Calculated discards of black grouper from commercial vertical line and longline fishing vessels in the Gulf of Mexico and US South Atlantic

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Introduction

In August 2001, the Southeast Fisheries Science Center (SEFSC) initiated a program to collect commercial fishing vessel discard data from Gulf of Mexico and US South Atlantic fisheries. A reporting form was developed that supplements the existing vessel coastal logbook forms that are currently mandatory for those fisheries (Poffenberger and McCarthy, 2004). Discard data from the SEFSC coastal fisheries logbook program were used to calculate the number of black grouper that were discarded during the period January 1, 2002 through December 31, 2008.

Data collection for the discard logbook program involves, each year, a 20% random sample of the vessels with South Atlantic snapper-grouper, Gulf of Mexico reef-fish, king mackerel, Spanish mackerel or shark permits selected to report the number of animals discarded by species. To assure that the sample was representative of vessels with those Federal permits, the universe of permitted vessels was stratified by region and gear fished. A random sample was selected, without replacement, from each stratum. Region was defined as the Gulf of Mexico (Gulf-side of the Florida Keys-Dry Tortugas to the Texas-Mexico border) and the South Atlantic (which extends from the North Carolina-Virginia border to the ocean-side of the Florida Keys-Dry Tortugas). Fishing gear strata included handline, electric reel (bandit rig), trolling, longline, trap, gillnet, and diving. The selected fishers were instructed to complete a supplemental discard form for every fishing trip that they made. Trips with no discards were reported as such.

Reported data included the numbers of discards by species, estimated condition of the fish when released, reason for release (due to regulations or unmarketable/unwanted), and the fishing area where the animal was discarded. There are six options for the condition of released fish: all animals are dead, majority of the animals are dead, all animals are alive when released, majority of animals are alive, the fish are kept but not sold, and the condition of the animals is unknown. To calculate species specific discard rates, discard data were matched to the landings and effort data reported (for the appropriate trip) to the coastal logbook program.

Methods

Two discard data sets were used to calculate black grouper discards. The first data set included all trips from vertical line (handline and electric reel/bandit rig) vessels that reported discards between January 1, 2002 and December 31, 2008 in the Gulf of Mexico and US South Atlantic, defined as the area from the Texas-Mexico border to 37^{o} N. A second data set was limited to longline vessels reporting discards from the Gulf of Mexico during the period 2002-2008. South Atlantic longline discards were not included in the analysis because South Atlantic black grouper landings account for only three percent of the total longline black grouper landings.

During the period 2002-2008, discard forms were submitted for 24,632 Gulf of Mexico and South Atlantic vertical line trips. Of those trips, discards were reported on 56.2% of trips. Discard forms were submitted

for 1,209 Gulf of Mexico longline trips during the same period; 812 trips (67.2%) reported discards. Black grouper discards were reported on 597 (2.4%) vertical line trips and on 11 (0.91%) Gulf of Mexico longline trips. There were 277,594 Gulf of Mexico and South Atlantic trips (all fishing gears; North Carolina landings excluded due to species misidentification, see below) reported during 2002-2008 to the coastal logbook program, of those 33,702 (1.2%) reported black grouper landings. Seventy-one percent of the positive black grouper trips were reported as vertical line trips and 19% were reported as Gulf of Mexico longline trips (0.16% South Atlantic longline trips). Only trips that could be unambiguously categorized to a single gear and area fished were used to calculate the above counts and percentages.

The objective of this analysis was to calculate the numbers of black grouper discarded by commercial vessels that fished for species other than shrimp or other shellfish. Fishing activity for these analyses included vertical line gear (handlines and electric reels) in both the Gulf of Mexico and US South Atlantic and longline gear in the Gulf of Mexico. Electric reel (bandit rig) was reported as handline until 2002 and the proper reporting of those gears required several years of transition, therefore electric reel gear was combined with handline gear for these analyses. No other single gear accounted for more than seven percent of black grouper landings.

The misreporting of gag grouper as black grouper complicated the discard calculations. This was particularly problematic in the Gulf of Mexico, as was noted in the SEDAR 10 gag grouper data workshop. Area specific corrections for misreporting in the Gulf of Mexico were made using the TIP gag:black grouper ratios reported by Chih and Turner (2006). Numbers of reported black and gag grouper discards were summed for individual trips and the appropriate area specific gag:black ratio applied to calculate corrected discards for both species. Those calculated discards were rounded to the nearest whole number. In cases where both species were reported for a trip, no misreporting was assumed and the reported discards were used in all analyses. Proper reporting was assumed in the South Atlantic, except when a trip reported landings in North Carolina. Discards from vessels reporting landings in North Carolina were excluded from the analyses. This was necessary due to species misreporting of gag grouper as black grouper (Muller, pers. comm.). Trip Interview Program (TIP) data included no black grouper in observed North Carolina landings, however gag grouper were observed. It was assumed that vessels misreporting landings would also misreport discards.

Five factors were considered as possible influences on the black grouper discard rate from vertical line vessels. Available longline data were too limited to allow for this analysis. In order to develop a well balanced sample design it was necessary to define categories within some of the factors examined:

Vertical line

Factor	Levels	Value
Year	7	2002-2008
Region	2	Gulf of Mexico, South Atlantic; see Figure 1.
Days at sea	2	1, 2+
Quarter	4	Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec
Crew	3	1, 2, or 3+ crew members

General linear model (GLM) analyses were used to identify any significant effects the above factors may have had on the black grouper discard rate of vertical line commercial fishing trips. Parameterization of each model was accomplished using a GLM procedure (GENMOD; Version 8.02 of the SAS System for Windows © 2000. SAS Institute Inc., Cary, NC, USA). For the GLM analysis of proportion positive trips, a type-3 model was fit, a binomial error distribution was assumed, and the logit link was selected. The response variable was proportion successful trips. During the analysis of catch rates on successful trips, a type-3 model assuming lognormal error distribution was examined. The linking function selected was "normal", and the response variable was log(CPUE). A type-3 model assuming lognormal error distribution was employed. The linking function selected was "normal", and the vertical line response

variable was log(CPUE) calculated as log(CPUE) = log(number of black grouper discards/hook hour). Only main effects were examined.

A forward stepwise regression procedure was used to determine the set of main effects that explained a significant portion of the observed variability. Each potential factor was added to the null model sequentially and the resulting reduction in deviance per degree of freedom was examined. The factor that caused the greatest reduction in deviance per degree of freedom was added to the base model if the factor was significant based upon a Chi-Square test ($p<0.05$), and the reduction in deviance per degree of freedom was ≥1%. This model then became the base model, and the process was repeated, adding factors individually until no factor met the criteria for incorporation into the final model.

Once the significant main effects were identified, the data were stratified by those factors and a mean discard rate was calculated for each stratum. Those mean rate calculations included all vertical line discard trips within each stratum, i.e. trips with no black grouper discards were included in the discard rate calculations to produce a mean nominal discard rate. Total vertical line effort (hook hours) was calculated from the coastal logbook data set for each stratum. Total discards for each stratum were then calculated as: stratum mean discard rate*stratum total effort. Coastal logbook total effort data were available to 1993. For the years prior to 2002 (the beginning of the discard logbook program), the overall mean discard rate was applied to the yearly total effort reported to the coastal logbook program.

For the calculation of longline discard rate, all available data were pooled and the mean discard rate across all years was calculated. That single mean discard rate was then applied to the yearly longline effort, defined as number of hooks fished per year.

Results and Discussion

The final models for the binomial on proportion positive trips and the lognormal on CPUE of successful vertical line trips were:

PPT = Quarter + Year + Crew Number

LOG(CPUE) = Crew Number + Days at Sea + Year + Region

When the discard logbook data set was stratified by all significant factors, some of the strata were unpopulated with a discard rate due to the small size of the data set. Discards were assumed to be zero for those strata.

Yearly discard totals for each gear are included in Table 1. Including stratum specific discard totals resulted in a large matrix that was not included here, however those totals are available upon request. Vertical line calculated discards were less than 10,000 black grouper per year. Longline calculated discards never exceeded 200 black grouper per year.

The release condition of discarded black grouper is reported in Table 2 for both gears with vertical line data reported yearly, but all years combined for longline due to small sample size. In all cases, 82% or more black grouper were reported as “all alive”. In 2004, approximately 12% of vertical line black grouper discards were reported as “all dead” as were nine percent of longline black grouper discards. All other discard release condition category/year combinations of vertical line reports accounted for less than four percent of the discards. Nine percent of longline discards were “kept”.

Fishers were requested to report the reason fish were discarded. “Due to regulatory restrictions” accounted for more than 98% of reported black grouper discards in all years prior to 2008 for vertical line trips. Longline trips reported discards due to regulations in 85% of reports. Beginning in 2008, the regulatory restriction reporting category was expanded to differentiate between fish discarded due to size restriction

and those discarded due to fishery closures. Approximately 68% black grouper discards were reported as undersized with another 19% discarded due to unspecified regulatory restrictions.

The number of trips reporting black grouper discards in the US South Atlantic and Gulf of Mexico ranged from 37 to 132 vertical line trips per year. Only 11 longline trips reported black grouper discards during the period 2002-2008. The number of yearly vertical line trips with discard reports ranged from 2,064 to 6,960 each year. The percentage of trips reporting "no discards" has increased since the inception of the discard logbook program; more than doubling from 25% to 55% for vertical line trips (combined Gulf of Mexico and South Atlantic). The number of longline Gulf of Mexico reporting trips varied from 100 to 280 trips each year; 24 to 40% of those trips reported "no discards", however no clear trend in the percentage of those reports was apparent over time. With increasing number of "no discards" vertical line reporting trips and the extremely small longline sample, black grouper discards may be both underreported and poorly characterized by the available self-reported discard data.

Literature Cited

Poffenberger, J. and K. McCarthy. 2004. Estimates of red snapper discards by vessels with Federal permits in the Gulf of Mexico. SEDAR 7-DW-22.

Table 1. Calculated yearly commercial vertical line vessel black grouper discards by region. Discards are reported in number of fish.

Year	Vertical Line Discards	Longline Discards
1993	5,571	134
1994	6,783	162
1995	6,125	145
1996	6,651	154
1997	7,036	168
1998	6,505	159
1999	7,296	178
2000	7,215	163
2001	6,244	153
2002	6,576	139
2003	8,324	160
2004	4,701	148
2005	9,400	110
2006	1,155	129
2007	8,886	115
2008	1,295	104

Table 2. Percent of black grouper discards by estimated condition at release from commercial vertical line vessels reported by region.

Region	Year	All Dead	Majority Dead	All Alive	Majority Alive	Kept	Unknown	Unreported	N Fish
Vertical Line	2002	0.75%	1.49%	95.52%	2.24%	0.00%	0.00%	0.00%	134
	2003	0.00%	0.00%	90.09%	5.41%	0.30%	3.90%	0.30%	333
	2004	11.79%	1.89%	85.85%	0.00%	0.47%	0.00%	0.00%	212
	2005	0.00%	0.46%	92.24%	5.48%	0.91%	0.00%	0.91%	219
	2006	0.00%	0.00%	98.25%	0.00%	1.75%	0.00%	0.00%	57
	2007	0.80%	0.00%	94.40%	3.20%	1.60%	0.00%	0.00%	250
	2008	0.00%	0.00%	98.82%	0.78%	0.39%	0.00%	0.00%	255
	N Fish	28	7	1,356	43	10	13	3	1,460
Longline		9.1%	0.0%	81.8%	0.0%	9.1%	0.0%	0.0%	151

Figure 1. Coastal Logbook defined fishing areas.