Appendix F
Potential Management Measures for Vermilion Snapper

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Summary

An update to the vermilion snapper Southeast Data Assessment and Review (SEDAR) stock assessment indicates the stock is undergoing overfishing (SEDAR Update #3 2007). The Council's SSC did not have confidence in the calculated biomass reference points from the SEDAR assessment; however, they did have confidence in the fishing mortality rate estimates. The SSC indicated a 61% reduction in overall harvest (commercial and recreational sectors) would be needed to reduce fishing mortality to the yield associated with Foy. This is equivalent to a catch level of 566,179 pounds gutted weight (628,459 pounds whole weight). Based on allocation alternatives suggested thus far by the Council this would correspond to harvest reductions of 57-58% in the commercial sector and 67-68% in the recreational sector (Table 1).

Table 1. Commercial and recreational portions of catch (pounds gutted weight) associated with allocations suggested by Council thus far.

Vermilion Snapper		**Allocation Alternative 2. 68%C/32%R**	
	Annual	**Commercial**	**Recreational**
Year	**Catch Limit** (gutted weight)	**Proportion** (gutted weight)	**Proportion** (gutted weight)
2008	566,179	385,002	181,177

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1 Summary of life history information

Vermilion snapper occur in the Western Atlantic, from North Carolina to Rio de Janeiro. It is most abundant off the southeastern United States and in the Gulf of Campeche (Hood and Johnson 1999). The vermilion snapper is commonly found over rock, gravel, or sand bottoms near the edge of the continental and island shelves (Allen 1985). Vermilion snapper are not sedentary (like most snappers) but are found off the bottom and have morphological characteristics reflective of pelagic species (i.e., forked tail, streamlined body shape, long pectorals, pointed snout). It occurs at depths from 18 to 122 m (59 to 400 ft), but is most abundant at depths less than 76 m (250 ft). Individuals often form large schools. Vermilion snapper probably do not have extensive long range or local movement patterns (SEDAR 2 2003).

The maximum size of a male vermilion snapper, reported by Allen (1985), was 60.0 cm (23.8 in) TL and 3.2 kg (7.1 pounds). Maximum reported age in the South Atlantic Bight was 14 years (Zhao *et al.* 1997; Potts *et al.* 1998). SEDAR 2 (2003) recommends that M be defined as 0.25/yr, with a range of 0.2-0.3/yr.

This species spawns in aggregations (Lindeman *et al.* 2000) from April through late September in the southeastern United States (Cuellar *et al.* 1996). Zhao *et al.* (1997) indicated most spawning in the South Atlantic Bight occurs from June through August. Eggs and larvae are pelagic. Vermilion snapper have separate sexes throughout their life. All vermilion snapper are mature at 2 years of age and 20.0 cm (7.9 in) (SEDAR 2 2003). Cuellar *et al.* (1996) collected vermilion snapper off the southeastern United States and found all were mature. The smallest female was 16.5 cm (6.5 in) FL and the smallest male was 17.9 cm (7.1 in) FL (Cuellar *et al.* 1996). Zhao and McGovern (1997) reported that 100% of males that were collected after 1982 along the southeastern United States were mature at 14.0 cm (5.6 in) TL and age 1. All females collected after 1988 were mature at 18.0 cm (7.1 in) TL and age 1.

This species preys on fishes, shrimps, crabs, polychaetes, and other benthic invertebrates, as well as cephalopods and planktonic organisms (Allen 1985). Sedberry and Cuellar (1993) reported small crustaceans (especially copepods), sergestid decapods, barnacle larvae, stomatopods, and decapods dominated the diets of small (< 50 mm (2 in) SL) vermilion snapper off the Southeastern United States. Larger decapods, fishes, and cephalopods are more important in the diet of larger vermilion snapper.

2 Reduction in harvest needed to end overfishing and achieve OY

Reduction in harvest needed to end overfishing using the Baranov equation and natural mortality = 0.25. Fproj represents the geometric mean of fishing mortality during 2004-2006.

Table 2. Reduction in harvest needed to achieve Fmax.

Fmax	Fproj	**Reduction**
0.355	0.9098	0.51

Fproj/Fmax = 2.56

Reduction in harvest needed to achieve OY using the Baranov equation and natural mortality = 0.25. Fproj represents the geometric mean of fishing mortality during 2004-2006.

Table 3. Reduction in harvest needed to achieve Foy.

Foy	Fproj	**Reduction**
0.26625	0.9098	0.61

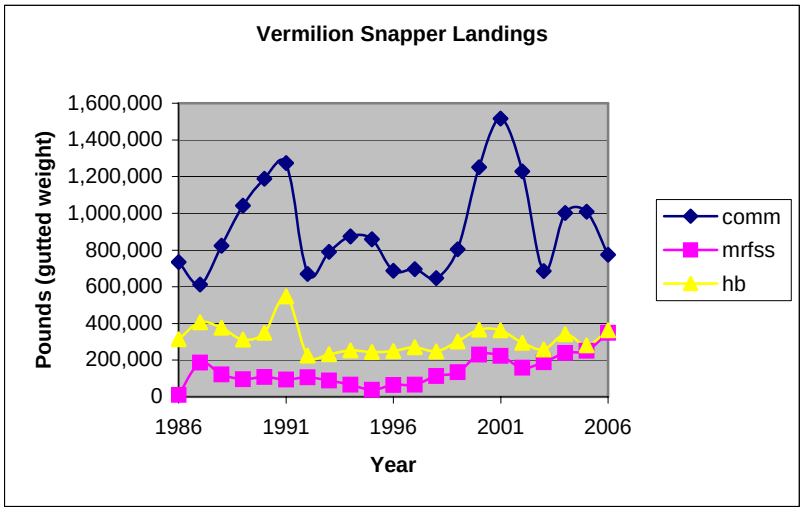
The SSC provided an estimate of this value based on the yield per recruit at the geometric mean of the 2004-2006 fishing mortality rates compared to that at 75% of Fmax (Foy). To lower the fishing mortality rate to 75% of Fmax, a 61% reduction in total catch is required. Using data from the SEDAR assessment (SEDAR Update #3 2007), this results in a total harvest (recreational and commercial) of 628,459 pounds whole weight (566,179 pounds gutted weight).

3 Vermilion Snapper Landings

3.1 Vermilion snapper landings

Table 4. Vermilion Snapper Landings – Pounds Gutted Weight. Source: ALS, MRFSS Web site; Headboat survey. Commercial data for 2006 are from logbook. Data do not include dead discards and MRFSS data are A+B1; weight not converted from numbers.

Year	comm	mrfss	headboat	% comm	% rec
1986	735,419	10,146	314,696	69.36%	30.64%
1987	611,652	186,783	407,152	50.73%	49.27%
1988	823,693	121,367	377,149	62.30%	37.70%
1989	1,040,863	95,466	312,196	71.86%	28.14%
1990	1,187,409	108,635	348,442	72.21%	27.79%
1991	1,274,161	94,495	547,554	66.49%	33.51%
1992	669,690	106,702	224,860	66.89%	33.11%
1993	790,162	88,468	231,710	71.16%	28.84%
1994	874,456	66,195	253,735	73.21%	26.79%
1995	859,165	38,212	244,916	75.21%	24.79%
1996	687,574	64,394	248,925	68.70%	31.30%
1997	695,448	66,448	270,190	67.38%	32.62%
1998	646,837	112,759	248,189	64.18%	35.82%
1999	804,086	133,651	302,459	64.84%	35.16%
2000	1,251,888	230,064	366,471	67.73%	32.27%
2001	1,515,535	222,690	362,718	72.14%	27.86%
2002	1,228,928	159,450	294,094	73.04%	26.96%
2003	686,586	187,733	258,957	60.58%	39.42%
2004	1,001,297	238,594	342,138	63.29%	36.71%
2005	1,009,300	251,560	281,059	65.46%	34.54%
2006	774,394	348,126	362,476	52.15%	47.85%



3.2 Vermilion Snapper Commercial Landings for 225 and Unlimited Permits

Table 2. Landings of vermilion snapper associated with 225 and unlimited permits.

Year	225 Permit	Unlimited Permit
1999	873	816,036
2000	1,510	1,240,938
2001	1,841	1,486,063
2002	802	1,180,863
2003	1,803	692,681
2004	980	958,730
2005	1,333	1,047,705

3.3 Vermilion Snapper Landings by State

3.3.1 Commercial

Table 3. Commercial landings by state for 1999-2005

State	99-05	Avg ww	Avg GW	Percent
FL	1,083,370	154,767	139,430	13.02%
Georgia	1,240,389	177,198	159,638	14.90%
NC	2,895,712	413,673	372,679	34.79%
SC	3,102,888	443,270	399,342	37.28%

3.3.2 Headboat

Table 4. Headboat landings by state for 1999-2005

State	99-05	avg ww	avg gw	percent
GA AND NORTH FL	412,957	58,994	53,148	16.85%
NORTH CAROLINA	649,665	92,809	83,612	26.51%
SOUTH CAROLINA	1,215,785	173,684	156,472	49.61%
SOUTH FLORIDA	172,358	24,623	22,183	7.03%

3.3.3 MRFSS

Table 5. MRFSS landings by state for 1999-2005.

MRFSS	99-05	avg ww	avg gw	percent
FL	860,636	122,948	110,764	54.40%
GA	149,079	21,297	19,186	9.42%
SC	361,455	51,636	46,519	22.85%
NC	210,800	30,114	27,130	13.33%

Table 6. MRFSS landings (A+B1) in number by state for 1999-2005.

MRFSS	99-05	avg	percent
FL	828,441	118,349	59.45%
GA	133,826	19,118	2.40%
SC	280,320	40,046	4.70%
NC	150,916	21,559	28.26%

Table 7. MRFSS landings (B2) in number by state for 1999-2005.

MRFSS	99-05	avg	percent
FL	769,816	109,974	55.24%
GA	65,170	9,310	2.40%
SC	208,051	29,722	4.70%
NC	96,945	13,849	28.26%

3.4 Vermilion Snapper Landings by Month and State

3.4.1 Commercial

Table 8. Average vermilion snapper commercial landings 1999-2005 (lbs gutted weight) by state and month. Includes Monroe County.

Month	Total	FL	GA	SC	NC
1	57,040	9,446	8,767	21,497	17,330
2	50,318	7,464	8,662	19,737	14,455
3	80,618	13,526	14,239	35,208	17,646
4	87,076	11,101	13,444	40,222	22,309
5	87,454	11,293	10,876	28,858	36,426
6	99,185	13,296	16,373	33,142	36,374
7	82,181	12,633	12,806	27,212	29,530
8	108,711	12,392	14,375	36,165	45,780
9	110,836	12,275	16,186	41,037	41,338
10	124,303	14,782	19,033	45,573	44,915
11	113,050	12,872	13,585	42,397	44,196
12	70,317	8,350	11,293	28,295	22,379

Table 9. Average vermilion snapper commercial landings 1999-2005 (percentage) by state and month. Includes Monroe County.

Month	Total	FL	GA	SC	NC
1	5.33%	6.77%	5.49%	5.38%	4.65%
2	4.70%	5.35%	5.43%	4.94%	3.88%
3	7.53%	9.70%	8.92%	8.82%	4.73%
4	8.13%	7.96%	8.42%	10.07%	5.99%
5	8.16%	8.10%	6.81%	7.23%	9.77%
6	9.26%	9.54%	10.26%	8.30%	9.76%
7	7.67%	9.06%	8.02%	6.81%	7.92%
8	10.15%	8.89%	9.00%	9.06%	12.28%
9	10.35%	8.80%	10.14%	10.28%	11.09%
10	11.61%	10.60%	11.92%	11.41%	12.05%
11	10.55%	9.23%	8.51%	10.62%	11.86%
12	6.57%	5.99%	7.07%	7.09%	6.00%

3.4.2 Headboat

Table 10. Average vermilion snapper headboat landings 1999-2005 (lbs gutted weight) by state and month.

Month	Total	South FL	GA - NFL	SC	NC
1	7,639	3,960	2,176	1,281	222
2	8,848	4,706	2,316	1,450	375
3	22,388	12,421	2,471	4,589	2,907
4	49,652	28,560	1,157	6,233	13,702
5	80,406	46,192	915	7,886	25,414
6	89,502	50,930	1,009	7,495	30,068
7	97,877	54,755	3,678	8,221	31,223
8	70,780	40,830	3,272	5,557	21,122
9	44,048	25,958	1,060	2,908	14,123
10	43,864	28,349	856	2,880	11,779
11	24,781	14,762	1,701	3,072	5,246
12	7,441	3,999	1,574	1,576	291

Table 11. Average vermilion snapper headboat landings 1999-2005 (percentage) by state and month.

Month	Total	FL	GA	SC	NC
1	1.40%	1.26%	9.81%	2.41%	0.14%
2	1.62%	1.49%	10.44%	2.73%	0.24%
3	4.09%	3.94%	11.14%	8.63%	1.86%
4	9.07%	9.05%	5.22%	11.73%	8.76%
5	14.69%	14.64%	4.12%	14.84%	16.24%
6	16.36%	16.15%	4.55%	14.10%	19.22%
7	17.89%	17.36%	16.58%	15.47%	19.95%
8	12.93%	12.94%	14.75%	10.46%	13.50%
9	8.05%	8.23%	4.78%	5.47%	9.03%
10	8.02%	8.99%	3.86%	5.42%	7.53%
11	4.53%	4.68%	7.67%	5.78%	3.35%
12	1.36%	1.27%	7.10%	2.97%	0.19%

3.4.3 MRFSS

Table 12. Average vermilion snapper MRFSS landings 1999-2005 (lbs gutted weight) by state and month.

Wave	Total	FL	GA	SC	NC
1	23,776	23,776	0	0	0
2	30,986	20,675	2,716	6,661	934
3	46,351	16,730	6,139	17,695	5,788
4	43,963	25,690	3,384	7,072	7,816
5	41,963	13,403	6,332	14,473	7,755
6	16,559	10,488	616	618	4,837

Table 13. Average vermilion snapper MRFSS landings 1999-2005 (percent lbs gutted weight) by state and month.

Wave	Total	FL	GA	SC	NC
1	11.68%	21.47%	0.00%	0.00%	0.00%
2	15.22%	18.67%	14.15%	14.32%	3.44%
3	22.77%	15.10%	32.00%	38.04%	21.33%
4	21.59%	23.19%	17.64%	15.20%	28.81%
5	20.61%	12.10%	33.00%	31.11%	28.59%
6	8.13%	9.47%	3.21%	1.33%	17.83%

Table 14. Average vermilion snapper MRFSS landings 1999-2005 (A+B1 Number) by state and month.

Wave	Total	FL	GA	SC	NC
1	25,014	25,014	0	0	0
2	28,718	20,116	2,311	5,429	862
3	37,110	15,271	5,416	11,711	4,713
4	38,269	23,059	3,081	6,164	5,965
5	35,966	12,877	5,733	12,001	5,355
6	14,472	10,284	682	771	2,734

Table 15. Average vermilion snapper MRFSS landings 1999-2005 (A+B1 Number, percent) by state and month.

Wave	Total	FL	GA	SC	NC
1	13.93%	23.46%	0.00%	0.00%	0.00%
2	15.99%	18.87%	13.42%	15.05%	4.39%
3	20.67%	14.32%	31.44%	32.46%	24.01%
4	21.31%	21.63%	17.89%	17.09%	30.39%
5	20.03%	12.08%	33.29%	33.27%	27.28%
6	8.06%	9.65%	3.96%	2.14%	13.93%

Table 16. Average vermilion snapper MRFSS landings 1999-2005 (B2 Number) by state and month.

Wave	Total	FL	GA	SC	NC
1	12,332	12,332	0	0	0
2	35,099	27,053	1,190	4,059	2,797
3	27,070	10,869	1,952	9,310	4,938
4	39,322	27,893	2,366	6,599	2,464
5	19,435	8,083	2,701	6,429	2,222
6	13,459	12,847	177	379	56

Table 17. Average vermilion snapper MRFSS landings 1999-2005 (B2 Number, percent) by state and month.

Wave	Total	FL	GA	SC	NC
1	8.41%	12.45%	0.00%	0.00%	0.00%
2	23.92%	27.31%	14.19%	15.16%	22.42%
3	18.45%	10.97%	23.28%	34.77%	39.58%
4	26.80%	28.15%	28.21%	24.64%	19.75%
5	13.25%	8.16%	32.21%	24.01%	17.81%
6	9.17%	12.97%	2.11%	1.42%	0.45%

Table 18. Harvested (A+B1) and discards (B2) catch of vermilion snapper for Waves 1-5 during 2005 and 2006.

	2006		
	A+B1	B2	%B2s
Wave 1	8,610	47	0.54%
Wave 2	32,271	53,517	62.38%
Wave 3	47,847	8,482	15.06%
Wave 4	107,442	15,258	12.44%
Wave 5	35,274	21,610	37.99%
Total	231,444	98,914	29.94%
	2007		
	A+B1	B2	%B2s
Wave 1	23,819	7,627	24.25%
Wave 2	33,187	13,543	28.98%
Wave 3	75,918	80,154	51.36%
Wave 4	103,079	99,631	49.15%
Wave 5	43,096	66,212	60.57%
Total	279,099	267,167	48.91%

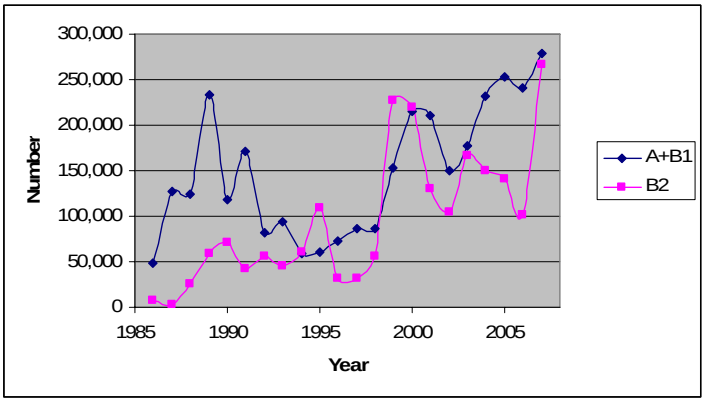


Figure 4-x. Annual number of vermilion snapper harvested (A+B1) and discarded (B2) during 1986 – 2007. Data for 2007 do not include Wave 6 (November – December) numbers.

3.5 Vermilion Snapper Commercial Percentage

Table 19. Vermilion Snapper % Commercial. Source ALS 1986-2006. Includes Monroe County.

% comm..

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1986	69.36%	59.45%	60.50%	63.77%	65.84%	65.99%	66.08%	66.61%	67.27%	67.97%	68.02%	67.98%	67.74%	67.53%	67.55%	68.00%	68.37%	68.01%	67.69%	67.58%	66.97%
1987		50.73%	56.78%	62.27%	65.18%	65.51%	65.67%	66.31%	67.07%	67.84%	67.91%	67.87%	67.62%	67.41%	67.44%	67.93%	68.32%	67.94%	67.62%	67.51%	66.88%
1988			62.30%	67.29%	69.12%	68.33%	68.13%	68.53%	69.11%	69.76%	69.67%	69.48%	69.10%	68.75%	68.63%	69.02%	69.35%	68.89%	68.49%	68.32%	67.62%
1989				71.86%	72.04%	69.92%	69.41%	69.69%	70.19%	70.80%	70.60%	70.31%	69.82%	69.37%	69.17%	69.52%	69.83%	69.32%	68.86%	68.66%	67.90%
1990					72.21%	69.13%	68.64%	69.13%	69.84%	70.61%	70.40%	70.09%	69.55%	69.07%	68.90%	69.32%	69.67%	69.13%	68.65%	68.45%	67.66%
1991						66.49%	66.63%	67.88%	69.10%	70.20%	69.99%	69.67%	69.08%	68.59%	68.46%	68.99%	69.41%	68.83%	68.34%	68.15%	67.32%
1992							66.89%	69.14%	70.61%	71.79%	71.22%	70.61%	69.75%	69.05%	68.82%	69.37%	69.80%	69.12%	68.55%	68.32%	67.40%
1993								71.16%	72.23%	73.22%	72.20%	71.29%	70.19%	69.33%	69.02%	69.58%	70.02%	69.28%	68.65%	68.40%	67.42%
1994									73.21%	74.19%	72.54%	71.32%	69.99%	69.02%	68.74%	69.41%	69.91%	69.12%	68.47%	68.22%	67.19%
1995										75.21%	72.17%	70.61%	69.06%	68.10%	68.00%	68.93%	69.56%	68.72%	68.06%	67.83%	66.76%
1996											68.70%	68.03%	66.75%	66.20%	66.66%	68.06%	68.90%	68.05%	67.41%	67.23%	66.14%
1997												67.38%	65.80%	65.44%	66.26%	67.97%	68.93%	67.99%	67.30%	67.12%	65.97%
1998													64.18%	64.54%	65.98%	68.07%	69.13%	68.05%	67.29%	67.10%	65.86%
1999														64.84%	66.57%	68.82%	69.85%	68.54%	67.62%	67.36%	65.99%
2000															67.73%	70.07%	70.96%	69.22%	68.03%	67.68%	66.12%
2001																72.14%	72.54%	69.78%	68.11%	67.66%	65.81%
2002																	73.04%	68.03%	66.19%	66.08%	63.99%
2003																		60.58%	61.96%	63.33%	61.30%
2004																			62.95%	64.33%	61.47%
2005																				65.76%	60.67%
2006																					55.05%

3.6 Vermilion Snapper Recreational Percentage

Table 20. Vermilion Snapper % Recreational. Source MRFSS Web site, NMFS Headboat survey.

% rec

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1986	30.64%	40.55%	39.50%	36.23%	34.16%	34.01%	33.92%	33.39%	32.73%	32.03%	31.98%	32.02%	32.26%	32.47%	32.45%	32.00%	31.63%	31.99%	32.31%	32.42%	33.03%
1987		49.27%	43.22%	37.73%	34.82%	34.49%	34.33%	33.69%	32.93%	32.16%	32.09%	32.13%	32.38%	32.59%	32.56%	32.07%	31.68%	32.06%	32.38%	32.49%	33.12%
1988			37.70%	32.71%	30.88%	31.67%	31.87%	31.47%	30.89%	30.24%	30.33%	30.52%	30.90%	31.25%	31.37%	30.98%	30.65%	31.11%	31.51%	31.68%	32.38%
1989				28.14%	27.96%	30.08%	30.59%	30.31%	29.81%	29.20%	29.40%	29.69%	30.18%	30.63%	30.83%	30.48%	30.17%	30.68%	31.14%	31.34%	32.10%
1990					27.79%	30.87%	31.36%	30.87%	30.16%	29.39%	29.60%	29.91%	30.45%	30.93%	31.10%	30.68%	30.33%	30.87%	31.35%	31.55%	32.34%
1991						33.51%	33.37%	32.12%	30.90%	29.80%	30.01%	30.33%	30.92%	31.41%	31.54%	31.01%	30.59%	31.17%	31.66%	31.85%	32.68%
1992							33.11%	30.86%	29.39%	28.21%	28.78%	29.39%	30.25%	30.95%	31.18%	30.63%	30.20%	30.88%	31.45%	31.68%	32.60%
1993								28.84%	27.77%	26.78%	27.80%	28.71%	29.81%	30.67%	30.98%	30.42%	29.98%	30.72%	31.35%	31.60%	32.58%
1994									26.79%	25.81%	27.46%	28.68%	30.01%	30.98%	31.26%	30.59%	30.09%	30.88%	31.53%	31.78%	32.81%
1995										24.79%	27.83%	29.39%	30.94%	31.90%	32.00%	31.07%	30.44%	31.28%	31.94%	32.17%	33.24%
1996											31.30%	31.97%	33.25%	33.80%	33.34%	31.94%	31.10%	31.95%	32.59%	32.77%	33.86%
1997												32.62%	34.20%	34.56%	33.74%	32.03%	31.07%	32.01%	32.70%	32.88%	34.03%
1998													35.82%	35.46%	34.02%	31.93%	30.87%	31.95%	32.71%	32.90%	34.14%
1999														35.16%	33.43%	31.18%	30.15%	31.46%	32.38%	32.64%	34.01%
2000															32.27%	29.93%	29.04%	30.78%	31.97%	32.32%	33.88%
2001																27.86%	27.46%	30.22%	31.89%	32.34%	34.19%
2002																	26.96%	31.97%	33.81%	33.92%	36.01%
2003																		39.42%	38.04%	36.67%	38.70%
2004																			37.05%	35.67%	38.53%
2005																				34.24%	39.33%
2006																					44.95%

3.7 Allocations and quota

Using the landings data (in pounds gutted weight) and the allocation the two time period shown below results in the commercial quotas and recreational allocations shown in Table 21:

Years 1986-2005 = 68% commercial & 32% recreational

Table 21. Commercial and recreational portions of the catch (pounds gutted weight) associated with allocations suggested by Council thus far.

Vermilion Snapper		**Allocation Alternative 2. 68%C/32%R**	
	Annual	**Commercial**	**Recreational**
Year	**Catch Limit** (gutted weight)	**Portion** (gutted weight)	**Portion** (gutted weight)
2008	566,179	385,002	181,177

4 Monthly catch and reduction provided by seasonal closure

4.1 Commercial

Table 22. Monthly catch (pounds gutted weight) of vermilion snapper during 1999-2005 (average), 2001, 2005, and 2006. Data are from ALS.

Month	1999-2005	2001	2005	2006
1	57,040	55,877	86,821	78,217
2	50,318	79,474	58,870	53,036
3	80,618	90,728	70,088	63,142
4	87,076	120,240	51,378	46,286
5	87,454	145,416	110,082	99,173
6	99,185	168,710	109,706	98,834
7	82,181	119,121	88,940	80,126
8	108,711	149,402	98,886	89,086
9	110,836	213,295	124,441	112,109
10	124,303	139,759	91,086	82,059
11	113,050	127,552	89,984	81,067
12	70,317	105,962	29,016	26,141
Total	1,071,089	1,515,535	1,009,300	911,283

To determine the effectiveness of a commercial seasonal closure five steps were taken. First, NMFS logbook data were examined to determine the most commonly taken species on trips with vermilion snapper. Second, trips were identified that caught at least 100 pounds of the most common species taken. Third, landings of vermilion snapper on trips identified in step 2 that targeted co-occurring species were determined. This would be considered to be incidental catch of vermilion snapper. Fourth, dead discards of vermilion snapper incidental catch was determined by applying a release mortality rate of 40% (SEDAR Update# 3 2007). Fifth, effectiveness of closure was determined by comparing the magnitude of dead discards to actual landings.

Based on an examination of the NMFS logbook data, the species most commonly taken on commercial trips with vermilion snapper during 2003-2005 were gag, scamp, gray triggerfish, greater amberjack, red grouper, almaco jack, red snapper, or black sea bass. If fishermen were to target these species during a closure and release mortality of vermilion snapper is 40% (SEDAR Update# 3 2007), it is anticipated that a closure would be 67% effective. Tables 13 and 14 provide reduction from a seasonal closure considering 100% and 67% effectiveness of closure.

Table 23. Monthly reduction in take based on 1999-2005 data if a seasonal closure is 100% effective.

Month	1	2	3	4	5	6	7	8	9	10	11	12
1	5.3%	10.0%	17.5%	25.7%	33.8%	43.1%	50.8%	60.9%	71.3%	82.9%	93.4%	100.0%
2		4.7%	12.2%	20.4%	28.5%	37.8%	45.5%	55.6%	65.9%	77.6%	88.1%	94.7%
3			7.5%	15.7%	23.8%	33.1%	40.8%	50.9%	61.3%	72.9%	83.4%	90.0%
4				8.1%	16.3%	25.6%	33.2%	43.4%	53.7%	65.3%	75.9%	82.5%
5					8.2%	17.4%	25.1%	35.2%	45.6%	57.2%	67.8%	74.3%
6						9.3%	16.9%	27.1%	37.4%	49.0%	59.6%	66.2%
7							7.7%	17.8%	28.2%	39.8%	50.3%	56.9%
8								10.1%	20.5%	32.1%	42.7%	49.2%
9									10.3%	22.0%	32.5%	39.1%
10										11.6%	22.2%	28.7%
11											10.6%	17.1%
12												6.6%

Table 24. Monthly reduction in take based on 1999-2005 data if seasonal closure is 93% effective

Month	1	2	3	4	5	6	7	8	9	10	11	12
1	5.0%	9.3%	16.3%	23.9%	31.5%	40.1%	47.2%	56.7%	66.3%	77.1%	86.9%	93.0%
2		4.4%	11.4%	18.9%	26.5%	35.1%	42.3%	51.7%	61.3%	72.1%	81.9%	88.0%
3			7.0%	14.6%	22.2%	30.8%	37.9%	47.3%	57.0%	67.8%	77.6%	83.7%
4				7.6%	15.2%	23.8%	30.9%	40.3%	50.0%	60.8%	70.6%	76.7%
5					7.6%	16.2%	23.3%	32.8%	42.4%	53.2%	63.0%	69.1%
6						8.6%	15.7%	25.2%	34.8%	45.6%	55.4%	61.5%
7							7.1%	16.6%	26.2%	37.0%	46.8%	52.9%
8								9.4%	19.1%	29.9%	39.7%	45.8%
9									9.6%	20.4%	30.2%	36.3%
10										10.8%	20.6%	26.7%
11											9.8%	15.9%
12												6.1%

Peak spawning is during June-August. A spawning season closure would provide a reduction of 27% if closure was 100% effective and 25% reduction if closure was 93% effective.

4.2 Recreational

Table 25. Average landings (pounds gutted weight) of vermilion snapper taken by headboat and MRFSS during 1999-2005.

Month	Headboat	MRFSS	Rec ww	Rec gw
1	4,396	13,196	17,592	15,848
2	5,224	13,196	18,420	16,594
3	13,787	10,939	24,726	22,276
4	31,702	10,939	42,641	38,415
5	51,272	25,725	76,997	69,367
6	56,532	25,725	82,257	74,105
7	60,777	24,264	85,041	76,614
8	45,320	24,264	69,584	62,688
9	28,812	23,425	52,238	47,061
10	31,466	23,425	54,891	49,451
11	16,384	7,412	23,797	21,438
12	4,437	7,412	11,850	10,675
			560,033	504,534

To determine the effectiveness of a recreational seasonal closure seven steps were taken. First, MRFSS data were examined to determine the most commonly species taken on trips with vermilion snapper during the proposed September through October closure. Second, trips were identified that caught at least 1 individual of the most common species taken identified in step 1. Third, landings of vermilion snapper on trips identified in step 2 that targeted co-occurring species were determined. This would be considered to be incidental catch of vermilion snapper. Fourth, incidental catch was compared to actual catch to determine percentage that would still be caught during a closed season. Fifth, the portion of the vermilion snapper incidental catch that would die when no retention was allowed was determined by applying a release mortality rate of 25% (SEDAR 2 2003). Sixth, the magnitude of incidental catch was estimated if the number of trips was reduced and if fishermen were able to avoid vermilion snapper. Seven, determine effectiveness of closure by comparing the magnitude of dead discards to actual landings if a closure did not occur.

Table 26. Most common species taken on MRFSS trips during September – October that also caught vermilion snapper. Landings are totals in number (A + B1) for 1999-2005. Represents sample not total expanded landings.

common	Obs	Mean	Sum	Percent	Cum %
vermilion snapper	309	6.177994	1909	35.16%	35.16%
white grunt	84	8.75	735	13.54%	48.70%
black sea bass	137	4.817518	660	12.16%	60.86%
gray triggerfish	88	2.943182	259	4.77%	65.63%
red porgy	78	3.307692	258	4.75%	70.38%
dolphin	25	5.16	129	2.38%	72.76%
snowy grouper	6	20.66667	124	2.28%	75.04%
king mackerel	49	2.489796	122	2.25%	77.29%
red snapper	71	1.605634	114	2.10%	79.39%

scamp	39	2.641026	103	1.90%	81.29%

Table 27. Incidental catch of vermilion snapper during a seasonal closure (Average 1999-2005). Dead discards determined by applying 25% release mortality rate. Assumes some trips will not be made during a seasonal closure.

Trip reduction	0%	20%	40%	60%
Incidental catch	1,557	1,173	1,082	832
Dead Discards	389	293	271	208
Effectiveness	79.61%	84.64%	85.83%	89.10%

Table 28. Incidental catch of vermilion snapper assuming a range in trips (0 to 60%) during a seasonal closure and fishermen can avoid vermilion snapper (range 0 to 60%) by changing fishing methods.

Trip reduction after quota	0%				20%				40%				60%			
Percent of discards avoided	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%
Discards	1,557	1,246	747	299	1,173	938	563	225	1,082	866	519	208	832	666	399	160
Dead Discards	389	311	187	75	293	235	141	56	271	216	130	52	208	166	100	40
Effectiveness	79.61%	83.69%	90.21%	96.09%	84.64%	87.71%	92.63%	97.05%	85.83%	88.66%	93.20%	97.28%	89.10%	91.28%	94.77%	97.91%

Examination of the MRFSS database indicated the species most commonly taken on recreational trips (MRFSS) during September – October with vermilion snapper during 1999-2005 were white grunt, black sea bass, gray triggerfish, and red porgy. If fishermen were to target these species during a closure and release mortality of vermilion snapper is 25% (SEDAR 2 2003), it is anticipated that a closure would be 80% effective if effort remained the same and fishermen were unable to avoid vermilion snapper. If 20% of the trips are not taken and fishermen can avoid 20% of vermilion snapper by changing fishing methods and locations then the effectiveness would be 88%.

Table 29. Most common species taken on Headboat trips during September - October that also caught vermilion snapper. Landings are for 1999-2005. Represents sample not total expanded landings.

species	specname	N	Mean	Sum
10	vermilion snapper	1994	166.5642	332129
33	black sea bass	2575	40.11456	103295
50	white grunt	1653	47.18935	78004
77	gray triggerfish	1940	29.10876	56471
51	tomtate	923	51.31203	47361
15	yellowtail snapper	1149	30.43603	34971
4	spottail pinfish	489	46.2229	22603
1	red porgy	809	24.57602	19882

Table 30. Incidental catch of vermilion snapper during a seasonal closure (Average 1999-2005). Dead discards determined by applying 25% release mortality rate. Assumes some trips will not be made during a seasonal closure.

Trip reduction	0%	20%	40%	60%
Incidental catch	323,149	189,241	148,112	99,580
Dead Discards	80,787	47,310	37,028	24,895
Effectiveness	75.68%	85.76%	88.85%	92.50%

Table 31. Incidental catch of gag on headboat trips assuming a range in trips (0 to 60%) during a seasonal closure and fishermen can avoid vermilion snapper (range 0 to 60%) by changing fishing methods.

Trip reduction after quota	0%				20%				40%				60%			
Percent of discards avoided	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%
Discards	323,149	258,519	155,112	62,045	189,241	151,393	90,836	36,334	148,112	118,490	71,094	28,438	99,580	79,664	47,798	19,119
Dead Discards	80,787	64,630	38,778	15,511	47,310	37,848	22,709	9,084	37,028	29,622	17,773	7,109	24,895	19,916	11,950	4,780
Effectiveness	75.68%	80.54%	88.32%	95.33%	85.76%	88.60%	93.16%	97.27%	88.85%	91.08%	94.65%	97.86%	92.50%	94.00%	96.40%	98.56%

Examination of the Headboat database indicated the species most commonly taken on recreational trips during September - April with vermilion snapper during 1999-2005 were black sea bass, white grunt, gray triggerfish, and tomtate. If fishermen were to target these species during a closure and release mortality of vermilion snapper is 25% (SEDAR 2 2003), it is anticipated that a closure would be 76% effective if effort remained the same and fishermen were unable to avoid gag. If 20% of the trips are not taken and fishermen can avoid 20% of gag by changing fishing methods and locations then the effectiveness would be 89%.

4.2.1 Headboat

Table 32. Average landings (pounds gutted weight) of vermilion snapper taken by headboat during 1999-2005.

Month	Lbs gw	Percent
1	3,960	1.3%
2	4,706	1.5%
3	12,421	3.9%
4	28,560	9.1%
5	46,191	14.6%
6	50,929	16.1%
7	54,754	17.4%
8	40,829	12.9%
9	25,957	8.2%
10	28,347	9.0%
11	14,761	4.7%
12	3,998	1.3%
Total	315,414	

Table 32. Monthly reduction in Headboat take based on 1999-2005 data if a seasonal closure is 100% effective.

Month	1	2	3	4	5	6	7	8	9	10	11	12
1	1.3%	2.7%	6.7%	15.7%	30.4%	46.5%	63.9%	76.8%	85.1%	94.1%	98.7%	100.0%
2		1.5%	5.4%	14.5%	29.1%	45.3%	62.6%	75.6%	83.8%	92.8%	97.5%	98.7%
3			3.9%	13.0%	27.6%	43.8%	61.1%	74.1%	82.3%	91.3%	96.0%	97.3%
4				9.1%	23.7%	39.8%	57.2%	70.2%	78.4%	87.4%	92.0%	93.3%
5					14.6%	30.8%	48.2%	61.1%	69.3%	78.3%	83.0%	84.3%
6						16.1%	33.5%	46.5%	54.7%	63.7%	68.3%	69.6%
7							17.4%	30.3%	38.5%	47.5%	52.2%	53.5%
8								12.9%	21.2%	30.2%	34.8%	36.1%
9									8.2%	17.2%	21.9%	23.2%
10										9.0%	13.7%	14.9%
11											4.7%	5.9%
12												1.3%

Table 34. Monthly reduction in Headboat take based on 1999-2005 data if a seasonal closure is 89% effective.

Month	1	2	3	4	5	6	7	8	9	10	11	12
1	1.1%	2.4%	6.0%	14.0%	27.0%	41.4%	56.9%	68.4%	75.7%	83.7%	87.9%	89.0%
2		1.3%	4.8%	12.9%	25.9%	40.3%	55.7%	67.3%	74.6%	82.6%	86.8%	87.9%
3			3.5%	11.6%	24.6%	39.0%	54.4%	65.9%	73.3%	81.3%	85.4%	86.6%
4				8.1%	21.1%	35.5%	50.9%	62.4%	69.8%	77.8%	81.9%	83.0%
5					13.0%	27.4%	42.9%	54.4%	61.7%	69.7%	73.9%	75.0%
6						14.4%	29.8%	41.3%	48.7%	56.7%	60.8%	62.0%
7							15.5%	27.0%	34.3%	42.3%	46.5%	47.6%
8								11.5%	18.8%	26.8%	31.0%	32.1%
9									7.3%	15.3%	19.5%	20.6%
10										8.0%	12.2%	13.3%
11											4.2%	5.3%
12												1.1%

4.2.2 MRFSS All Modes

Table 35. Average landings (pounds gutted weight) of vermilion snapper taken by MRFSS (all modes) during 1999-2005.

Month	Lbs gw	Percent
1	11,888	5.8%
2	11,888	5.8%
3	15,493	7.6%
4	15,493	7.6%
5	23,176	11.4%
6	23,176	11.4%
7	21,860	10.7%
8	21,860	10.7%
9	21,104	10.4%
10	21,104	10.4%
11	8,279	4.1%
12	8,279	4.1%
Total	203,599	

Table 36. Monthly reduction in MRFSS (all modes) take based on 1999-2005 data if a seasonal closure is 100% effective.

Month	1	2	3	4	5	6	7	8	9	10	11	12
1	5.8%	11.7%	19.3%	26.9%	38.3%	49.7%	60.4%	71.1%	81.5%	91.9%	95.9%	100.0%
2		5.8%	13.4%	21.1%	32.4%	43.8%	54.6%	65.3%	75.7%	86.0%	90.1%	94.2%
3			7.6%	15.2%	26.6%	38.0%	48.7%	59.5%	69.8%	80.2%	84.3%	88.3%
4				7.6%	19.0%	30.4%	41.1%	51.8%	62.2%	72.6%	76.6%	80.7%
5					11.4%	22.8%	33.5%	44.2%	54.6%	65.0%	69.0%	73.1%
6						11.4%	22.1%	32.9%	43.2%	53.6%	57.7%	61.7%
7							10.7%	21.5%	31.8%	42.2%	46.3%	50.3%
8								10.7%	21.1%	31.5%	35.5%	39.6%
9									10.4%	20.7%	24.8%	28.9%
10										10.4%	14.4%	18.5%
11											4.1%	8.1%
12												4.1%

Table 37. Monthly reduction in MRFSS (all modes) take based on 1999-2005 data if a seasonal closure is 89% effective.

Month	1	2	3	4	5	6	7	8	9	10	11	12
1	5.2%	10.4%	17.2%	23.9%	34.1%	44.2%	53.8%	63.3%	72.5%	81.8%	85.4%	89.0%
2		5.2%	12.0%	18.7%	28.9%	39.0%	48.6%	58.1%	67.3%	76.6%	80.2%	83.8%
3			6.8%	13.5%	23.7%	33.8%	43.4%	52.9%	62.1%	71.4%	75.0%	78.6%
4				6.8%	16.9%	27.0%	36.6%	46.1%	55.4%	64.6%	68.2%	71.8%
5					10.1%	20.3%	29.8%	39.4%	48.6%	57.8%	61.4%	65.1%
6						10.1%	19.7%	29.2%	38.5%	47.7%	51.3%	54.9%
7							9.6%	19.1%	28.3%	37.6%	41.2%	44.8%
8								9.6%	18.8%	28.0%	31.6%	35.2%
9									9.2%	18.5%	22.1%	25.7%
10										9.2%	12.8%	16.5%
11											3.6%	7.2%
12												3.6%

4.2.3 MRFSS/Headboat Combined

Table 38. Average landings (pounds gutted weight) of vermilion snapper taken by MRFSS/Headboat during 1999-2005.

Month	Lbs gw	Percent
1	15,848	3.1%
2	16,594	3.2%
3	27,914	5.4%
4	44,053	8.5%
5	69,367	13.4%
6	74,105	14.3%
7	76,614	14.8%
8	62,688	12.1%
9	47,061	9.1%
10	49,451	9.5%
11	23,040	4.4%
12	12,277	2.4%
Total	519,013	

Table 39. Monthly reduction in MRFSS/Headboat take based on 1999-2005 data if a seasonal closure is 100% effective.

Month	1	2	3	4	5	6	7	8	9	10	11	12
1	3.1%	6.3%	11.6%	20.1%	33.5%	47.8%	62.5%	74.6%	83.7%	93.2%	97.6%	100.0%
2		3.2%	8.6%	17.1%	30.4%	44.7%	59.5%	71.5%	80.6%	90.1%	94.6%	96.9%
3			5.4%	13.9%	27.2%	41.5%	56.3%	68.3%	77.4%	86.9%	91.4%	93.7%
4				8.5%	21.9%	36.1%	50.9%	63.0%	72.0%	81.6%	86.0%	88.4%
5					13.4%	27.6%	42.4%	54.5%	63.6%	73.1%	77.5%	79.9%
6						14.3%	29.0%	41.1%	50.2%	59.7%	64.2%	66.5%
7							14.8%	26.8%	35.9%	45.4%	49.9%	52.2%
8								12.1%	21.1%	30.7%	35.1%	37.5%
9									9.1%	18.6%	23.0%	25.4%
10										9.5%	14.0%	16.3%
11											4.4%	6.8%
12												2.4%

Table 40. Monthly reduction in MRFSS/Headboat take based on 1999-2005 data if a seasonal closure is 89% effective.

Month	1	2	3	4	5	6	7	8	9	10	11	12
1	2.7%	5.6%	10.3%	17.9%	29.8%	42.5%	55.6%	66.4%	74.5%	82.9%	86.9%	89.0%
2		2.8%	7.6%	15.2%	27.1%	39.8%	52.9%	63.7%	71.7%	80.2%	84.2%	86.3%
3			4.8%	12.3%	24.2%	36.9%	50.1%	60.8%	68.9%	77.4%	81.3%	83.4%
4				7.6%	19.4%	32.2%	45.3%	56.0%	64.1%	72.6%	76.5%	78.7%
5					11.9%	24.6%	37.7%	48.5%	56.6%	65.0%	69.0%	71.1%
6						12.7%	25.8%	36.6%	44.7%	53.1%	57.1%	59.2%
7							13.1%	23.9%	32.0%	40.4%	44.4%	46.5%
8								10.7%	18.8%	27.3%	31.3%	33.4%
9									8.1%	16.5%	20.5%	22.6%

10										8.5%	12.4%	14.5%
11											4.0%	6.1%
12												2.1%

5 Commercial Trip Limit Analysis

5.1 Trip limit Analysis, All Snapper Grouper Permits

Table 41. Trip limit analysis (all snapper grouper permits) for data from 1999-2005.

Trip Limit (pounds gutted weight)	Avg 1999-2005				
	Avg no. trips	Avg pounds gw over limit	Expected catch	% trips over limit	% reduction in catch from limit
0	2,593	1,061,737	0	100.0	100.0
225	1,132	710,176	351,561	43.7	66.9
270	1,034	661,394	400,343	39.9	62.3
450	751	502,465	559,272	29.0	47.3
541	640	439,923	621,814	24.7	41.4
631	550	386,363	675,373	21.2	36.4
721	471	340,450	721,287	18.2	32.1
811	408	301,002	760,735	15.7	28.3
901	355	266,784	794,953	13.7	25.1
991	312	236,900	824,837	12.0	22.3
1,081	270	210,659	851,078	10.4	19.8
1,171	239	187,723	874,014	9.2	17.7
1,261	213	167,413	894,324	8.2	15.8
1,351	188	149,290	912,447	7.3	14.1
1,441	166	133,302	928,435	6.4	12.6
1,532	149	119,127	942,610	5.7	11.2
1,622	133	106,443	955,294	5.1	10.0
1,712	116	95,256	966,481	4.5	9.0
1,802	103	85,451	976,286	4.0	8.0
2,027	76	65,433	996,304	2.9	6.2
2,252	58	50,379	1,011,358	2.2	4.7
2,477	43	38,998	1,022,739	1.7	3.7
2,703	33	30,540	1,031,197	1.3	2.9
2,928	25	24,092	1,037,645	0.9	2.3
3,153	19	19,167	1,042,570	0.7	1.8
3,378	15	15,322	1,046,415	0.6	1.4
3,604	11	12,468	1,049,269	0.4	1.2
3,829	9	10,255	1,051,482	0.3	1.0
4,054	6	8,617	1,053,120	0.2	0.8
4,279	4	7,393	1,054,344	0.2	0.7
4,505	4	6,482	1,055,255	0.1	0.6
4,730	3	5,691	1,056,046	0.1	0.5
4,955	2	5,118	1,056,619	0.1	0.5
5,180	2	4,623	1,057,114	0.1	0.4
5,405	2	4,205	1,057,532	0.1	0.4

Table 42. Trip limit analysis (all snapper grouper permits) for data from three time periods.

Trip Limit (pounds gutted weight)	1999-2005	2001	2006
	% reduction in catch	% reduction in catch	% reduction in catch
0	100.0	100.0	100.0
225	66.9	70.1	65.2
270	62.3	65.7	60.6
450	47.3	51.4	45.9
541	41.4	45.5	40.3
631	36.4	40.5	35.4
721	32.1	36.1	31.3
811	28.3	32.3	27.9
901	25.1	28.9	25.0
991	22.3	25.9	22.4
1,081	19.8	23.2	20.0
1,171	17.7	20.9	18.0
1,261	15.8	18.8	16.1
1,351	14.1	16.9	14.4
1,441	12.6	15.2	13.0
1,532	11.2	13.7	11.7
1,622	10.0	12.2	10.5
1,712	9.0	11.0	9.4
1,802	8.0	9.8	8.5
2,027	6.2	7.5	6.5
2,252	4.7	5.7	5.0
2,477	3.7	4.3	3.9
2,703	2.9	3.2	3.1
2,928	2.3	2.4	2.5
3,153	1.8	1.8	1.9
3,378	1.4	1.3	1.5
3,604	1.2	0.9	1.1
3,829	1.0	0.6	0.9
4,054	0.8	0.5	0.7
4,279	0.7	0.3	0.6
4,505	0.6	0.3	0.5
4,730	0.5	0.2	0.4
4,955	0.5	0.2	0.3
5,180	0.4	0.2	0.3
5,405	0.4	0.1	0.3

5.2 Trip Limit Analysis for 225 Permits

Table 43. Vermilion snapper trip limit analysis for 225 permit holders, 1999-2005.

Trip Limit (pounds whole weight)	Trip Limit (pounds gutted weight)	Avg 1999-2005			
		Avg no. trips	Avg pounds over limit	% trips over limit	% reduction in catch from limit
0	**0**	31	1,450	100.0	100.0
25	**23**	17	906	55.1	62.5
30	**27**	15	824	49.5	56.9
50	**45**	9	573	29.6	39.5
60	**54**	8	488	24.5	33.6
70	**63**	7	416	21.3	28.7
80	**72**	5	357	15.7	24.6
90	**81**	4	313	13.0	21.6
100	**90**	3	277	10.2	19.1
110	**99**	2	249	7.4	17.2
120	**108**	2	229	6.5	15.8
130	**117**	2	211	5.1	14.5
140	**126**	2	195	5.1	13.5
150	**135**	1	182	3.7	12.6
160	**144**	1	171	3.7	11.8
170	**153**	1	159	3.2	11.0
180	**162**	1	150	2.8	10.4
190	**171**	1	141	2.8	9.8
200	**180**	1	133	2.8	9.2
225	**203**	1	112	2.3	7.7

Table 44. Vermilion snapper trip limit analysis for 225 permit holders, three time periods.

Trip Limit (pounds whole weight)	Trip Limit (pounds gutted weight)	1999-2005	2001	2006
		% reduction in catch	% reduction in catch	% reduction in catch
0	**0**	100.0	100.0	100.0
25	**23**	62.5	58.9	60.1
30	**27**	56.9	52.4	53.2
50	**45**	39.5	31.6	28.5
60	**54**	33.6	24.9	18.1
70	**63**	28.7	19.0	11.0
80	**72**	24.6	14.3	7.7
90	**81**	21.6	11.9	6.5
100	**90**	19.1	9.9	5.4
110	**99**	17.2	8.6	4.2
120	**108**	15.8	7.6	3.0
130	**117**	14.5	6.6	1.9
140	**126**	13.5	5.6	0.7

Trip Limit (pounds whole weight)	Trip Limit (pounds gutted weight)	1999-2005 % reduction in catch	2001 % reduction in catch	2006 % reduction in catch
150	**135**	12.6	4.7	0.0
160	**144**	11.8	3.7	0.0
170	**153**	11.0	2.7	0.0
180	**162**	10.4	1.9	0.0
190	**171**	9.8	1.5	0.0
200	**180**	9.2	1.0	0.0
225	**203**	7.7	0.0	0.0

5.3 Trip Limit Analysis for Unlimited Permits

Table 45. Trip limit analysis (unlimited snapper grouper permits) for data from three time periods.

Trip Limit (pounds gutted weight)	1999-2005 % reduction in catch	2001 % reduction in catch	2006 % reduction in catch
0	100.0	100.0	100.0
225	67.0	70.2	65.0
270	62.4	65.8	60.4
450	47.4	51.4	45.6
541	41.5	45.6	39.9
631	36.4	40.6	35.1
721	32.1	36.2	31.0
811	28.4	32.3	27.6
901	25.2	28.9	24.7
991	22.3	25.9	22.1
1,081	19.9	23.3	19.8
1,171	17.7	20.9	17.7
1,261	15.8	18.8	15.8
1,351	14.1	16.9	14.2
1,441	12.6	15.2	12.8
1,532	11.2	13.7	11.5
1,622	10.0	12.3	10.3
1,712	9.0	11.0	9.3
1,802	8.1	9.8	8.3
2,027	6.2	7.5	6.5
2,252	4.8	5.7	5.0
2,477	3.7	4.3	3.9
2,703	2.9	3.2	3.0
2,928	2.3	2.4	2.4
3,153	1.8	1.8	1.9
3,378	1.4	1.3	1.4
3,604	1.2	0.9	1.1
3,829	1.0	0.6	0.9
4,054	0.8	0.5	0.7
4,279	0.7	0.3	0.6
4,505	0.6	0.3	0.5
4,730	0.5	0.2	0.4
4,955	0.5	0.2	0.4
5,180	0.4	0.2	0.3
5,405	0.4	0.1	0.3

5.4 Trip Limit by State

Table 46. Trip limit analysis (all snapper grouper permits) by state for data from 1999-2005.

Trip Limit (pounds gutted weight)	FL % reduction in catch	GA % reduction in catch	SC % reduction in catch	NC % reduction in catch	All States % reduction in catch
0	100.0	100.0	100.0	100.0	100.0
225	59.9	82.8	70.6	55.0	66.9
270	55.3	79.7	66.3	49.7	62.3
450	40.5	68.4	52.0	33.2	47.3
541	34.7	63.3	46.2	27.2	41.4
631	29.7	58.5	41.1	22.3	36.4
721	25.6	54.0	36.6	18.4	32.1
811	22.1	49.7	32.6	15.4	28.3
901	19.1	45.8	29.0	12.9	25.1
991	16.6	42.2	25.8	10.9	22.3
1,081	14.4	38.8	23.0	9.3	19.8
1,171	12.6	35.5	20.4	8.0	17.7
1,261	10.9	32.5	18.2	6.9	15.8
1,351	9.5	29.8	16.1	6.0	14.1
1,441	8.2	27.1	14.3	5.3	12.6
1,532	7.1	24.7	12.6	4.8	11.2
1,622	6.2	22.4	11.1	4.3	10.0
1,712	5.5	20.4	9.8	3.9	9.0
1,802	4.8	18.6	8.7	3.6	8.0
2,027	3.5	14.7	6.3	2.9	6.2
2,252	2.5	11.6	4.6	2.4	4.7
2,477	1.8	9.0	3.4	2.1	3.7
2,703	1.4	7.0	2.5	1.8	2.9
2,928	1.2	5.3	1.9	1.5	2.3
3,153	1.0	4.0	1.5	1.3	1.8
3,378	0.8	2.8	1.3	1.2	1.4
3,604	0.7	2.0	1.1	1.0	1.2
3,829	0.6	1.4	0.9	0.9	1.0
4,054	0.6	1.0	0.8	0.8	0.8
4,279	0.5	0.7	0.8	0.7	0.7
4,505	0.4	0.5	0.7	0.6	0.6
4,730	0.4	0.3	0.7	0.5	0.5
4,955	0.3	0.2	0.7	0.4	0.5
5,180	0.3	0.1	0.7	0.4	0.4
5,405	0.2	0.1	0.6	0.3	0.4
Mean/Trip	275	1,305	579	354	454

6 Recreational Size Limit Analysis

Amendment 13C increased the recreational size limit to 12" TL. The management measure went into effect in October 2006. Analyses below assumes the effect of the 12" TL would be realized in the future.

Table 47. Estimate of harvest reduction associated with the size limit for (1) headboat, (2) private MRFSS, (3) charter MRFSS, (4) private/charter MRFSS combined, and (5) all recreational sectors combined. Assumes a release mortality of 25%. **Assumes compliance with size limit.**

	Estimated Harvest Reductions				
Size Limit	Headboat	Private	Charter	MRFSS	Combined
12 inch	34.3	37.1	18.7	27.5	31.7
13 inch	54.2	47.2	33.9	40.2	48.7
14 inch	63.8	55.7	50.8	53.1	59.6

Table 48. Estimate of harvest reduction associated with the size limit for (1) headboat, (2) private MRFSS, (3) charter MRFSS, (4) private/charter MRFSS combined, and (5) all recreational sectors combined. Assumes a release mortality of 25%. **Assumes non-compliance with size limit.**

	Estimated Harvest Reductions				
Size Limit	Headboat	Private	Charter	MRFSS	Combined
12 inch	23.3	19.6	14.2	16.8	20.8
13 inch	48.5	34.3	30.6	32.4	42.2
14 inch	60.7	46.8	48.9	47.9	55.7

7 Recreational Bag and Size Limit Analysis

Amendment 13C increased the recreational size limit to 12" TL. Analyses below assumes the effect of the 12" TL would be realized in the future. Combination % reduction = 1-(1-size limit % reduction)*(1-bag limit % reduction).

7.1 MRFSS

7.1.1 Charter

Table 49. Percent reductions in recreational harvest (MRFSS Charter) under different combinations of bag limits and size limits. Amendment 13C increased the size limit to 12" TL. Assumes compliance with size limit. Assumes 25% release mortality.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
12 inches	20.3	22.2	24.5	27.2	30.3	34.1	38.6	44.3	52.8
13 inches	35.2	36.7	38.6	40.8	43.3	46.4	50.1	54.7	61.6
14 inches	51.8	52.9	54.3	56.0	57.9	60.1	62.9	66.3	71.4

Table 50. Percent reductions in recreational harvest (MRFSS Charter) under different combinations of bag limits and size limits. Amendment 13C increased the size limit to 12" TL. Assumes non-compliance with size limit. Assumes 25% release mortality.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish

12 inches	**15.9**	**17.9**	**20.3**	**23.2**	**26.5**	**30.4**	**35.2**	**41.2**	**50.2**
13 inches	**32.0**	**33.6**	**35.6**	**37.9**	**40.5**	**43.7**	**47.6**	**52.4**	**59.7**
14 inches	**49.9**	**51.1**	**52.5**	**54.2**	**56.2**	**58.6**	**61.4**	**65.0**	**70.3**

Table 51. Percent reductions in recreational harvest (MRFSS Charter) under different combinations of bag limits and size limits. Amendment 13C increased the size limit to 12" TL. Assumes non-compliance with size limit and excludes captain and crew. Assumes 25% release mortality.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
12 inches	16.9	18.7	21.5	23.5	26.5	30.6	35.8	42.5	53.9
13 inches	32.8	34.2	36.5	38.1	40.5	43.8	48.1	53.5	62.8
14 inches	50.5	51.6	53.2	54.4	56.2	58.6	61.8	65.7	72.6

7.1.2 Private

Table 52. Percent reductions in recreational harvest (MRFSS Private) under different combinations of bag limits. Amendment 13C increased the size limit to 12" TL. Assumes compliance with size limit. Does not consider non-compliance with size limit.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
12 inches	37.3	37.5	38.2	39.0	40.2	42.0	44.5	48.0	53.4
13 inches	47.3	47.5	48.0	48.8	49.8	51.2	53.4	56.3	60.8
14 inches	55.8	56.0	56.4	57.0	57.9	59.1	60.9	63.4	67.1

Table 53. Percent reductions in recreational harvest (MRFSS Private) under different combinations of bag limits. Amendment 13C increased the size limit to 12" TL. Assumes non-compliance with size limit. Takes into consideration non-compliance with size limit.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
12 inches	19.8	20.1	20.9	22.1	23.6	25.9	29.1	33.6	40.4
13 inches	34.4	34.7	35.4	36.3	37.5	39.4	42.0	45.7	51.3
14 inches	46.9	47.1	47.6	48.4	49.4	50.9	53.0	56.0	60.5

7.1.3 Charter/Private Combined

Table 54. Estimate of MRFSS harvest reduction (percent) under various catch limits using data from 1999-2005. Amendment 13C increased the size limit to 12" TL. Based on proportion of landings represented by Charter (52%) and Private (48%) sectors. Assumes compliance with size limit.

Min Size	**9 fish**	**8 fish**	**7 fish**	**6 fish**	**5 fish**	**4 fish**	**3 fish**	**2 fish**	**1 fish**
12 inches	**28.3**	**29.4**	**30.8**	**32.5**	**34.6**	**37.3**	**40.8**	**45.4**	**52.3**
13 inches	**40.9**	**41.8**	**42.9**	**44.4**	**46.1**	**48.3**	**51.2**	**55.0**	**60.7**
14 inches	**53.7**	**54.3**	**55.3**	**56.4**	**57.7**	**59.5**	**61.8**	**64.7**	**69.2**

Table 55. Estimate of MRFSS harvest reduction (percent) under various catch limits using data from 1999-2005. Amendment 13C increased the size limit to 12" TL. Based on proportion of landings represented by Charter (52%) and Private (48%) sectors. Assumes non-compliance with size limit.

Min Size	**9 fish**	**8 fish**	**7 fish**	**6 fish**	**5 fish**	**4 fish**	**3 fish**	**2 fish**	**1 fish**
12 inches	**17.7**	**18.9**	**20.6**	**22.5**	**25.0**	**28.1**	**32.1**	**37.4**	**45.3**

13 inches	**33.1**	**34.1**	**35.4**	**37.0**	**39.0**	**41.5**	**44.8**	**49.1**	**55.5**
14 inches	**48.5**	**49.2**	**50.2**	**51.5**	**53.0**	**55.0**	**57.5**	**60.8**	**65.7**

Table 56. Estimate of MRFSS harvest reduction (percent) under various catch limits using data from 1999-2005. Amendment 13C increased the size limit to 12" TL. Based on proportion of landings represented by Charter (52%) and Private (48%) sectors. Assumes non-compliance with size limit and excludes captain and crew.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
12 inches	18.3	19.3	21.1	22.7	25.0	28.2	32.4	38.0	47.2
13 inches	33.6	34.4	35.9	37.2	39.0	41.6	45.1	49.6	57.1
14 inches	48.8	49.5	50.6	51.6	53.0	55.0	57.7	61.2	66.9

7.2 Headboat

Table 57. Estimate of Headboat harvest reduction (percent) under various catch limits using data from 1999-2005. Amendment 13C increased the size limit to 12" TL. Assumes compliance with size limit.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
12 inches	36.5	38.6	42.3	45.9	50.0	54.2	59.3	65.1	71.8
13 inches	55.7	57.2	59.7	62.2	65.1	68.0	71.6	75.7	80.3
14 inches	64.9	66.1	68.1	70.1	72.4	74.7	77.5	80.7	84.4

Table 58. Estimate of Headboat harvest reduction (percent) under various catch limits using data from 1999-2005. Amendment 13C increased the size limit to 12" TL. Assumes non-compliance with size limit.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
12 inches	25.8	28.3	32.6	36.8	41.6	46.5	52.5	59.3	67.1
13 inches	50.2	51.9	54.7	57.6	60.8	64.1	68.1	72.7	77.9
14 inches	62.0	63.3	65.5	67.6	70.1	72.6	75.7	79.1	83.1

Table 59. Estimate of Headboat harvest reduction (percent) under various catch limits using data from 1999-2005. Amendment 13C increased the size limit to 12" TL. Assumes non-compliance with size limit, excludes captain and crew.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
12 inches	26.8	30.3	32.5	37.4	41.6	46.3	50.6	56.4	62.9
13 inches	50.9	53.2	54.7	58.0	60.8	64.0	66.8	70.7	75.1
14 inches	62.5	64.3	65.4	67.9	70.1	72.5	74.7	77.6	81.0

7.3 Headboat/MRFSS Combined

Table 60. Estimate of Headboat/MRFSS harvest reduction (percent) under various catch limits using data from 1999-2005. Amendment 13C increased the size limit to 12" TL. Based on proportion of landings represented by Headboat (61%) and MRFSS (39%) sectors. Assumes compliance with size limit.

Min Size	**9 fish**	**8 fish**	**7 fish**	**6 fish**	**5 fish**	**4 fish**	**3 fish**	**2 fish**	**1 fish**
12 inches	**33.5**	**35.2**	**38.1**	**41.0**	**44.4**	**48.1**	**53.2**	**58.1**	**64.9**
13 inches	**50.2**	**51.5**	**53.7**	**55.9**	**58.4**	**61.2**	**65.0**	**68.6**	**73.7**
14 inches	**60.8**	**61.8**	**63.5**	**65.2**	**67.3**	**69.4**	**72.4**	**75.3**	**79.3**

Table 61. Estimate of Headboat/MRFSS harvest reduction (percent) under various catch limits using data from 1999-2005. Based on proportion of landings represented by Headboat (61%) and MRFSS (39%) sectors. Includes effect of increasing size limit to 12" TL. Takes into consideration non-compliance with size limit.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
12 inches	**29.2**	**31.1**	**34.2**	**37.3**	**40.9**	**44.8**	**50.2**	**55.4**	**62.7**
13 inches	**47.0**	**48.4**	**50.6**	**53.0**	**55.7**	**58.7**	**62.7**	**66.6**	**72.0**
14 inches	**58.6**	**59.7**	**61.5**	**63.3**	**65.4**	**67.7**	**70.9**	**73.9**	**78.1**

Table 62. Estimate of Headboat/MRFSS harvest reduction (percent) under various catch limits using data from 1999-2005. Based on proportion of landings represented by Headboat (61%) and MRFSS (39%) sectors. Includes effect of increasing size limit to 12" TL. Takes into consideration non-compliance with size limit, excludes captain and crew.

Min Size	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
12 inches	29.4	31.2	34.3	37.4	40.9	44.9	49.8	55.7	63.3
13 inches	47.1	48.5	50.8	53.1	55.7	58.7	62.4	66.8	72.5
14 inches	58.7	59.7	61.6	63.3	65.4	67.7	70.6	74.0	78.5

8 Combined Effects of Size Limit, Bag Limit, and Seasonal Closure

Amendment 13C increased the recreational size limit to 12" TL. Analyses below assumes the effect of the 12" TL would be realized in the future. Combination % reduction for bag limit and seasonal closure = 1-(1-bag limit % reduction)*(1-closure % reduction). Combination % reduction for bag limit/seasonal closure and size limit = 1-(1-bag limit, closure % reduction)*(1-size limit % reduction).

Table 63. Reduction from size limit, bag limit, and seasonal closure. Assumes 25% release mortality, non compliance with size limit, and excludes captain and crew. Vermilion Snapper 12" TL size limit; 89% effectiveness of seasonal closure

closure	open	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
sept-may	June-Aug	66.40%	67.27%	68.75%	70.19%	71.89%	73.76%	76.11%	78.89%	82.52%
sept-april	May-Aug	58.01%	59.09%	60.94%	62.74%	64.86%	67.20%	70.14%	73.62%	78.16%
oct-april	May-Sept	52.31%	53.54%	55.65%	57.69%	60.09%	62.75%	66.09%	70.04%	75.19%
oct-may 15	May 16 - Sept	56.51%	57.63%	59.55%	61.41%	63.61%	66.03%	69.08%	72.68%	77.38%
oct-may 22	May 23-Sept	58.61%	59.68%	61.50%	63.28%	65.36%	67.67%	70.57%	74.00%	78.47%
oct-may	June -Sept	60.71%	61.72%	63.46%	65.14%	67.12%	69.31%	72.06%	75.31%	79.56%
nov-april	May-Oct	46.33%	47.71%	50.08%	52.38%	55.08%	58.08%	61.84%	66.28%	72.08%
nov-mar	April-Oct	40.99%	42.52%	45.12%	47.65%	50.62%	53.91%	58.05%	62.93%	69.30%
dec-mar	April-Nov	38.21%	39.80%	42.53%	45.17%	48.29%	51.73%	56.07%	61.18%	67.85%
dec-feb	Mar-Nov	34.83%	36.51%	39.38%	42.17%	45.46%	49.10%	53.66%	59.05%	66.10%
jan-feb	Mar-Dec	33.34%	35.06%	38.00%	40.86%	44.22%	47.93%	52.61%	58.12%	65.32%
jan-mar	Apr-Dec	36.72%	38.35%	41.14%	43.85%	47.05%	50.57%	55.01%	60.24%	67.08%
jan-apr	May-Dec	42.05%	43.55%	46.10%	48.58%	51.51%	54.74%	58.80%	63.59%	69.85%
sept-oct	nov-aug	41.10%	42.62%	45.21%	47.74%	50.71%	53.99%	58.12%	62.99%	69.36%
no closure	All year	29.41%	31.23%	34.35%	37.37%	40.93%	44.87%	49.81%	55.65%	63.28%

Table 64. Reduction from size limit, bag limit, and seasonal closure. Assumes 25% release mortality, non compliance with size limit, and excludes captain and crew. Vermilion Snapper 13" TL size limit; 89% effectiveness of seasonal closure.

closure	open	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
sept-may	June-Aug	74.82%	75.47%	75.47%	77.66%	78.93%	80.33%	82.10%	84.18%	86.90%
sept-april	May-Aug	68.52%	69.34%	69.34%	72.07%	73.66%	75.41%	77.62%	80.22%	83.63%
oct-april	May-Sept	64.25%	65.18%	65.18%	68.28%	70.09%	72.08%	74.58%	77.54%	81.40%
oct-may 15	May 16 - Sept	67.17%	68.02%	68.02%	70.87%	72.53%	74.36%	76.66%	79.38%	82.92%
oct-may 22	May 23-Sept	67.40%	68.24%	68.24%	71.08%	72.72%	74.54%	76.82%	79.52%	83.04%
oct-may	June -Sept	68.97%	69.77%	69.77%	72.47%	74.04%	75.77%	77.94%	80.51%	83.86%
nov-april	May-Oct	59.77%	60.80%	68.02%	64.30%	66.33%	68.58%	71.39%	74.72%	79.07%
nov-mar	April-Oct	55.77%	56.91%	56.91%	60.76%	62.99%	65.45%	68.55%	72.21%	76.99%
dec-mar	April-Nov	53.68%	54.87%	54.87%	58.90%	61.24%	63.82%	67.07%	70.90%	75.90%
dec-feb	Mar-Nov	51.15%	52.41%	52.41%	56.65%	59.12%	61.84%	65.27%	69.31%	74.59%
jan-feb	Mar-Dec	50.03%	51.32%	51.32%	55.67%	58.19%	60.97%	64.47%	68.61%	74.01%
jan-mar	Apr-Dec	52.57%	53.79%	53.79%	57.91%	60.31%	62.95%	66.27%	70.20%	75.32%
jan-apr	May-Dec	56.56%	57.68%	57.68%	61.46%	63.65%	66.07%	69.12%	72.71%	77.40%
sept-oct	nov-aug	55.85%	56.99%	56.99%	60.82%	63.05%	65.51%	68.61%	72.26%	77.03%
no closure	All year	47.09%	48.45%	48.45%	53.05%	55.72%	58.67%	62.38%	66.76%	72.47%

Table 65. Reduction from size limit, bag limit, and seasonal closure. Assumes 25% release mortality, non compliance with size limit, and excludes captain and crew. Vermilion Snapper 14" TL size limit; 88% effectiveness of seasonal closure.

closure	open	9 fish	8 fish	7 fish	6 fish	5 fish	4 fish	3 fish	2 fish	1 fish
sept-may	June-Aug	80.09%	80.60%	80.60%	82.33%	83.34%	84.45%	85.84%	87.49%	89.64%
sept-april	May-Aug	75.23%	75.87%	75.87%	78.02%	79.27%	80.65%	82.39%	84.44%	87.11%
oct-april	May-Sept	71.93%	72.65%	72.65%	75.09%	76.51%	78.08%	80.04%	82.36%	85.40%
oct-may 15	May 16 - Sept	74.36%	75.02%	75.02%	77.25%	78.54%	79.97%	81.77%	83.89%	86.66%
oct-may 22	May 23-Sept	75.58%	76.21%	76.21%	78.33%	79.56%	80.92%	82.63%	84.66%	87.29%
nov-april	May-Oct	68.47%	69.28%	69.28%	72.02%	73.61%	75.37%	77.58%	80.19%	83.60%
nov-mar	April-Oct	65.38%	66.27%	66.27%	69.28%	71.03%	72.96%	75.39%	78.25%	81.99%
dec-mar	April-Nov	63.77%	64.70%	64.70%	67.85%	69.68%	71.70%	74.24%	77.23%	81.15%
dec-feb	Mar-Nov	61.81%	62.79%	62.79%	66.11%	68.04%	70.17%	72.85%	76.01%	80.13%
jan-feb	Mar-Dec	60.95%	61.96%	61.96%	65.35%	67.32%	69.50%	72.24%	75.47%	79.68%
jan-mar	Apr-Dec	62.90%	63.86%	63.86%	67.09%	68.96%	71.03%	73.63%	76.69%	80.70%
jan-apr	May-Dec	65.99%	66.87%	66.87%	69.83%	71.54%	73.44%	75.82%	78.63%	82.31%
sept-oct	nov-aug	65.44%	66.33%	66.33%	69.33%	71.08%	73.00%	75.43%	78.29%	82.02%
no closure	All year	58.68%	59.74%	59.74%	63.33%	65.42%	67.72%	70.62%	74.04%	78.50%

9 Recreational Boat Limits

9.1 Headboat

Table 66. Reduction in harvest of vermilion snapper caught based on boat limit (number) for headboats using data from 1999-2005. Includes reduction from 12" size limit. Assumes 25% release mortality.

Vessel Limit Number	Reduction Compliance	Reduction Non Compliance
100	63.9	57.9
95	63.5	58.8
90	61.8	59.7
85	48.6	60.6
80	49.8	61.5
70	52.3	63.5
65	53.7	64.5
60	55.0	65.5
55	56.4	66.6
50	57.8	67.7
45	59.4	68.8
40	60.9	70.0
35	62.5	71.2
30	64.1	72.4
25	65.8	73.8
20	67.6	75.1
15	69.5	76.6
10	71.5	78.2
9	72.0	78.5
8	72.4	78.8

7	72.9	79.2
6	73.3	79.5
5	73.8	79.9
4	74.3	80.3
3	74.8	80.7
2	75.3	81.1
1	75.8	81.5

9.2 Charter

Table 67. Reduction in harvest of vermilion snapper caught based on boat limit (number) for charter boats (MRFSS) using data from 1999-2005. Includes reduction from 12" size limit. Assumes 25% release mortality.

Vessel Limit Number	Reduction Compliance	Reduction Non Compliance
50	24.7	20.5
45	26.9	22.9
40	28.7	24.7
35	31.2	27.4
30	33.8	30.1
25	37.1	33.7
20	40.6	37.3
15	45.2	42.2
10	51.0	48.3
9	52.5	49.9
8	54.2	51.6
7	56.0	53.5
6	57.9	55.6
5	60.0	57.8
4	62.3	60.2
3	64.7	62.8
2	67.4	65.6
1	70.4	68.8

9.3 Private

Table 68. Reduction in harvest of vermilion snapper caught based on boat limit (number) for private boats (MRFSS) using data from 1999-2005. Includes reduction from 12" size limit. Assumes 25% release mortality.

Vessel Limit Number	Reduction Compliance	Reduction Non Compliance
25	37.4	14.6
20	38.0	15.4
15	39.9	18.0
10	43.3	22.6

9	44.8	24.6
8	46.1	26.5
7	47.6	28.5
6	49.3	30.7
5	51.3	33.5
4	53.6	36.7
3	56.3	40.4
2	59.7	45.0
1	64.2	51.1

10 Post Quota Bycatch Mortality

Regulations in Amendment 16 will initially decrease the allowable commercial catch of gag from 18 to 37%, depending on the allocation alternative selected. In addition, a 61% reduction in commercial harvest could occur for vermilion snapper based on a recent assessment update; however, this value could change since a new age based assessment is being conducted. A variety of management measures are available to end overfishing of these species, including a commercial quota. If a commercial quota is met for gag or vermilion snapper, it is expected there would still be some catch when fishermen target co-occurring species. These species would have to be released and a percentage of the incidentally caught gag and vermilion snapper would die, depending on depth of capture. The magnitude of incidentally caught gag and vermilion snapper that die after a quota is met is referred to as post quota bycatch mortality (PQBM). The range of management measures used, how fishermen will behave in response to reduced harvest levels, and ability to avoid a species after the quota is met will affect PQBM.

Assumptions

- Trip based logbook data are used to estimate incidental catch of vermilion snapper and gag when fishermen target co-occurring species.
- Vermilion snapper and gag are taken by many fishermen on the same trip.
- If a fisherman cannot net at least $50.00/day, the trip is not included in analyses.
- In determining incidental catch of gag or vermilion snapper, a co-occurring species is targeted if at least 100 lbs whole weight is taken on a trip.
- If vermilion snapper or gag make up greater than 75% of the catch on a trip, it is not included in analyses.
- Fishermen will not use diving gear to target gag after a quota is met or during a seasonal closure.
- There will not be an increase in fishing effort before or after a seasonal closure.
- Some trips that target co-occurring species will not be taken after a quota is met. A range of 20 to 60% is used.
- Fishermen can avoid vermilion snapper and gag to some degree by changing hook size, method of fishing, and location. A range of 20 to 60% in reduction of catch is used.
- Dead discards are determined by applying release mortality rate of 40% for commercially caught vermilion snapper and gag.

Estimate of PQBM with Quota

50% of quota Jan-June and 50% of quota July-Dec

Table 69. Incidental catch of vermilion snapper after a January-June quota is met assuming a range in trips (0 to 60%) are not taken after quota is met and fishermen can avoid vermilion snapper (range 0 to 60%) by changing fishing methods.

Trip reduction after quota	0%				20%				40%				60%			
Percent of discards avoided	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%
Discards	136,426	109,141	65,485	26,194	74,794	59,835	35,901	14,361	74,794	59,835	35,901	14,361	46,584	37,267	22,360	8,944
Dead Discards	54,571	43,656	26,194	10,478	29,918	23,934	14,361	5,744	29,918	23,934	14,361	5,744	18,634	14,907	8,944	3,578

Table 70. Incidental catch of vermilion snapper after a July-December quota is met assuming a range in trips (0 to 60%) are not taken after quota is met and fishermen can avoid gag (range 0 to 60%) by changing fishing methods.

Trip reduction after quota	0%				20%				40%				60%			
Percent of discards avoided	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%
Discards	202,108	161,686	97,012	38,805	114,338	91,470	54,882	21,953	114,338	91,470	54,882	21,953	71,264	57,011	34,207	13,683
Dead Discards	80,843	64,675	38,805	15,522	45,735	36,588	21,953	8,781	45,735	36,588	21,953	8,781	28,506	22,805	13,683	5,473

40% of quota Jan-June and 60% of quota July-Dec

Table 71. Incidental catch of vermilion snapper after a January-June quota is met assuming a range in trips (0 to 60%) are not taken after quota is met and fishermen can avoid vermilion snapper (range 0 to 60%) by changing fishing methods.

Trip reduction after quota	0%				20%				40%				60%			
Percent of discards avoided	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%
Discards	148,833	119,067	71,440	28,576	82,833	66,267	39,760	15,904	72,146	57,717	34,630	13,852	53,402	42,722	25,633	10,253
Dead Discards	59,533	47,627	28,576	11,430	33,133	26,507	15,904	6,362	28,858	23,087	13,852	5,541	21,361	17,089	10,253	4,101

Table 72. Incidental catch of vermilion snapper after a July-December quota is met assuming a range in trips (0 to 60%) are not taken after quota is met and fishermen can avoid gag (range 0 to 60%) by changing fishing methods.

Trip reduction after quota	0%				20%				40%				60%			
Percent of discards avoided	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%
Discards	190,917	152,734	91,640	36,656	108,677	86,942	52,165	20,866	84,602	67,682	40,609	16,244	63,545	50,836	30,502	12,201
Dead Discards	76,367	61,094	36,656	14,662	43,471	34,777	20,866	8,346	33,841	27,073	16,244	6,497	25,418	20,334	12,201	4,880

50% of quota Jan-Aug and 50% of quota Sept-Dec

Table 73. Incidental catch of vermilion snapper after a January-August quota is met assuming a range in trips (0 to 60%) are not taken after quota is met and fishermen can avoid vermilion snapper (range 0 to 60%) by changing fishing methods.

Trip reduction after quota	0%				20%				40%				60%			
Percent of discards avoided	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%
Discards	237,776	190,221	114,133	45,653	134,180	107,344	64,406	25,763	107,590	86,072	51,643	20,657	76,287	61,029	36,618	14,647
Dead Discards	95,111	76,088	45,653	18,261	53,672	42,938	25,763	10,305	43,036	34,429	20,657	8,263	30,515	24,412	14,647	5,859

Table 74. Incidental catch of vermilion snapper after a September-December quota is met assuming a range in trips (0 to 60%) are not taken after quota is met and fishermen can avoid gag (range 0 to 60%) by changing fishing methods.

Trip reduction after quota	0%				20%				40%				60%			
Percent of discards avoided	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%	0%	20%	40%	60%
Discards	122,189	97,751	58,651	23,460	67,003	53,602	32,161	12,865	39,544	31,635	18,981	7,592	41,728	33,383	20,030	8,012
Dead Discards	48,876	39,101	23,460	9,384	26,801	21,441	12,865	5,146	15,817	12,654	7,592	3,037	16,691	13,353	8,012	3,205

11 References

Allen, G.R. 1985. FAO species catalogue. Vol. 6. Snappers of the world. An annotated and illustrated catalogue of lutjanid species known to date. FAO Fish. Synop. 6(125):208 p.

Cuellar, N., G.R. Sedberry, and D.M. Wyanski. 1996. Reproductive seasonality, maturation, fecundity, and spawning frequency of the vermilion snapper, Rhomboplites aurorubens, off the southeastern United States. Fish. Bull. 94: 635-653.

Hood, P.B. and A.K. Johnson. 1999. Age, growth, mortality, and reproduction of vermilion snapper, *Rhomboplites aurorubens*, from the eastern Gulf of Mexico. Fish. Bull. 97: 828-841.

Lindeman, K.C., R. Pugliese, G.T. Waugh, and J.S. Ault. 2000. Developmental patterns within a multispecies reef fishery: management applications for essential fish habitats and protected areas. Bull. Mar. Sci. 66(3): 929-956.

Potts, J.C., C.S. Manooch, III, and D.S. Vaughan. 1998. Age and Growth of Vermilion Snapper from the Southeastern United States. Trans. Am. Fish. Soc. 127: 787-795.

SEDAR 2. 2003. Complete Assessment and Review Report of South Atlantic Vermilion Snapper. Results of a series of workshops convened between October 2002 and February 2003. South Atlantic Fishery Management Council, One Southpark Circle #306, Charleston, SC 29414.

SEDAR Update #3. 2007. Report of Stock Assessment: Vermilion Snapper. Assessment Workshop of April 2-4, 2007. Beaufort, North Carolina. Report Issued May, 18, 2007.

Sedberry, G.R. and N. Cuellar. 1993. Planktonic and benthic feeding by the reef-associated vermilion snapper, *Rhomboplites aurorubens* (Teleostei: Lutjanidae). Fish. Bull. U.S. 91(4): 699-709.

Zhao, B. and J.C. McGovern. 1997. Temporal variation in sexual maturity and gear-specific sex ratio of the vermilion snapper, *Rhomboplites aurorubens*, in the South Atlantic Bight. Fish. Bull. 95: 837-848.

Zhao, B., J.C. McGovern, and P.J. Harris. 1997. Age, growth, and temporal change in size-at-age of the vermilion snapper from the South Atlantic Bight. Trans. Am. Fish. Soc. 126:181-193.