Release Mortality Of Undersized Fish From The Snapper/Grouper Complex Off The North Carolina Coast.

Final Report to North Carolina Sea Grant Fisheries Resources Grant Program

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Introduction

The snapper/grouper complex in North Carolina consists of about 75 species that are important to recreational and commercial fishermen, but their catch is only dominated by 10-14 species. Gag grouper (*Myctemperca microlepis)*, red grouper(*Epinephelus mono)*, red porgy (*Pagrus pagrus),* and scamp grouper(*Myctemperca phenax)* are the more targeted species off the coast of North Carolina and represent the majority of the reef fish catch. The current stock status of these species has fluctuated throughout the years but each fishery is regulated by minimum size limits. This approach allows for small fish to be returned to the population to contribute to the existence of the stock. It reduces the chances of growth and recruitment overfishing.

Resource managers assume that most of the discarded fish, which are released alive, will survive. Because of changing regulations, an increase in the minimal sizes on the fishery will increase the probability of catching an "undersized" fish. This may also increase the probability of release mortality.

Reef fishes potentially live for decades and even small amounts of release mortality can have dramatic impacts on the population because of cumulative mortality. An individual in a population with a 20% release mortality can experience near certain mortality over 5-years if exposed to being hooked only once per year. This is a realistic possibility considering the feeding behavior of many reef species to bait. Understanding the role of hook and release mortality in the reef fish complex is essential.

An increase in the survival of undersized fish may also have an indirect advantage of reducing losses in annual spawning stock biomass. There is considerable evidence that large quantities of discards represent production and yield forgone, or future economic losses to the fishery (Davis 2002; Trumble et al. 2000). A recent stock assessment of red porgy suggested that effective monitoring of the stock recovery, especially under further fishing mortality reductions, would require more detailed information on discards. Stock assessments of fishes included in the snapper/grouper complex recommend that discard rates and discard mortality in the fishery be quantified. It is common for these stock assessments to rely on release mortality estimates that are not species-specific, area-specific, or are out of date. Managers understand and clearly state the potential problems of using inaccurate discard mortality rates, but to date, there is no published study that directly addresses discard mortality of the snapper/grouper complex along the North Carolina coast.

The objective of this project is to investigate the effects of hooking on the mortality rates of undersized gag grouper, red porgy, and scamp off the coast of North Carolina. We compared the effect of hook size, hook location, and holding period on mortality. "We also determined that hook and release mortality estimates based on short-term survival, which is defined as the first 2-h after release, provides reasonable estimates of hook and release mortality. These data will be important information to managers and will allow them to improve preliminary estimates of the snapper/grouper complex fishing mortality of gag grouper, red porgy, and scamp.

The goals of the project are to:

1. To assess short-term (first 2-h after release) and long-term survival (48 hour after release) of gag grouper, red porgy, and scamp subjected to stress associated with hook-and-line fishing.

2. To compare the influence of holding methodologies on the assessment of release mortality.

3. To generate hook and release mortality estimates for the snapper/grouper complex and provide recommendations for future reef fish management.

4. Generate catch-effort data for targeted and non-targeted species.

Methods

Field Sampling

We began sampling in June of 2003 to evaluate the release mortality of undersized gag grouper, red porgy, and scamp. We made 23 sampling trips 15-45 miles off the coast of North Carolina. Sampling trips were conducted out of the Atlantic Beach area on a 30' research vessel the "RV Cutting Edge." Effort was distributed in the vicinity of three areas (35°.15.78'N, 75 ° 15.22'W; 34 °.11.21'N, 76 °.36.30'W; and 33.35.62'N, 76 °.30.14W'). The position (from Global Positioning System), depth, and time of each sampling episode were recorded at the beginning and end of each trial. We sampled during the day into the early evening. The sampling day usually lasted for 12-h and began at 0630.

Hand-held rods and electric reels (known as an electromate) were used to capture fish. We used a double-hooked drop rig that consisted of two hooks connected together by monofilament fishing line on a triangular swivel. Two hook types (Circle, Live bait Hooks) and five hook sizes (2/0-6/0) were used and randomly assigned to each fishing rig. At the bottom of the rig was a lead weight ranging from 8 to 16oz.

Once a fish was captured, the fish was brought on deck, dehooked with a dehooker, immediately identified, and measured to the nearest mm. The fish was marked with an external uniquely numbered Floy-tag inserted just below the dorsal region. The location of the hook (lip, eye, external (foul), or stomach (gut)) was recorded. The fish was placed in an onboard holding tank until enough fish were collected to place into the holding cages. Thirty minutes after the first fish was captured, all fish were placed in either the holding cage and lowered to the bottom or remained in the on-board holding tank. The fish that remained in the tank were held for 2-h. Fish in the holding cages were held for either 2-h or 48-h (Further description is provided below).

Black sea bass traps were used to capture control fish. There fish were handled in the same fashion as the fish collected by hook and line. Fish captured in the black sea bass traps served as control subjects because they were not be subjected to stress associated with hooking.

Fish Monitoring

We held fish at two locations during the study: an onboard holding tank and in holding cages. The onboard holding tank was a 190-l circular tank. This tank was aerated through a free flowing seawater system. The holding cages consisted of either a circular steel ring design or a square coated chicken wire design. The circular cages consisted of circular stainless steel rings 1.82m in diameter and approximately 0.60m

in height. The cages were covered with knotless nylon trawl webbing. The square holding cage was a 1x1x2 m cage with plastic coated chicken wire. On the bottom of the cages were square shaped rebar that was approximately 5kg to anchor the cages on the bottom. All cages had approximately 150m of floating rope with a large crab pot buoy attached to the end.

Short-term mortality was defined as the number of dead fish after the 2-h holding period. The 2-h treatment consisted of two sub-treatments. One group consisted of fish lowered to the bottom in holding cages and the second group was a group of fish held in an onboard tank. At the end of the two-hour holding period, the fish from the holding cages and onboard-tank were retrieved and the number of dead fish counted. The 48-h treatment was defined as the number of dead fish after a 48-h hold period. After 48-h, the fish were handled in the same manner as the two-hour treatment.

Catch-Effort and Predator Mortality Data

During each sampling trip, we kept a record of all fish captured to determine effort (catch-effort). We calculated catch-effort as the number of fish collected on each sampling day divided by the actual number of rod hours. The fishing hour was rounded to the nearest hour. Rod hour varied from 5 to 8 h..

We quantitatively identified mortality from other fish after being released. During sampling, we often observed large predatory fish (Barracuda, King mackerel, Sharks) at the surface adjacent to the boat. We recorded two modes of mortality through predation:

1. As the fish was being reeled to the surface
2. After the fish had been released

Fish that were rapidly brought to the surface from depth had bloated swim bladders. This prevented them from quickly returning to the bottom once released. We observed these floating fish until they were eaten or up to 5 minutes and recorded the number that became victims of predation.

Analysis and Statistical Procedure

Information was collected on different hooking-variables to evaluate their effect on catch and release mortality. Logistic regression was used to model the effects of hook location, hook size, holding period, and holding location of captured fish. The standard logistic regression model was fit as:

$$p_i = e / 1 + e,$$

where: p_i is the probability of mortality and equal to a linear function of the modeled variables. A log-maximum likelihood statistic (chi-squared distributed

under the null hypothesis that all explanatory variables in the model were zero) was used to assess the significance of the model. Estimates of the coefficients, associated odds ratios and logistic regression were generated with SAS software.

Results

Species Composition and Length Distributions.

Between June 2003 and May 2004, 266 undersized fish were captured for the treatment group (Appendix A). About 74% of the species collected were red porgy and the remaining 13 % consisted of gag grouper and scamp species (Table 1; Figure 1). The mean, minimum and maximum size ranges are provided in Table 1.

Table 1. The mean total lengths (mm) of undersized gag grouper, red porgy, and scamp collected of the coast off North Carolina. S.E. = Standard Error; N=Sample size

Species	Mean	S.E.	N	Minimum	Maximum	Current Minimum Length
Gag	476.6	14.1	33	295	573	606
Red Porgy	312.7	3.2	196	210	354	355
Scamp	395.7	11.9	34	165	495	508

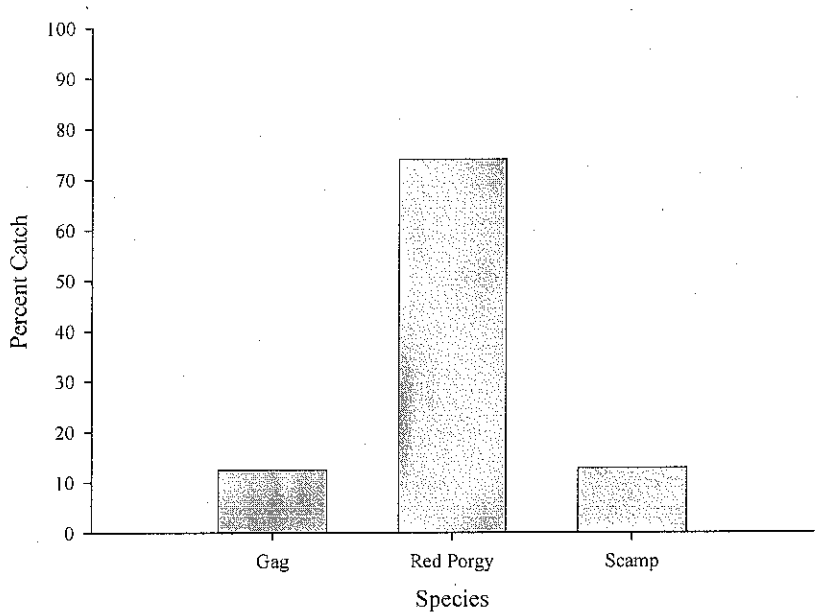

Figure 1. Percent catch of gag grouper, red porgy, and scamp off the coast of North Carolina.

The length distributions of all undersized species collected were skewed to the left (Figure 2). For red porgy, most of the fish collected were very close to the legal size limit of 355mm. For the other species, the lengths were more evenly distributed.

Figure 3 shows the length distributions of gag grouper, red porgy, and scamp including legal sized fish (Appendix B)

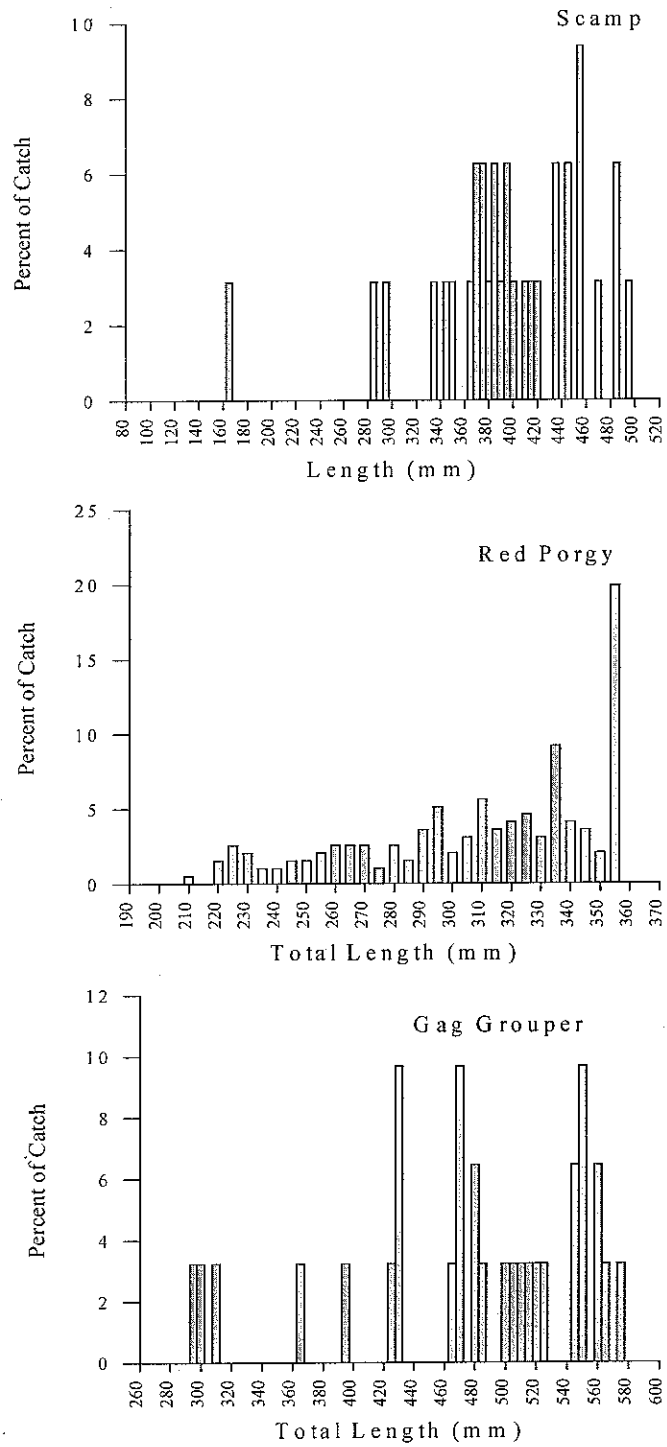

Figure 2. Length distributions (mm) of undersized gag grouper, red porgy, and scamp collected of the coast off North Carolina.

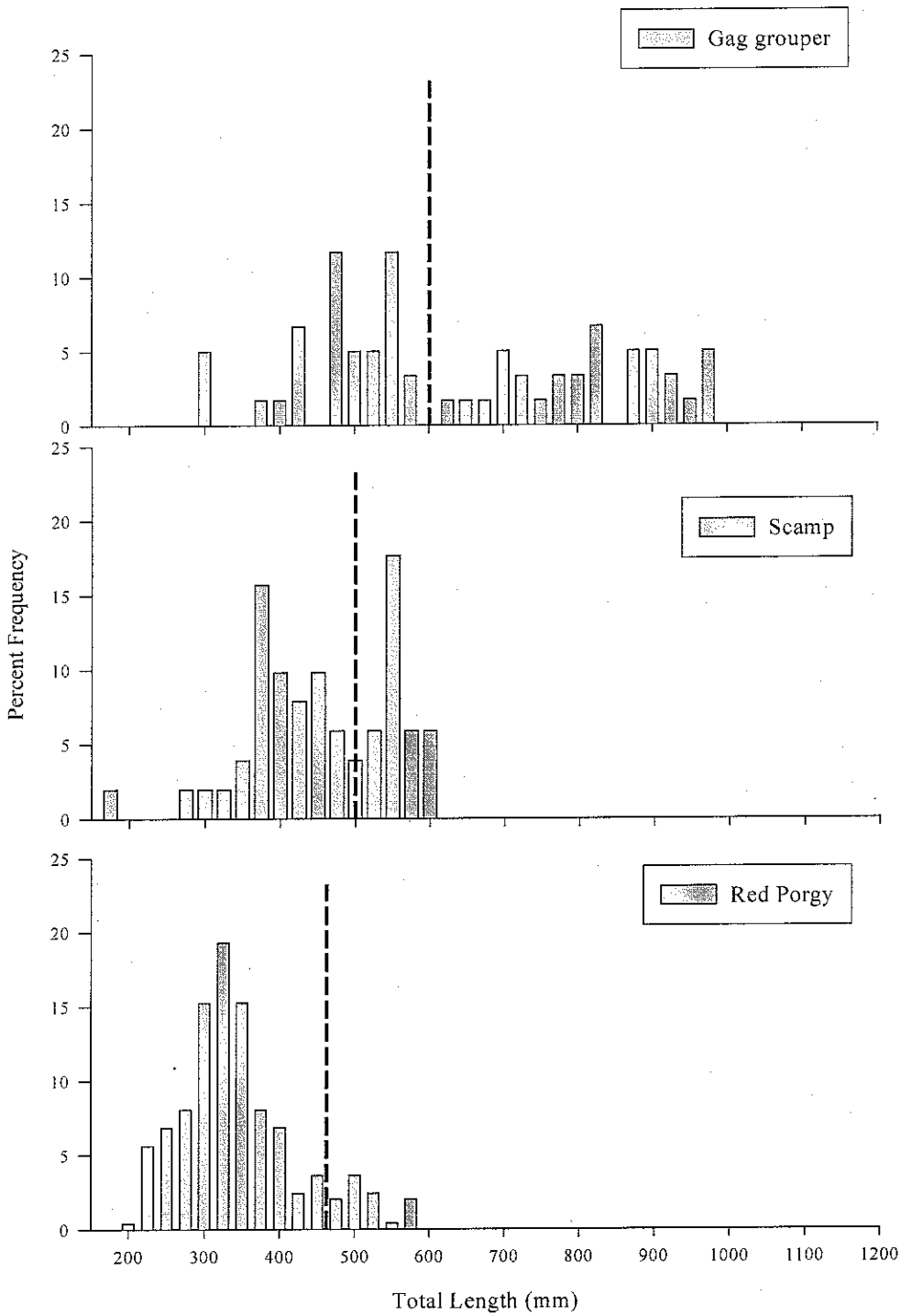

Figure 3. Length distributions (mm) of all (including legal sized fish) gag grouper, red porgy, and scamp collected of the coast off North Carolina. The vertical dash line represents the minimum size limit.

Control Fish

The modified black sea bass pots were not very effective in collecting undersized fish species of interest. We collected only six fish in the desired size ranges of interests for the control group so we were not able to test the control group of fish. We were also unable to collect sufficient numbers of American red, *Lutjanus campechanus*, and Vermilion snappers, *Rhonnboplites aurorubens*, by the end of the sampling period so those two species were eliminated from the study.

Factors affecting mortality

Almost all of the fish collected were hooked in the lip area (93%) followed by fish hooked in the stomach area (5%). A higher percentage of fish that were hooked in the stomach died (39%) than did fish hooked in the other areas (Table 2).

Table 2. Hook location for gag grouper, red porgy, and scamp (combined) collected off the coast of North Carolina.

			Survive	
Hook Location	N	Percent	Yes	No
Eye	4	0.75	50	50
Foul	2	1.51	100	0
Lip	246	92.83	92.2	7.8
Stomach (gut)	13	4.91	61.5	38.5

The combined total mortality for all species was almost 10%. The effect of mortality from hooking differed between species. Gag grouper had the highest overall mortality of 22% (Table 3). The lowest effect of hooking on mortality was for red porgy where 5.6% of the collected fish died (Table 3).

Table 3. Overall percent survival of undersized gag grouper, red porgy, and scamp collected of the coast off North Carolina. The number in parentheses represents the sample size.

	Survive	
Species	No	Yes
Gag grouper	21.9 (7)	78.7 (26)
Red Porgy	5.6 (11)	94.4 (185)
Scamp	23.5 (8)	76.5 (26)

The effect of the independent variables of the logistic model hook size, hook location, and holding period did not significantly affect the survival of gag grouper and scamp (Table 4). The probability values (*P*) were greater than 0.05. Only 21% of gag and 19% of scamp died as a result of being hooked in the lip. For red porgy, only 3% of the lip hooked fish died (Table 5). Hook location significantly (X^2=10.48, P=0.001) affected the survival of red porgy (Table 4). Specifically, individuals hooked in the lip had a higher likelihood of surviving than those hooked in other locations. The odds ratio was 0.35 suggesting that the odds for survival was about 35% higher for fish hooked in the lip than in other areas. About half of the red porgy hooked in the stomach died (Table 3).

Table 4. Summary of logistic regression analysis of independent variables (Hook size, hook location, and holding period) on post-release mortality of undersized gag grouper, red porgy and scamp caught hook and line collected off the coast of North Carolina.

Species	Independent Variable	Score chi-square	Odds-ratio	Probability
Gag	Hook size	0.098	0.950	0.75
	Hook Location	0.001	0.039	0.98
	Holding Period	0.011	0.665	0.92
Scamp	Hook size	0.084	0.917	0.77
	Hook Location	2.124	0.131	0.15
	Holding Period	0.249	1.012	0.62
Red Porgy	Hook size	1.261	0.866	0.61
	Hook Location	10.48	0.350	<0.01
	Holding Period	0.003	1.294	0.96

Table 5. Observed percent mortality of undersized gag grouper, red porgy, and scamp hooked in various locations on their body. The number in parentheses represents the total number of fish collected in each category.

		Survive	
Species	Hook Location	No	Yes
Gag	Lip	21.2 (7)	72.7 (24)
	Stomach	-	100 (2)
Red porgy	External (foul)	-	100 (2)
	Eye	-	100 (12)
	Lip	3.3 (6)	96.7 (176)
	Stomach	45.5 (5)	54.5 (6)
Scamp	Eye	66.6 (2)	33.3 (1)
	Lip	19.3 (6)	80.6 (25)

Short-term (2-h) Holding location Comparison

The effect of holding location was consistent among species. There was no significant effect of holding location on the mortality of fish in the 2-h time period treatment ($x^2=1.07$ $P=0.301$) on mortality. Hook and release mortality was 6.1% for fish held in the surface tank and 10.5% for fish held in the holding cage at the bottom (Table 6).

Catch-Effort and other Mortality

We caught 24 different fish species during the study (see Appendix C)). Catch-effort ranged from 1.15 - 0.08 fish per rod hour (FRH) (Figure 4). Red porgy had a significantly higher catch-effort, averaging 1.15 FRH. This was about three times higher than any other fish species. After red porgy, white grunt and black sea bass had the highest catch-effort, averaging 0.57 FRH. White grunt were captured on almost every sampling day regardless of sampling location. The catch-rate of gag grouper was 1.5 times higher for sub-legal fish than legal fish (Figure 5). The largest difference in catch-effort was with red porgy where the sub-legal catch-effort was 3.1 times higher than for the legal sized fish.

Table 6. Observed mortality of gag grouper, red porgy, and scamp after capture by hook and line. All species were hooked in various locations on the body and were held in a surface tank for 2-h, a caged lowered to the bottom for 2 or 48-h.

		Holing Period and Cage Location								
		2-hSurface Tank			2-h Bottom Cage			48-h Bottom Cage		
Species	Hook location	N	Number Dead	Percent Mortality	N	Number Dead	Percent Mortality	N	Number Dead	Percent Mortality
Gag	Lip	4	0	0	18	0	0	19	7	37
	Stomach	2	0	0						
Red Porgy	External	2	0	0						
	Eye							1	0	0
	Lip	71	1	<1	58	5	8	53	0	0
	Stomach	6	4	66	5	1	20			
Scamp	Eye									
	Lip	1	0	0	8	2	25	22	4	18

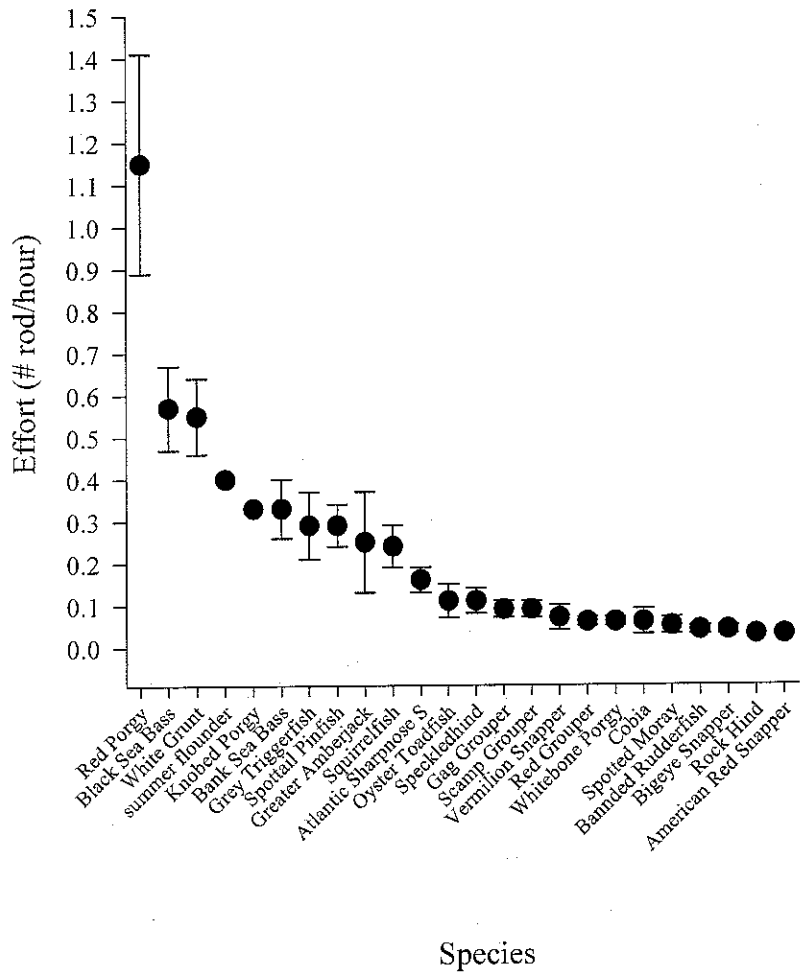

Figure 4. Catch-Effort -number of fish per rod hour (FRH) for all species collected while sampling the snapper grouper complex off the coast of North Carolina. Catch-effort was calculated by dividing the number of fish collected in a 5-8 h period divided by the number of fishermen onboard the vessel. Legal and sub-legal sized fish are included in the figure only for gag grouper, red porgy, and scamp.

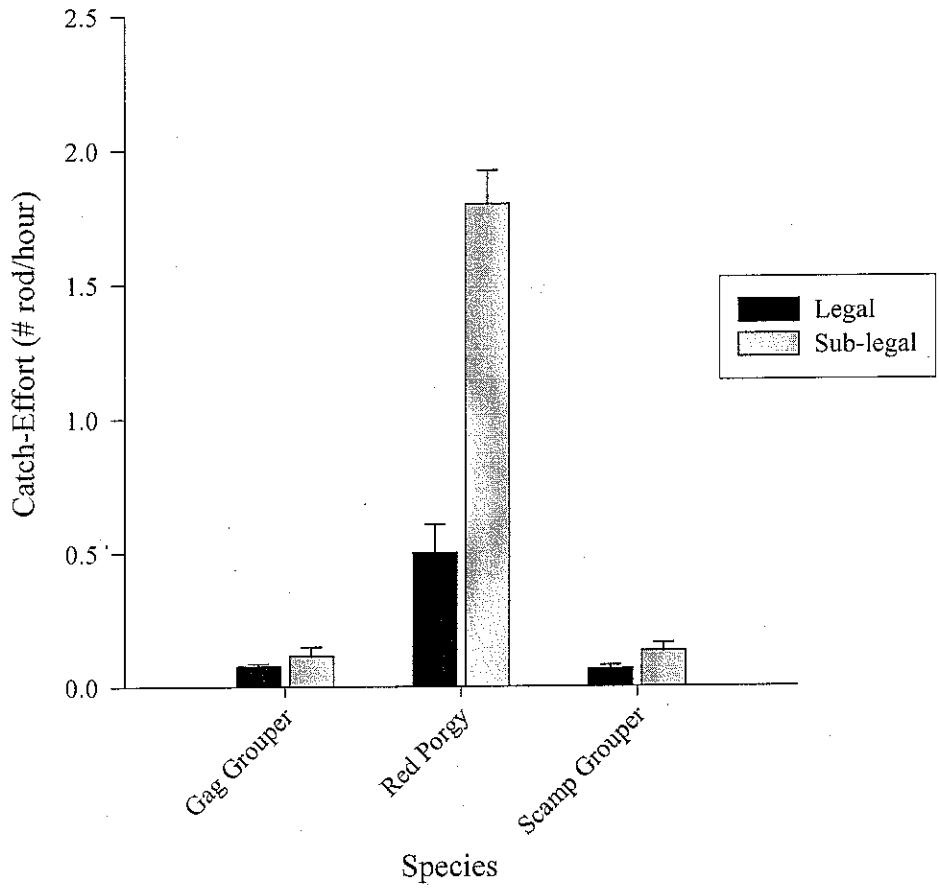

Figure 5. Comparison of Catch-Effort of legal and sub-legal gag grouper, red porgy, and scamp while sampling the snapper grouper complex off the coast of North Carolina. Catch-Effort was calculated by dividing the number of fish collected in a 5-8 hour period divided by the number of fishermen onboard the vessel.

Mortality through Predation

We observed only a 1.3% predation rate of fish collected during the study. This percentage included both predation on released fish and predation on fish while being reeled to the surface. About 95% of the predation occurred while fish were being reeled to the surface. We could not positively identify each species of predator on every occasion. Of the predators positively identified, shark and barracuda species were the most frequent.

Discussion

The results from this study indicate that the mortality on gag grouper, red porgy, and scamp associated with hook and line does vary among species off the coast of North Carolina. Our results also indicated that mortality among gag grouper and scamp could be significant with respect to hooking location.. Overall, mortality was 10% for all species combined. Species-specific hook and release mortality was highest for gag and scamp (~24%) and scamp and 5% for red porgy. The mortality between the holding periods was very similar. For fish held for 2-h, mortality was 8.4%. For fish held for 48-h, mortality was 12.3%. This suggests that short-term holding practices may be appropriate for evaluating hook and release mortality.

Our mortality estimates varied compared to results from published hook and release mortality estimates of reef fishes. Collins (1991) showed that acute mortality (2-hours) of 19 species of reef fishes was 19% for fish captured at 36m. Our estimate of acute mortality (2-h) was 8%. Wilson (1992) showed that the survival of scamp was 0% at depths >35m. We found a survival rate of scamp at 76% at <35m. Wilson and Burns (1996) sampled groupers of the coast of Florida and found that survival was 92% for groupers (gag and scamp) collected at 43m. This estimate was 15% higher than our estimates of survival for groupers. Also, there may be differences other than depth (i.e. hook location) that may be the reason for the differences in results

Most of the gag grouper and scamp were lip hooked while a larger proportion of red porgy were gut hooked. Gag grouper and scamp generally mouth their food for a while before swallowing it. This gives the angler time to set the hook while it was still in the fish's mouth, thus reducing the chance of gut hooking the fish. Red porgy (and snappers in general) do not mouth their food but immediately swallow their food. Any lag time in setting the hook after the fish takes the bait will often result in gut hooking, organ puncture and possibly death.

Fish that are rapidly retrieved from depth will experience some level of hyperbaric trauma (Gotshall 1964). Our samples were collected from depths <35m. We could not test the effect of depth on survival rates because our samples came from such a narrow range of depths. However depth may in fact affect the survival rate of fish. Burns et al (2002) showed that hook and release mortality for red grouper, gag, and red snapper were depth-related at depths >43m. We did not have representative samples from those depths.

For all of the species, lip hooked fish had the highest survival rate. A large percentage of the fish we collected were lip hooked fish. There are many possible reasons for this, including angler experience, feeding nature of the fish, and style and shape of the hook.

We used primarily a J-style hook throughout the study. The specific type of J-hook was a live bait hook. These types of hooks have a shorter shank and a wider gap-width than a traditional J-hook. At first glance the live bait hooks resemble circle hooks. A circle hook is defined as a fishing hook whose point is perpendicular to the

shank. We did catch a small (<5%) of fish with circle hooks. We did not collect enough samples among treatments (hook size, hook location, holding location, and holding period) to have enough power to perform statistical tests. The fisherman participating in the study had difficulty catching undersized fish without going to a larger circle hook size outside of the range of hook sizes of interest

The differences between j-hooks and circle hooks are differentiated only by the orientation of the point to the shank. The characteristics in gap size and shank length between the two styles may overlap. There is no parallel standard definition among fishing hook manufactures that clearly defines hook types. From our data, we hypothesized that the high percentage of lip hooked fish may be partly related to overall characteristics and shape of the live bait hook. Fishing hook morphology as well as the style of the hook should be considered when investigating the effects of hooking on mortality.

We collected 266 fish, which was far below our projected sample size. We made 24 trips during the period and few trips produced catches of undersized fish. However, we encountered several additional problems during the project that reduced the number of samples. First, weather became an issue all throughout the sampling season. We had to choose a series of days where it was safe enough weather to leave the holding cages in the water for 48 hours. This was a very difficult task because on several days the weather became too rough to fish. On those days we only went out to retrieve the cages, not to collect samples. During the sampling period, we lost data from three holding cages containing fish samples. We could not locate the buoys of two of the cages. We often fished in areas that were frequented by divers and commercial and recreational fishermen, so it is possible that these cages were stolen. The buoys may also have been run over by merchant ship traffic during the night. The webbing of the third holding cage became torn by either predator fish or through wear on the net webbing. All of the tagged fish escaped so we were unable to collected data on those fish. However, we did get a call from a commercial fisherman fishing in South Carolina who had captured one of our tagged escaped scamp 3 weeks after escaping.

The range of depths where our samples were collected was relatively narrow and ranged from 25 to 35 m. We did collect fish at 75m but had difficulty holding them in the cages at depth. The current was often very strong in areas at this depth. When we set our holding cages on the bottom, the current dragged our buoys underwater. This continued even after we tried to attach two or larger buoys to the end of the rope. We were able to retrieve our holding cages but we were unable draw any conclusions from the collected fish.

Predation did not occur in all areas. It seemed to be dependent on the number and type of predators in the area. For instance, if we caught shark species at a particular location, the predation rates were usually much higher compared to other areas where we caught no sharks.

We tried to use black sea bass pots to collect control fish. We collected only four fish as controls but did not include them in the analysis. Even when we reduced the size of the entry aperture, the sea bass pots were more effective in collecting larger

legal fish than smaller undersized fish. Instead of the black sea bass pots, an alternative trap style, such as a Chevron trap, may have been more appropriate for collecting control fish. Scientists often use Chevron traps to collect deepwater fishes. Initially, we chose not to use Chevron traps because of their cost and bulky design. We were very careful not to overload the holding cages with too many test fish during the study. As a general rule, only 10-15 fish were placed in the holding cages. Because we were holding fish in a relatively small space, the additional effects of confinement are unknown. We did observe some scale loss and abrasions on the extremities of collected fish after confinement. But we are certain that a small portion of the observed mortality was because of confinement stress. It is very difficult to separate out the confinement effects on mortality.

In our original proposal, we included red snapper and vermilion snapper in the study. Early on in the sampling season we had difficulty locating these two species. We could only collect legal sized individuals. We were constantly inquiring about the catches of snapper and grouper from recreational headboats and commercial fisherman, but they too had very low catches of these species. About three fourths of the way through the study period, we decided to drop red and vermilion snapper from the study and concentrate on the remaining species.

We also had difficulty locating red porgy at the beginning of the study. A scientist at NOAA suggested that the unusually cool temperatures at the bottom of the water column in 2003 could have been responsible for the absence of red porgy and vermilion snappers. We received reports of large numbers of red porgy being caught south of Morehead City, just outside of our proposed sampling area. We expanded our sampling area to include more southern areas. Once locating these it became very easy to collect large numbers of fish for the study. We caught most of the red porgy in three days of sampling.

The catch-effort data showed that red porgy had the highest FRH than the other fishes. We located sizeable schools of red porgy that allowed us to catch very large numbers of fish during a short period of time. If we remove red porgy from the analysis, white grunt had the highest FRH than all other species. We collected white grunt at almost all locations. However, their abundance was very seasonal and we collected them primarily during the summer months. During the end of October through January, black sea bass had the highest FRH.

We suggest that additional research is needed to further understand the total effects of hooking mortality in order to enhance our estimates for specific angling gear. The physiological stress responses of reef fishes related to hooking have not been thoroughly addressed as fishes that are common in nearshore and freshwater areas (Muoneke and Childress 1994, Pankhurst and Dedual 1994, Furguson and Tufts 1992). We used the most common techniques to catch reef fishes with respect to type of tackle and bait combinations. We suggest that holding and observing post-released fish in a more controlled environment such as land-based holding tanks would provide more informative data concerning the actual cause of death to the fish.

Our results suggest that hook and release mortality should be considered in future stock assessments of reef fishes. Estimates of short-and long-term post release mortality

are necessary to improve fishing mortality estimates used in stock assessment models, assisting fisheries managers in developing appropriate daily catch and size limit regulations, and to develop an awareness of the role of anglers in the conservation of fish stocks.

However, in order to use these data in stock assessments, there should be detailed information on the scale of exploitation by the commercial and recreational fishermen. Additional information such as effort and associated release rates should be assessed before this component of population mortality can be appropriately incorporated into stock assessments and management decisions.

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Appendices

Appendix A. Observational data of gag grouper, red porgy, and scamp collected off the coast of North Carolina

Depth (m)	Tag Number	Species	Length (T.L. mm)	Hook Size (X/0)	Hook Location	Holding location	Holding Period	Survive
31.1	263	Gag	429	6	Lip	Bottom	48	No
31.1	262	Gag	561	6	Lip	Bottom	48	Yes
31.1	281	Scamp	283	4	Lip	Bottom	48	Yes
31.1	280	Scamp	408	2	Lip	Bottom	48	Yes
31.1	279	Scamp	350	2	Lip	Bottom	48	Yes
31.1	278	Scamp	455	6	Lip	Bottom	48	Yes
31.1	277	Scamp	443	4	Lip	Bottom	48	No
32.3	267	Scamp	390	2	Lip	Bottom	48	Yes
32.3	266	Scamp	370	2	Lip	Bottom	48	Yes
32.3	265	Scamp	364	2	Lip	Bottom	48	Yes
32.3	264	Scamp	394	3	Lip	Bottom	48	No
32.3	263	Scamp	417	3	Lip	Bottom	48	Yes
32.3	262	Scamp	345	2	Lip	Bottom	48	Yes
32.3	260	Scamp	377	2	Lip	Bottom	48	Yes
32.3	259	Gag	427	2	Lip	Bottom	48	Yes
32.3	300	Gag	470	2	Lip	Bottom	48	Yes
32.3	298	Scamp	368	2	Lip	Bottom	48	Yes
32.3	297	Scamp	387	2	Lip	Bottom	48	Yes
27.1	252	Scamp	385	2	Lip	Bottom	2	Yes
27.1	251	Gag	423	2	Lip	Bottom	2	Yes
27.1	253	Scamp	305	6	Lip	Bottom	2	Yes
27.1	523	Gag	403	6	Lip	Bottom	2	Yes
27.1	524	Scamp	327	3	Lip	Bottom	2	Yes
29.3	275	Scamp	453	2	Lip	Bottom	48	No
29.3	274	Scamp	435	3	Lip	Bottom	48	Yes
29.3	273	Scamp	402	2	Lip	Bottom	48	Yes
29.3	290	Gag	470	2	Lip	Bottom	48	Yes
29.3	289	Scamp	165	2	Eye	Bottom	48	No
29.3	288	Scamp	397	2	Lip	Bottom	48	Yes
29.3	287	Scamp	378	2	Lip	Bottom	48	Yes
29.3	286	Scamp	435	2	Lip	Bottom	48	No
29.3	285	Gag	367	3	Lip	Bottom	48	Yes
29.3	294	Scamp	445	2	Eye	Bottom	2	No
29.3	295	Gag	472	2	Lip	Bottom	2	Yes
29.3	292	Scamp	469	2	Lip	Bottom	2	No
25.0	11211	Gag	510	5	Lip	Bottom	2	Yes
25.0	11212	Gag	310	3	Lip	Bottom	2	Yes
26.2	1138	Gag	300	5	Lip	Surface	48	Yes
26.2	1139	Gag	295	5	Stomach	Surface	2	Yes
31.1	226	Gag	485	3	Lip	Bottom	48	Yes

31.1	227	Gag	503	6	Lip	Bottom	48	No
31.1	228	Gag	429	6	Lip	Bottom	48	No
31.1	229	Gag	481	6	Lip	Bottom	48	Yes
31.1	230	Gag	467	3	Lip	Bottom	48	No
31.1	231	Gag	546	6	Lip	Bottom	48	No
31.1	232	Gag	525	6	Lip	Bottom	48	No
31.1	233	Scamp	457	6	Lip	Bottom	48	Yes
31.1	234	Gag	558	6	Lip	Bottom	48	Yes
31.1	235	Gag	551	6	Lip	Bottom	48	Yes
31.1	236	Gag	549	3	Lip	Bottom	48	No
31.1	237	Gag	549	6	Lip	Bottom	48	Yes
31.1	238	Gag	500	6	Lip	Bottom	48	Yes
31.1	239	Gag	513	6	Lip	Bottom	48	Yes
31.1	0	Scamp	422	4	Lip	Bottom	48	Yes
31.4	240	Gag	522	6	Lip	Bottom	2	Yes
31.4	241	Gag	395	3	Lip	Bottom	2	Yes
31.4	242	Scamp	495	6	Lip	Bottom	2	No
31.4	243	Gag	480	6	Lip	Bottom	2	Yes
31.4	0	Gag	428	6	Lip	Bottom	2	Yes
32.3	296	Scamp	374	2	Lip	Bottom	2	Yes
29.3	291	Scamp	486	2	Eye	Bottom	2	Yes
29.3	292	Scamp	486	2	Lip	Bottom	2	Yes
32.6	180	Red Porgy	322	2	Lip	Bottom	2	Yes
32.6	179	Red Porgy	305	5	Lip	Bottom	2	Yes
32.6	178	Red Porgy	325	6	Lip	Bottom	2	Yes
32.6	177	Red Porgy	355	5	Stomach	Bottom	2	Yes
32.6	176	Red Porgy	315	5	Lip	Bottom	2	Yes
32.6	150	Red Porgy	355	2	Lip	Bottom	2	Yes
32.6	149	Red Porgy	322	3	Lip	Bottom	2	Yes
32.6	148	Red Porgy	298	3	Eye	Bottom	2	Yes
32.6	147	Red Porgy	270	3	Lip	Bottom	2	Yes
32.6	146	Red Porgy	296	5	Lip	Bottom	2	Yes
32.6	145	Red Porgy	340	3	Lip	Bottom	2	Yes
32.6	144	Red Porgy	349	5	Lip	Bottom	2	Yes
32.6	143	Red Porgy	332	2	Lip	Bottom	2	Yes
33.2	244	Red Porgy	265	3	Stomach	Bottom	2	Yes
33.2	245	Red Porgy	275	3	Stomach	Bottom	2	Yes
33.2	246	Red Porgy	271	3	Lip	Bottom	2	No
33.2	247	Red Porgy	333	3	Lip	Bottom	2	No
33.2	248	Red Porgy	325	5	Lip	Bottom	2	Yes
33.2	249	Red Porgy	265	6	Lip	Bottom	2	Yes
33.2	250	Red Porgy	335	3	Lip	Bottom	2	Yes
33.2	175	Red Porgy	225	3	Lip	Bottom	2	Yes
33.2	174	Red Porgy	210	3	Lip	Bottom	2	Yes
33.2	173	Red Porgy	311	5	Lip	Bottom	2	Yes
33.2	172	Red Porgy	311	5	Lip	Bottom	2	Yes
33.2	171	Red Porgy	325	5	Lip	Bottom	2	Yes
33.2	1009	Red Porgy	310	5	Lip	Bottom	2	No

33.2	0	Red Porgy	245	3	Stomach	Bottom	2	Yes
33.2	170	Red Porgy	333	3	Lip	Bottom	2	Yes
33.2	169	Red Porgy	355	2	Lip	Bottom	2	Yes
33.2	168	Red Porgy	345	3	Lip	Bottom	2	Yes
33.2	167	Red Porgy	309	3	Lip	Bottom	2	Yes
33.2	166	Red Porgy	326	5	Lip	Bottom	2	Yes
33.2	165	Red Porgy	355	5	Lip	Bottom	2	Yes
33.2	164	Red Porgy	333	3	Lip	Bottom	2	Yes
33.2	163	Red Porgy	337	3	Lip	Bottom	2	Yes
33.2	162	Red Porgy	337	3	Lip	Bottom	2	Yes
33.2	161	Red Porgy	355	5	Lip	Bottom	2	Yes
33.2	159	Red Porgy	355	3	Lip	Bottom	2	Yes
33.2	158	Red Porgy	260	3	Lip	Bottom	2	Yes
33.2	157	Red Porgy	261	3	Lip	Bottom	2	Yes
33.2	156	Red Porgy	342	5	Lip	Bottom	2	Yes
33.2	155	Red Porgy	220	3	Lip	Bottom	2	Yes
33.2	154	Red Porgy	305	2	Lip	Bottom	2	Yes
33.2	152	Red Porgy	307	6	Lip	Bottom	2	Yes
33.2	151	Red Porgy	252	3	Lip	Bottom	2	Yes
33.2	200	Red Porgy	324	3	Lip	Bottom	2	Yes
33.2	199	Red Porgy	290	3	Lip	Bottom	2	Yes
33.2	198	Red Porgy	274	3	Lip	Bottom	2	Yes
33.2	197	Red Porgy	293	3	Lip	Bottom	2	Yes
33.2	196	Red Porgy	282	3	Lip	Bottom	2	Yes
33.2	195	Red Porgy	310	3	Lip	Surface	2	Yes
33.2	194	Red Porgy	355	3	Lip	Surface	2	Yes
33.2	193	Red Porgy	341	3	Lip	Surface	2	Yes
33.2	192	Red Porgy	355	3	Lip	Surface	2	Yes
33.2	191	Red Porgy	301	3	Lip	Surface	2	Yes
33.2	190	Red Porgy	336	5	Lip	Surface	2	Yes
33.2	189	Red Porgy	296	3	Lip	Surface	2	Yes
33.2	188	Red Porgy	296	3	Lip	Surface	2	Yes
33.2	187	Red Porgy	305	3	Lip	Surface	2	Yes
33.2	186	Red Porgy	278	3	Lip	Surface	2	Yes
33.2	185	Red Porgy	300	3	Lip	Surface	2	Yes
33.2	184	Red Porgy	321	2	Lip	Surface	2	Yes
33.2	183	Red Porgy	344	3	Stomach	Surface	2	No
33.2	182	Red Porgy	355	3	Lip	Surface	2	Yes
33.2	181	Red Porgy	308	3	Lip	Surface	2	Yes
34.1	143	Red Porgy	355	6	Stomach	Bottom	2	No
34.1	142	Red Porgy	337	2	Lip	Bottom	2	Yes
34.1	141	Gag	547	6	Lip	Bottom	2	Yes
34.1	140	Red Porgy	342	2	Lip	Bottom	2	Yes
34.1	139	Red Porgy	335	2	Lip	Bottom	2	Yes
34.1	138	Gag	573	6	Lip	Bottom	2	Yes
34.1	136	Red Porgy	337	5	Lip	Bottom	2	No
34.1	135	Red Porgy	355	3	Lip	Bottom	2	Yes
34.1	134	Red Porgy	289	3	Lip	Bottom	2	Yes

34.1	133	Scamp	295	3	Lip	Bottom	2	Yes
34.1	132	Red Porgy	335	3	Lip	Bottom	2	Yes
34.1	131	Red Porgy	340	3	Lip	Bottom	2	Yes
34.1	130	Red Porgy	341	5	Lip	Bottom	2	Yes
34.1	129	Red Porgy	345	5	Lip	Bottom	2	Yes
34.1	128	Red Porgy	351	3	Lip	Bottom	2	Yes
34.1	127	Red Porgy	346	3	Lip	Bottom	2	Yes
34.1	126	Red Porgy	295	3	Lip	Bottom	2	No
34.1	1	Red Porgy	310	5	Stomach	Surface	2	Yes
34.1	2	Red Porgy	355	2	Stomach	Surface	2	Yes
34.1	3	Red Porgy	335	2	Stomach	Surface	2	No
34.1	4	Red Porgy	355	5	Lip	Surface	2	Yes
34.1	5	Red Porgy	321	2	Lip	Surface	2	Yes
34.1	6	Red Porgy	333	2	Lip	Surface	2	Yes
34.1	7	Red Porgy	350	5	Lip	Surface	2	Yes
34.1	8	Red Porgy	335	5	Lip	Surface	2	Yes
34.1	9	Red Porgy	335	2	Lip	Surface	2	No
34.1	10	Scamp	333	6	Lip	Surface	2	Yes
34.1	11	Red Porgy	335	5	Lip	Surface	2	Yes
34.1	12	Red Porgy	315	5	Lip	Surface	2	Yes
34.1	13	Gag	565	3	Stomach	Surface	2	Yes
34.1	14	Red Porgy	332	3	External	Surface	2	Yes
34.1	15	Red Porgy	315	3	External	Surface	2	Yes
34.1	16	Red Porgy	312	2	Lip	Surface	2	Yes
34.1	17	Red Porgy	310	2	Lip	Surface	2	Yes
34.1	18	Red Porgy	278	2	Lip	Surface	2	Yes
34.1	19	Red Porgy	295	6	Lip	Surface	2	Yes
34.1	20	Red Porgy	330	2	Lip	Surface	2	Yes
33.2	745	Red Porgy	269	3	Lip	Surface	2	Yes
33.2	746	Red Porgy	271	5	Lip	Surface	2	Yes
33.2	747	Red Porgy	299	5	Lip	Surface	2	Yes
33.2	748	Red Porgy	244	2	Lip	Surface	2	Yes
33.2	749	Red Porgy	317	4	Lip	Surface	2	Yes
33.2	750	Red Porgy	296	5	Lip	Surface	2	Yes
33.2	751	Red Porgy	258	5	Lip	Surface	2	Yes
33.2	752	Red Porgy	288	5	Lip	Surface	2	Yes
33.2	753	Red Porgy	355	3	Lip	Surface	2	Yes
33.2	754	Red Porgy	257	5	Lip	Surface	2	Yes
33.2	755	Red Porgy	282	3	Lip	Surface	2	Yes
33.2	756	Red Porgy	311	3	Lip	Surface	2	Yes
33.2	757	Red Porgy	231	4	Lip	Surface	2	Yes
33.2	758	Red Porgy	259	3	Lip	Surface	2	Yes
33.2	759	Red Porgy	282	2	Lip	Surface	2	Yes
33.2	760	Red Porgy	229	4	Stomach	Surface	2	No
33.2	761	Red Porgy	294	4	Lip	Surface	2	Yes
33.2	762	Red Porgy	339	2	Lip	Surface	2	Yes
33.2	763	Red Porgy	353	5	Lip	Surface	2	Yes
33.2	764	Red Porgy	224	4	Lip	Surface	2	Yes

33.2	765	Red Porgy	333	4	Lip	Surface	2	Yes
33.2	766	Red Porgy	248	4	Lip	Surface	2	Yes
33.2	767	Red Porgy	355	2	Lip	Surface	2	Yes
33.2	768	Red Porgy	287	3	Lip	Surface	2	Yes
33.2	769	Red Porgy	269	4	Lip	Surface	2	Yes
33.2	770	Red Porgy	315	5	Lip	Surface	2	Yes
33.2	771	Red Porgy	327	5	Lip	Surface	2	Yes
33.2	772	Red Porgy	295	3	Lip	Surface	2	Yes
33.2	773	Red Porgy	355	5	Lip	Surface	2	Yes
33.2	774	Red Porgy	319	4	Stomach	Surface	2	No
33.2	775	Red Porgy	355	2	Lip	Surface	2	Yes
33.2	776	Red Porgy	227	2	Lip	Surface	2	Yes
33.2	777	Red Porgy	246	2	Lip	Surface	2	Yes
33.2	778	Red Porgy	355	3	Lip	Surface	2	Yes
33.2	779	Red Porgy	228	3	Lip	Surface	2	Yes
33.2	780	Red Porgy	355	2	Lip	Surface	2	Yes
33.2	781	Red Porgy	240	5	Lip	Surface	2	Yes
33.2	782	Red Porgy	325	4	Lip	Surface	2	Yes
33.2	783	Red Porgy	355	3	Lip	Surface	2	Yes
33.2	784	Red Porgy	355	2	Lip	Surface	2	Yes
33.2	785	Red Porgy	355	2	Lip	Surface	2	Yes
33.2	786	Red Porgy	327	4	Lip	Surface	2	Yes
33.2	787	Red Porgy	321	2	Lip	Surface	2	Yes
33.2	788	Red Porgy	355	3	Lip	Surface	2	Yes
33.2	789	Red Porgy	355	5	Lip	Surface	2	Yes
33.2	790	Red Porgy	258	3	Lip	Surface	2	Yes
33.2	827	Red Porgy	355	3	Lip	Bottom	48	Yes
33.2	828	Red Porgy	264	3	Lip	Bottom	48	Yes
33.2	829	Red Porgy	316	2	Lip	Bottom	48	Yes
33.2	830	Red Porgy	329	4	Lip	Bottom	48	Yes
33.2	831	Red Porgy	295	3	Lip	Bottom	48	Yes
33.2	832	Red Porgy	355	2	Lip	Bottom	48	Yes
33.2	833	Red Porgy	343	4	Lip	Bottom	48	Yes
33.2	834	Red Porgy	321	3	Lip	Bottom	48	Yes
33.2	835	Red Porgy	227	2	Lip	Bottom	48	Yes
33.2	836	Red Porgy	288	3	Lip	Bottom	48	Yes
33.2	837	Red Porgy	255	5	Lip	Bottom	48	Yes
33.2	838	Red Porgy	264	4	Lip	Bottom	48	Yes
33.2	839	Red Porgy	230	4	Lip	Bottom	48	Yes
33.2	840	Red Porgy	355	5	Lip	Bottom	48	Yes
33.2	841	Red Porgy	346	3	Lip	Bottom	48	Yes
33.2	842	Red Porgy	329	5	Lip	Bottom	48	Yes
33.2	843	Red Porgy	340	2	Lip	Bottom	48	Yes
33.2	844	Red Porgy	250	2	Lip	Bottom	48	Yes
33.2	845	Red Porgy	355	2	Lip	Bottom	48	Yes
33.2	846	Red Porgy	355	5	Lip	Bottom	48	Yes
33.2	847	Red Porgy	335	3	Lip	Bottom	48	Yes
33.2	848	Red Porgy	347	5	Lip	Bottom	48	Yes

33.2	849	Red Porgy	355	5	Lip	Bottom	48	Yes
33.2	850	Red Porgy	222	2	Lip	Bottom	48	Yes
33.2	851	Red Porgy	330	5	Lip	Bottom	48	Yes
33.2	852	Red Porgy	288	3	Lip	Bottom	48	Yes
33.2	853	Red Porgy	317	4	Lip	Bottom	48	Yes
33.2	854	Red Porgy	355	3	Lip	Bottom	48	Yes
33.2	855	Red Porgy	236	5	Lip	Bottom	48	Yes
33.2	856	Red Porgy	235	3	Lip	Bottom	48	Yes
33.2	857	Red Porgy	355	4	Lip	Bottom	48	Yes
33.2	858	Red Porgy	305	4	Lip	Bottom	48	Yes
33.2	859	Red Porgy	241	4	Lip	Bottom	48	Yes
33.2	860	Red Porgy	291	4	Lip	Bottom	48	Yes
33.2	861	Red Porgy	266	3	Lip	Bottom	48	Yes
33.2	862	Red Porgy	222	2	Lip	Bottom	48	Yes
33.2	863	Red Porgy	355	3	Lip	Bottom	48	Yes
33.2	864	Red Porgy	226	5	Lip	Bottom	48	Yes
33.2	865	Red Porgy	323	3	Lip	Bottom	48	Yes
33.2	866	Red Porgy	351	4	Lip	Bottom	48	Yes
33.2	867	Red Porgy	355	4	Lip	Bottom	48	Yes
33.2	868	Red Porgy	318	4	Lip	Bottom	48	Yes
33.2	869	Red Porgy	285	2	Lip	Bottom	48	Yes
33.2	870	Red Porgy	288	3	Lip	Bottom	48	Yes
33.2	871	Red Porgy	355	3	Lip	Bottom	48	Yes
33.2	872	Red Porgy	355	5	Lip	Bottom	48	Yes
33.2	873	Red Porgy	355	2	Lip	Bottom	48	Yes
33.2	874	Red Porgy	308	5	Lip	Bottom	48	Yes
33.2	875	Red Porgy	256	3	Lip	Bottom	48	Yes
33.2	876	Red Porgy	355	3	Lip	Bottom	48	Yes
33.2	877	Red Porgy	257	3	Lip	Bottom	48	Yes
33.2	878	Red Porgy	284	2	Lip	Bottom	48	Yes
33.2	879	Red Porgy	307	4	Lip	Bottom	48	Yes

Appendix B. Date of capture and total length (mm) of legal sized gag grouper, red porgy, and scamp collected off the coast of North Carolina.

Date	Species	Length	Date	Species	Length	Date	Species	Length
06/23/03	Gag	673	03/13/04	Red Porgy	488	03/25/04	Red Porgy	416
06/23/03	Gag	883	03/13/04	Red Porgy	390	03/25/04	Red Porgy	406
07/10/03	Gag	875	03/13/04	Red Porgy	393	03/25/04	Red Porgy	508
07/10/03	Gag	835	03/13/04	Red Porgy	498	03/25/04	Red Porgy	496
07/10/03	Gag	885	03/13/04	Red Porgy	359	03/25/04	Red Porgy	436
07/27/03	Gag	980	03/13/04	Red Porgy	365	03/25/04	Red Porgy	431
07/27/03	Gag	978	03/13/04	Red Porgy	482	03/25/04	Red Porgy	522
07/27/03	Gag	957	03/13/04	Red Porgy	364	03/25/04	Red Porgy	407
07/27/03	Gag	892	03/13/04	Red Porgy	439	03/25/04	Red Porgy	526
07/30/03	Gag	901	03/13/04	Red Porgy	379	03/25/04	Red Porgy	513
08/13/03	Gag	817	03/13/04	Red Porgy	377	06/23/03	Scamp	552
08/13/03	Gag	709	03/16/04	Red Porgy	439	07/27/03	Scamp	511
08/13/03	Gag	965	03/16/04	Red Porgy	514	07/29/03	Scamp	592
08/13/03	Gag	722	03/16/04	Red Porgy	455	07/29/03	Scamp	538
08/19/03	Gag	633	03/16/04	Red Porgy	428	07/30/03	Scamp	580
09/25/03	Gag	906	03/16/04	Red Porgy	357	07/30/03	Scamp	553
09/25/03	Gag	823	03/16/04	Red Porgy	529	07/30/03	Scamp	529
10/13/03	Gag	914	03/16/04	Red Porgy	538	08/19/03	Scamp	551
10/13/03	Gag	655	03/16/04	Red Porgy	491	10/13/03	Scamp	514
10/14/03	Gag	714	03/16/04	Red Porgy	385	10/31/03	Scamp	592
10/14/03	Gag	759	03/18/04	Red Porgy	402	11/21/03	Scamp	522
10/14/03	Gag	808	03/18/04	Red Porgy	411	11/21/03	Scamp	540
10/14/03	Gag	767	03/18/04	Red Porgy	500	11/23/03	Scamp	550
10/31/03	Gag	802	03/18/04	Red Porgy	495	03/13/04	Scamp	551
10/31/03	Gag	701	03/18/04	Red Porgy	428	03/13/04	Scamp	587
11/21/03	Gag	823	03/18/04	Red Porgy	471	03/13/04	Scamp	553
11/21/03	Gag	927	03/18/04	Red Porgy	441	03/18/04	Scamp	589
03/18/04	Gag	692	03/18/04	Red Porgy	451	03/18/04	Scamp	584
03/25/04	Gag	787	03/18/04	Red Porgy	460	03/25/04	Scamp	549
03/13/04	Red Porgy	489	03/18/04	Red Porgy	412			
03/13/04	Red Porgy	486	03/18/04	Red Porgy	443			
03/13/04	Red Porgy	508	03/18/04	Red Porgy	455			
03/13/04	Red Porgy	478	03/18/04	Red Porgy	459			
03/13/04	Red Porgy	465	03/18/04	Red Porgy	377			
03/13/04	Red Porgy	368	03/18/04	Red Porgy	431			
03/13/04	Red Porgy	397	03/18/04	Red Porgy	514			

Appendix C Effort Data (number of fish per rod hour) from sampling of the snapper/grouper complex of North Carolina

Species	Scientific Name	Date											
		6/23/03	7/10/03	7/16/03	7/27/03	7/29/03	7/30/03	8/13/03	8/19/03	8/21/03	9/2/03	9/25/03	10/13/03
American Red Snapper	Lutjanus campechanus							0.02					
Atlantic Sharpenose Shark	Rhizopnionodori terraenovae				0.07	0.14	0.06	0.05	0.05	0.13			0.06
Bank Sea Bass	Centnopnistis ocyunus	0.19	0.07	0.06	0.07			0.12	0.25	0.05	0.02	0.22	0.35
Bandded Rudderfish	Seriola zonata										0.01	0.03	0.02
Bigeye Snapper	Priancanthus arenatus	0.03	0.01	0.01									
Black Sea Bass	Centnopnistis striata	0.25	0.06	0.08	0.12			0.17	0.20	0.02	0.60	0.23	0.21
Cobia	Rachycentron canadum	0.06	0.01	0.01									
Gag Grouper	Myctemperca microlepis	0.06		0.03	0.02			0.03	0.03				0.27
Greater Amberjack	Serbia dumeniii							0.10			0.07		
Grey Triggerfish	Balistes capniscus	0.39	0.08	0.08	0.12						0.02		0.17
Knobed Porgy	Calamus nodosus						0.14						
Oyster Toadfish	Opsanus tao												
Pinfish	Lagodon rhomboides					0.11	0.03				0.15	0.02	
Red Grouper	Epinephelus mono											0.05	
Red Porgy	Pagrus pagrus												
Rock Hind	Epinephelus adscensionis					0.01		0.02					
Scamp Grouper	Myctemperca phenax	0.08		0.18	0.07			0.07	0.08				0.04
Speckledhind	Epinephelus drummondhayi	0.06	0.03	0.03			0.08						
Spottail Pinfish	Diplodus holbrooki				0.10	0.13	0.39		0.05	0.02		0.13	0.17
Spotted Moray	Gymnothorax moninga										0.04		
Squirrelfish	Hobolocentrus adscensicnis							0.05					
Summer flounder	Paralichthys dentatus												
Vermilion Snapper	Rhonnboplites aurorubens			0.01		0.01	0.06						
White Grunt	Haemulon plumieri	0.36	0.18	0.18	0.38	0.36	0.72	0.37	0.25	0.20	0.12	0.37	0.50
Whitebone Porgy	Calamus leucosteus							0.05	0.03	0.02			0.04

Appendix C cont.—Effort Data (number of fish per rod hour) from sampling of the snapper/grouper complex of North Carolina

Species	Scientific Name	Date										
		10/14/03	10/31/03	11/21/03	11/23/03	1/21/04	1/24/04	3/4/04	3/13/04	3/16/04	3/18/04	3/25/04
American Red Snapper	Lutjanus campechanus											
Atlantic Sharpnose Shark	Rhizopnionodori terraenovae	0.06	0.05	0.02	0.06	0.02		0.10			0.18	
Bank Sea Bass	Centnopnistis ocyunus	0.29	0.06		0.31	0.53		0.20	0.05		0.07	
Banded Rudderfish	Seriola zonata								0.02			
Bigeye Snapper	Priancanthus arenatus											
Black Sea Bass	Centnopnistis striata	0.27	0.26	0.60	0.52	0.37	0.38	0.53	0.02			
Cobia	Rachycentron canadum											
Gag Grouper	Myctemperca microlepis	0.08		0.03	0.04						0.05	
Greater Amberjack	Serbia dumeniii	0.02				0.25						
Grey Triggerfish	Balistes capniscus	0.44			0.17		0.06	0.03				
Knobed Porgy	Calamus nodosus											
Oyster Toadfish	Opsanus tao			0.03	0.06							
Pinfish	Lagodon rhomboides		0.05	0.10	0.17			0.20				
Red Grouper	Epinephelus mono	0.04		0.05					0.03		0.02	
Red Porgy	Pagrus pagrus								0.87	0.77	0.75	0.74
Rock Hind	Epinephelus adscensionis											
Scamp Grouper	Mycteroperca phenax	0.02									0.03	
Speckledhind	Epinephelus drummondhayi											
Spottail Pinfish	Diplodus holbrooki	0.19		0.27	0.35							
Spotted Moray	Gymnothorax moninga	0.02		0.02								
Squirrelfish	Hobolocentrus adscensicnis				0.10	0.13					0.12	
summer flounder	Paralichthys dentatus						0.17					
Vermilion Snapper	Rhonnboplites aurorubens					0.03						
White Grunt	Haemulon plumieri	0.44	0.13		0.08			0.17	0.05		0.10	
Whitebone Porgy	Calamus leucosteus	0.04		0.02							0.02	