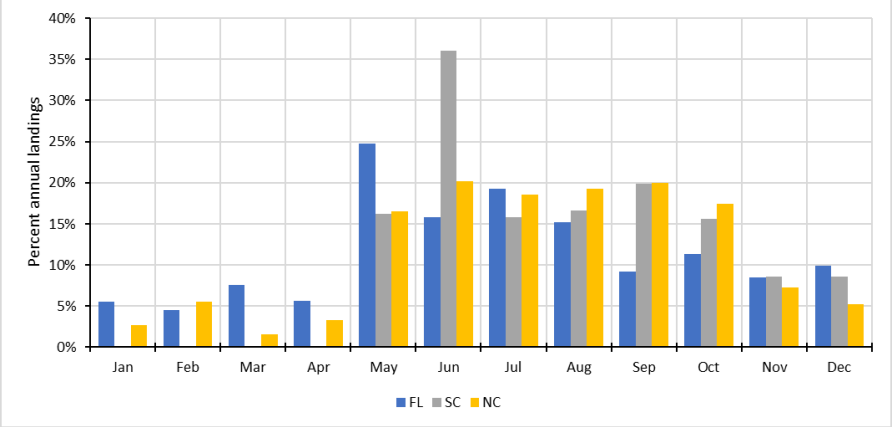


Figure 20. (A) Average monthly commercial landings (lbs ww) of **hogfish** attributed to spearfishing gear by state, 2009-2017. (B) Percent monthly landings of gag and black grouper attributed to spearfishing gear by state, 2009-2017.

Recreational landings estimates for spearfishing gear in South Atlantic states other than Florida are very uncertain since the MRIP survey does not adequately sample this portion of the recreational fishery. As such, data are summarized by state and month for all snapper grouper species reported to have been harvested with spearfishing gear from 2010 through 2017. Mean landings in Florida show a peak in July with a smaller peak in March (**Figure 21**). A recreational season from May through October was implemented in 2017 for recreational harvest of hogfish in east Florida. In Georgia and the Carolinas recreational spearfishing occurs mainly in the summer months and in November (**Figure 22**).

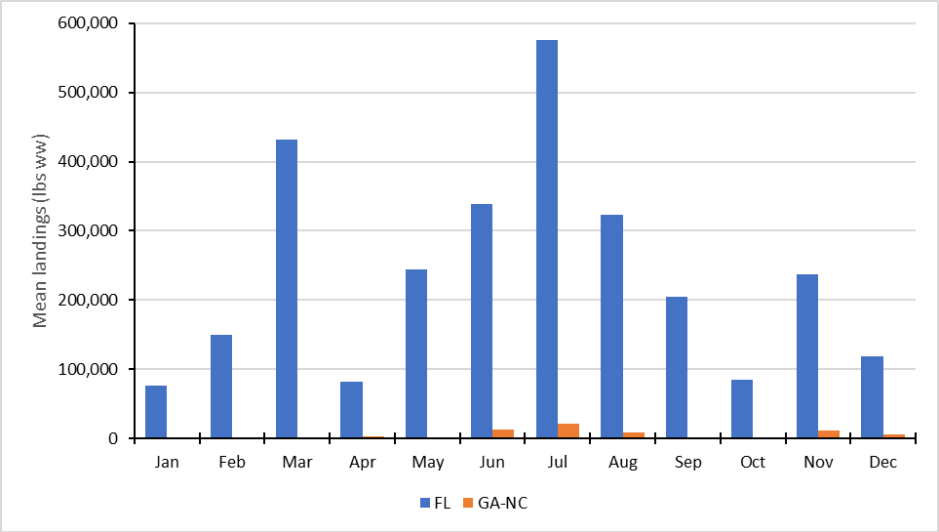


Figure 21. Average monthly recreational landings by spearfishing for all snapper grouper species in Florida and Georgia-North Carolina from 2010 through 2017.

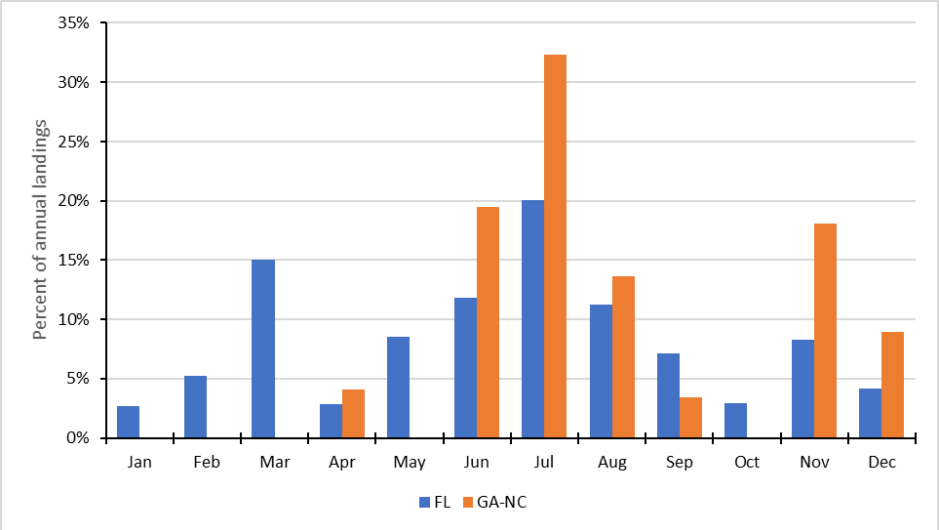


Figure 22. Percent of annual recreational landings by spearfishing for all snapper grouper species in Florida and Georgia-North Carolina from 2010 through 2017.

Spearfishing and National Standard 5

The reauthorized Magnuson Stevens Fishery Conservation and Management Act mandates that fishery management plans and the regulations they implement be consistent with ten National Standards. National Standard 5 reads: "Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose". This national standard encourages efficient fisheries so the optimum yield can be harvested at the lowest economic cost. Being a highly efficient means of harvest, spearfishing thus meets the guidance contained in National Standard 5 from an economic standpoint. However, as mentioned previously, studies havee

suggested that spearfishing can result in rapid decreases in abundance and mean size of target species, deplete large individuals in a population affecting reproductive output and possibly leading to recruitment overfishing and, among protogynous species such as grouper and hogfish, alter sex ratios and limit sperm availability via disproportionate removal of larger, male individuals.

Appendix A

Table A-1. Commercial landings (pounds whole weight, lbs ww) of **gag and black grouper combined** in the South Atlantic region with all gear and spearfishing gear, by state, 2007-2017.

Gag and Black Grouper															
Year	**Dive Gear (lbs. ww)**					**All Gear (lbs. ww)**					**% Dive Gear**				
	FL	**GA**	**SC**	**NC**	**Total**	**FL**	**GA**	**SC**	**NC**	**Total**	**FL**	**GA**	**SC**	**NC**	**Total**
2007	129,423	0	6,901	4,479	140,803	360,571	33,273	269,807	200,849	864,500	35.9%	0.0%	2.6%	2.2%	16.3%
2008	113,302	0	8,192	5,345	126,839	240,472	11,582	202,859	179,779	634,693	47.1%	0.0%	4.0%	3.0%	20.0%
2009	80,791	318	11,647	3,669	96,425	180,359	11,812	158,317	220,925	571,413	44.8%	2.7%	7.4%	1.7%	16.9%
2010	88,476	0	21,931	7,303	117,710	163,365	5,066	140,948	222,967	532,346	54.2%	0.0%	15.6%	3.3%	22.1%
2011	66,165	0	29,604	5,145	100,913	167,091	33,422	189,038	201,825	591,376	39.6%	0.0%	15.7%	2.5%	17.1%
2012	74,633	0	15,845	5,662	96,140	186,367	1,276	99,115	187,580	474,338	40.0%	0.0%	16.0%	3.0%	20.3%
2013	60,751	60	18,609	6,888	86,307	164,096	21,614	159,201	167,372	512,283	37.0%	0.3%	11.7%	4.1%	16.8%
2014	81,798	0	18,030	9,870	109,698	201,502	4,622	116,700	168,146	490,971	40.6%	0.0%	15.4%	5.9%	22.3%
2015	87,304	139	13,790	11,298	112,530	196,914	3,535	95,814	126,846	423,109	44.3%	3.9%	14.4%	8.9%	26.6%
2016	68,750	0	12,229	17,901	98,879	151,557	2,091	75,976	120,731	350,355	45.4%	0.0%	16.1%	14.8%	28.2%
2017	80,822	683	9,781	13,250	104,535	147,682	2,663	72,061	97,914	320,320	54.7%	25.6%	13.6%	13.5%	32.6%
Avg.	**84,747**	**109**	**15,142**	**8,255**	**108,253**	**196,361**	**11,905**	**143,621**	**172,267**	**524,155**	**43.2%**	**0.9%**	**10.5%**	**4.8%**	**20.7%**
Avg. 07-09	**107,839**	**106**	**8,913**	**4,497**	**121,355**	**260,467**	**18,889**	**210,328**	**200,518**	**690,202**	**41.4%**	**0.6%**	**4.2%**	**2.2%**	**17.6%**
Avg. 15-17	**78,958**	**274**	**11,933**	**14,149**	**105,315**	**165,384**	**2,763**	**81,283**	**115,164**	**364,594**	**47.7%**	**9.9%**	**14.7%**	**12.3%**	**28.9%**

Table A-2. Commercial landings (pounds whole weight, lbs ww) of **red grouper** in the South Atlantic region with all gear and spearfishing gear, by state, 2007-2017.

Red Grouper															
Year	**Dive Gear (lbs. ww)**					**All Gear (lbs. ww)**					**% Dive Gear**				
	FL	**GA**	**SC**	**NC**	**Total**	**FL**	**GA**	**SC**	**NC**	**Total**	**FL**	**GA**	**SC**	**NC**	**Total**
2007	6,078	0	837	927	7,841	161,259	13	135,510	448,580	745,363	3.8%	0.0%	0.6%	0.2%	1.1%
2008	2,211	0	847	2,159	5,216	76,558	0	158,071	474,404	709,033	2.9%		0.5%	0.5%	0.7%
2009	3,586	0	2,593	1,128	7,307	42,114	0	100,523	296,255	438,892	8.5%		2.6%	0.4%	1.7%
2010	2,458	0	2,486	1,223	6,167	23,403	0	76,065	231,780	331,247	10.5%		3.3%	0.5%	1.9%
2011	4,936	0	1,638	1,168	7,741	25,976	1,534	57,997	154,277	239,785	19.0%	0.0%	2.8%	0.8%	3.2%
2012	5,928	0	945	1,725	8,597	31,043	83	23,987	111,781	166,894	19.1%	0.0%	3.9%	1.5%	5.2%
2013	8,177	0	1,258	812	10,246	34,833	442	18,936	72,259	126,470	23.5%	0.0%	6.6%	1.1%	8.1%
2014	9,389	0	497	1,252	11,138	68,721	290	11,992	53,096	134,098	13.7%	0.0%	4.1%	2.4%	8.3%
2015	10,204	0	617	1,660	12,481	56,507	75	6,041	35,147	97,770	18.1%	0.0%	10.2%	4.7%	12.8%
2016	5,442	0	660	2,539	8,641	28,173	25	4,499	21,011	53,708	19.3%	0.0%	14.7%	12.1%	16.1%
2017	7,168	0	294	3,103	10,566	24,232	19	2,297	18,250	44,798	29.6%	0.0%	12.8%	17.0%	23.6%
Avg.	**5,962**	**0**	**1,152**	**1,609**	**8,722**	**52,075**	**226**	**54,174**	**174,258**	**280,732**	**11.4%**	**0.0%**	**2.1%**	**0.9%**	**3.1%**
Avg. 07-09	**3,958**	**0**	**1,426**	**1,404**	**6,788**	**93,310**	**4**	**131,368**	**406,413**	**631,096**	**4.2%**	**0.0%**	**1.1%**	**0.3%**	**1.1%**
Avg. 15-17	**7,605**	**0**	**524**	**2,434**	**10,562**	**36,304**	**40**	**4,279**	**24,802**	**65,425**	**20.9%**	**0.0%**	**12.2%**	**9.8%**	**16.1%**

Table A-3. Commercial landings (pounds whole weight, lbs ww) of **hogfish** in the South Atlantic region with all gear and spearfishing gear, by state, 2007-2017.

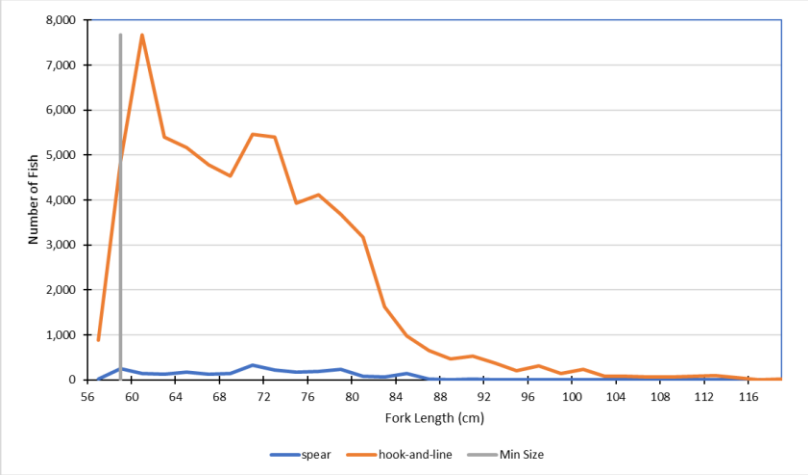
Hogfish															
Year	**Dive Gear (lbs. ww)**					**All Gear (lbs. ww)**					**% Dive Gear**				
	FL	**GA**	**SC**	**NC**	**Total**	**FL**	**GA**	**SC**	**NC**	**Total**	**FL**	**GA**	**SC**	**NC**	**Total**
2007	8,462	0	5,081	1,864	15,407	15,975	6	14,071	7,112	37,164	53.0%	0.0%	36.1%	26.2%	41.5%
2008	12,749	0	4,029	8,050	24,829	19,318	49	17,277	13,035	49,679	66.0%	0.0%	23.3%	61.8%	50.0%
2009	6,045	0	17,819	6,449	30,313	13,613	3	23,397	10,839	47,852	44.4%	0.0%	76.2%	59.5%	63.3%
2010	4,656	0	23,917	9,314	37,886	11,815	0	28,843	13,046	53,705	39.4%		82.9%	71.4%	70.5%
2011	5,598	0	16,411	7,415	29,424	11,901	0	25,157	10,793	47,851	47.0%		65.2%	68.7%	61.5%
2012	7,134	0	9,300	5,377	21,811	13,751	0	12,363	8,256	34,370	51.9%		75.2%	65.1%	63.5%
2013	9,485	0	9,459	6,010	24,954	16,268	0	13,146	7,847	37,262	58.3%		72.0%	76.6%	67.0%
2014	11,546	0	6,590	7,272	25,407	20,209	0	11,569	9,767	41,544	57.1%		57.0%	74.5%	61.2%
2015	12,525	0	4,430	4,894	21,849	22,038	0	6,394	8,223	36,655	56.8%		69.3%	59.5%	59.6%
2016	10,125	0	4,881	6,630	21,636	16,503	1	7,733	9,201	33,438	61.4%	0.0%	63.1%	72.1%	64.7%
2017	6,935	0	5,700	13,482	26,117	9,986	0	10,062	15,776	35,825	69.4%		56.6%	85.5%	72.9%
Avg.	**8,660**	**0**	**9,783**	**6,978**	**25,421**	**15,580**	**5**	**15,456**	**10,354**	**41,395**	**55.6%**	**0.0%**	**63.3%**	**67.4%**	**61.4%**
Avg. 07-09	**9,085**	**0**	**8,976**	**5,454**	**23,516**	**16,302**	**19**	**18,249**	**10,328**	**44,898**	**55.7%**	**0.0%**	**49.2%**	**52.8%**	**52.4%**
Avg. 15-17	**9,862**	**0**	**5,004**	**8,335**	**23,200**	**16,176**	**0**	**8,063**	**11,067**	**35,306**	**61.0%**	**0.0%**	**62.1%**	**75.3%**	**65.7%**

Appendix B

Length distributions for gag, red grouper, scamp, and hogfish sampled in North Carolina from the commercial fishery are presented for hook-and-line gear and spearfishing gear to explore the size selectivity of the gear. Data from 2007 through 2017 were queried but length data were not available for all years for some species (i.e., hogfish). **Figures B-1** through **B-4** show numbers of fish and percent by length (in 2-cm bins) for hook-and-line and spearfishing gear. Data are from the North Carolina Division of Marine Fisheries.

Gag

(A)



(B)

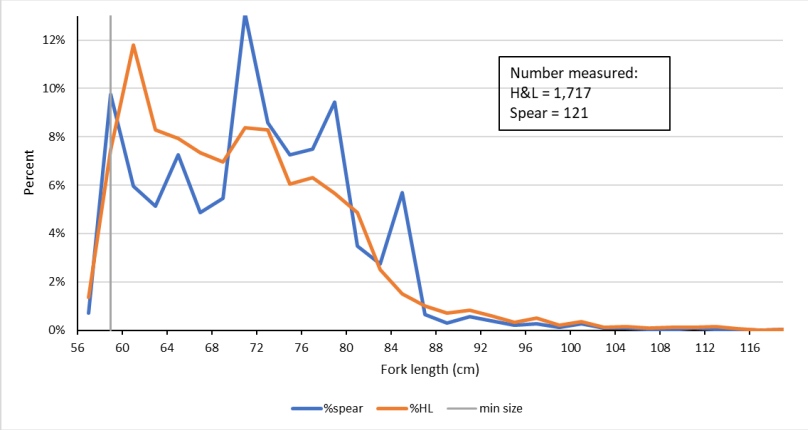
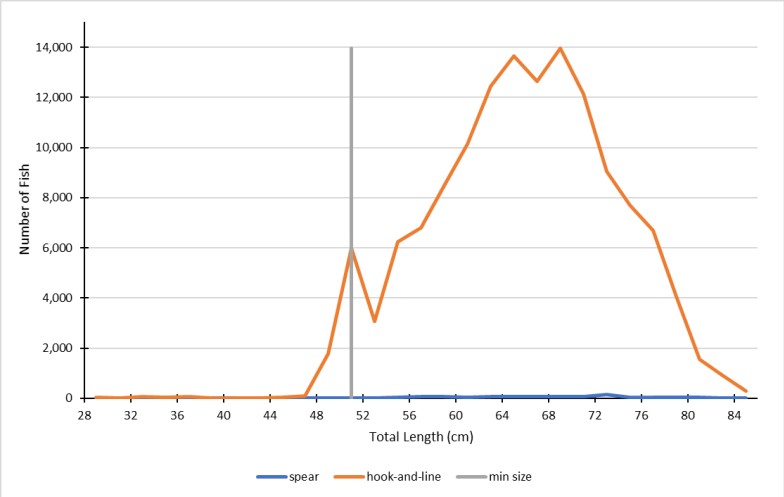


Figure B-1. Length distribution of **gag** in numbers of fish (A) and percentage (B) from commercial hook-and-line (orange) and spear (blue) samples collected in North Carolina from 2007 through 2017. Minimum size shown in gray (converted to fork length using length conversion from SEDAR 10).

Source: North Carolina Division of Marine Fisheries, 2019.

Red grouper

(A)



(B)

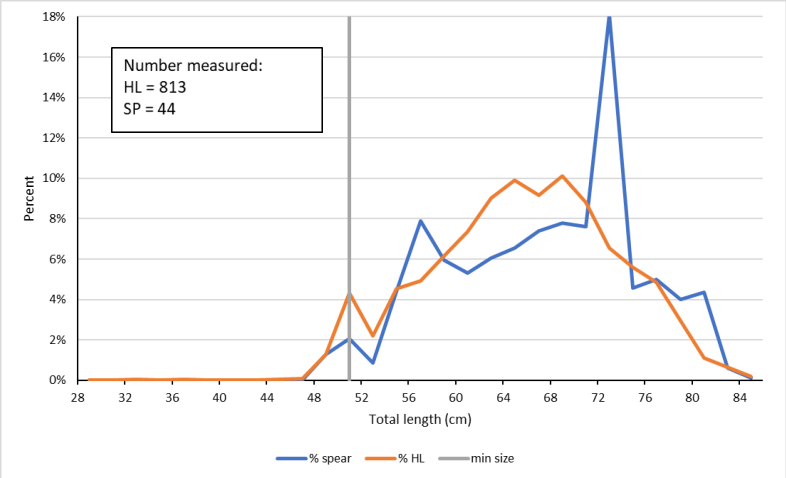
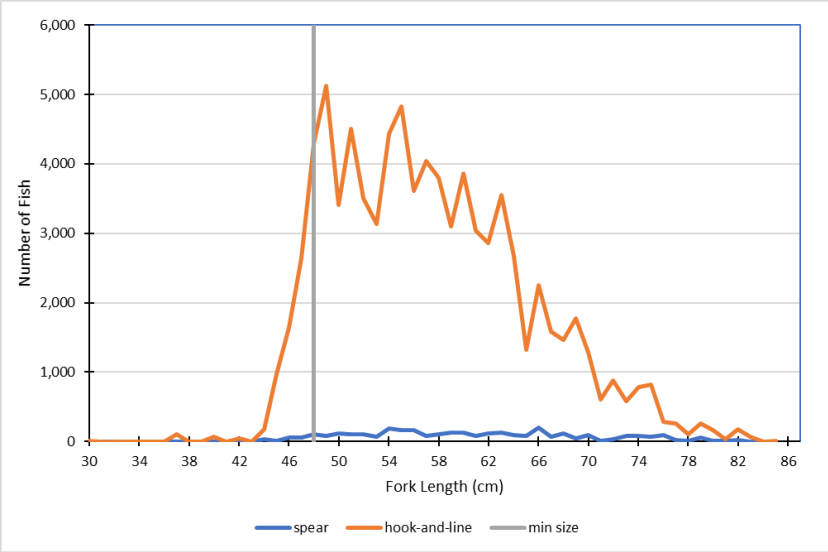


Figure B-2. Length distribution of **red grouper** in numbers of fish (A) and percentage (B) from commercial hook-and-line (orange) and spear (blue) samples collected in North Carolina from 2007 through 2017. Minimum size shown in gray.

Source: North Carolina Division of Marine Fisheries, 2019.

Scamp

(A)



(B)

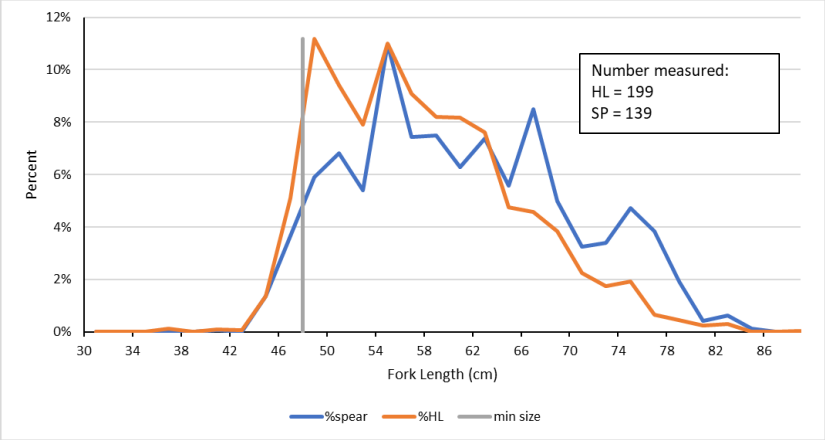
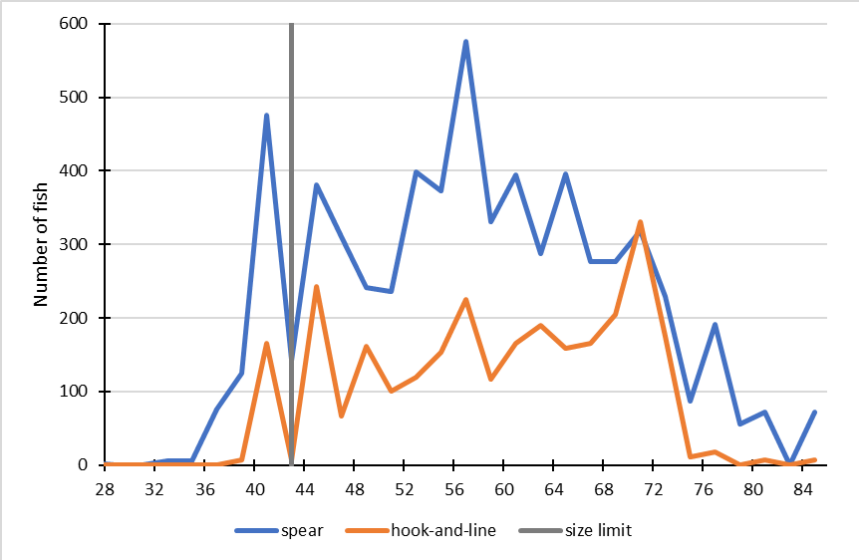


Figure B-3. Length distribution of **scamp** in numbers of fish (A) and percentage (B) from commercial hook-and-line (orange) and spear (blue) samples collected in North Carolina from 2007 through 2017. Minimum size shown in gray (converted from total length using Fishbase length conversion).

Source: North Carolina Division of Marine Fisheries, 2019.

Hogfish

(A)



(B)

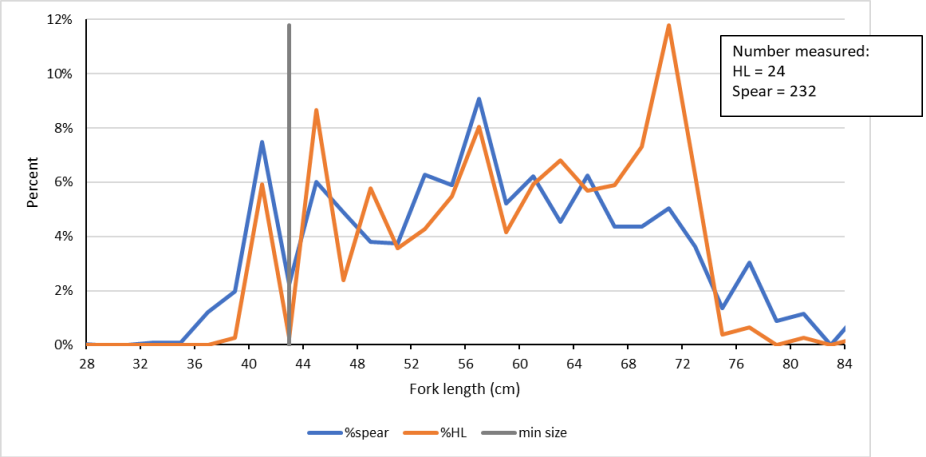


Figure B-4. Length distribution of **hogfish** in numbers of fish (A) and percentage (B) from commercial hook-and-line (orange) and spear (blue) samples collected in North Carolina from 2007 through 2017. Minimum size shown in gray.

Source: North Carolina Division of Marine Fisheries, 2019.