

# **A Brief Explanation of Systematic Differences between MRFSS and MRIP Catch Estimates in Four Sample Cases**

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## Executive Summary

In general, differences between original MRFSS and weighted MRIP estimates were variable with no consistent direction. However, systematic differences, including both increases and decreases, were observed for a limited number of species.

This report summarizes findings for four species where systematic differences were observed among original MRFSS and revised MRIP annual catch estimates from 2004-2010. One example case was selected from each of the four estimation regions along the Atlantic and Gulf of Mexico coasts. In all four cases, most of the differences, either increases or decreases, were due to changes in the private boat fishing mode (PR) estimates. These changes usually resulted from differences in catch rates between fishing access sites with higher fishing pressure (overrepresented in MRFSS estimation) and those with lower pressure (underrepresented in MRFSS estimation).

In the North Atlantic region, revised MRIP estimates of Atlantic cod unobserved harvest (B1-catch) and unobserved releases (B2-catch) were systematically lower than the original MRFSS estimates in Massachusetts. The total difference in B1-catch between MRFSS and MRIP 2004-2010 estimates was 1.1 million fish (41% of MRFSS estimate). For B2-catch, the total difference was 2.5 million fish (34% of MRFSS). Private boat fishing mode (PR) accounted for 83% of the B1-catch differences and over 95% for B2. During this period, PR trips with B1 and B2 cod catches were overrepresented in MRFSS estimation by 11.2% and 10%, respectively.

For the Mid-Atlantic, MRIP estimates of striped bass observed harvest (A-catch) were higher than MRFSS estimates in New York from 2004-2010 by over 330 thousand fish (20% of MRFSS estimate). By fishing mode, PR made up 52% of the total difference, followed by charter boat mode (CH) and shore fishing mode (SH) both at 24%. For PR, low pressure sites had higher catch rates but were underrepresented in MRFSS estimation by 13.8%, whereas high pressure sites with lower catch rates were overrepresented in MRFSS by the same amount. In CH mode, differences in catch rates were variable increasing in four years while decreasing in the other three years. However, CH effort increased in five of the seven years. This increase in effort resulted from more off-frame CH vessels being intercepted at lower pressure sites. Under MRFSS, these intercepts had been underrepresented resulting in lower CH effort expansion factors leading to lower effort and catch estimates. In SH mode, lower pressure category sites had higher A-catch rates but were underrepresented in MRFSS by just over 5%.

In the South Atlantic, MRIP estimates of black sea bass A-catch and B2-catch were systematically lower than corresponding MRFSS estimates. For 2004-2010, MRIP A-catch estimates were smaller by 272 thousand fish (29% of MRFSS estimate), and the difference in B2-catch estimates was almost 1.2 million fish (20% of MRFSS). PR mode accounted for over 90% of the differences in both A and B2-catch estimates. PR trips with A and B2 black sea bass catches were both overrepresented in MRFSS estimation by over 6%.

Red snapper was investigated for the Gulf of Mexico region, where MRIP estimates of A, B1, and B2-catch were generally larger than MRFSS estimates for the West coast of Florida. From 2004-2010, MRIP A, B1, and B2 estimates exceeded MRFSS estimates by 563 thousand (18% of MRFSS estimate), 139 thousand (55% of MRFSS), and 2.1 million fish (24% of MRFSS), respectively. PR mode accounted for over 96% of the A-catch difference and more than 99% of the differences in B1 and B2 estimates. For PR, catch rates were higher at low pressure sites compared to high pressure sites. In MRFSS estimation, A-catch data from the low pressure sites had been underrepresented by almost 12% from 2004-2010.

## North Atlantic Region: Atlantic Cod

In the North Atlantic region, revised MRIP estimates of Atlantic cod unobserved harvest (B1-catch) and unobserved releases (B2-catch) were systematically smaller than the original MRFSS estimates in Massachusetts from 2004-2010. Over this time period, total differences were on the order of millions of fish with the largest annual differences observed in 2010 for both B1 and B2-catch (Figure 1).

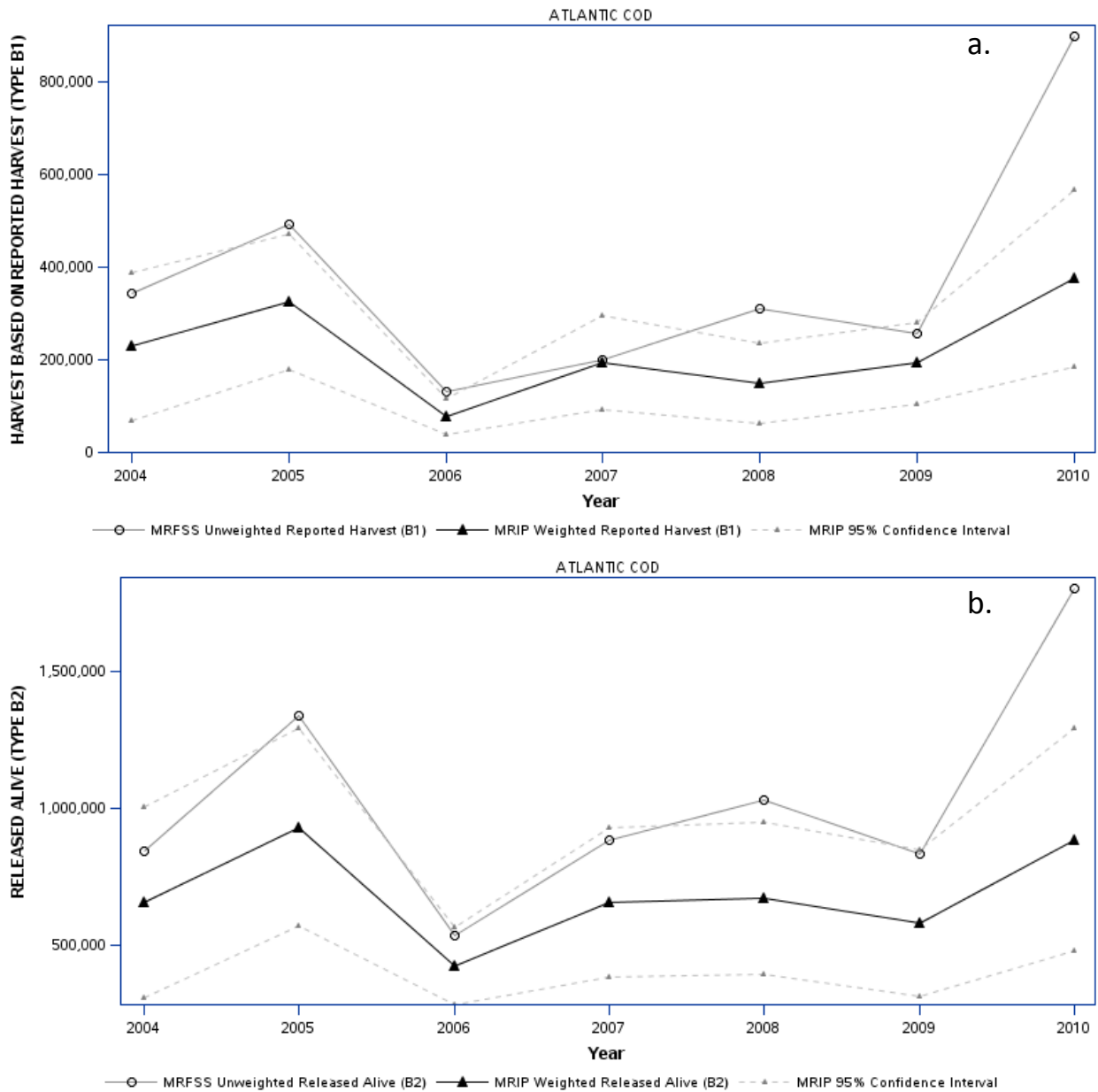


Figure 1. MRFSS and MRIP Atlantic cod catch estimates for Massachusetts, 2004-2010. Panels: (a) Reported harvest B1-catch, (b) Released alive B2-catch

The total difference in B1-catch between MRFSS and MRIP 2004-2010 estimates was nearly 1.1 million fish (Table 1). For B2-catch, the total difference was over 2.4 million fish. Private boat fishing mode (PR) accounted for over 80% of the difference in B1 and almost 96% of the difference in B2-catch. The remaining analysis focuses on PR mode.

Table 1. MRFSS and MRIP B1 and B2-Catch Estimates in Massachusetts, 2004-2010, with Differences by Mode

	B1 Unobserved Harvest (No. Fish)		B2 Unobserved Releases (No. Fish)	
MRFSS	2,636,422		7,261,598	
MRIP	1,546,452		4,806,835	
Differences (MRFSS – MRIP)				
	Total	1,089,970		2,454,761
	By Mode			
	Shore	0		3,822 (0.1%)
	For Hire	182,703 (17%)		102,120 (4.2%)
	Private	907,267 (83%)		2,348,819 (95.7%)

Total and annual differences in Atlantic cod PR B1 and B2-catch estimates were primarily due to differences in mean catch rate estimates. In all years the MRIP mean B1 and B2-catch per trip estimates were smaller than MRFSS (Table 2). Differences in B1 means ranged from 0.004 in 2006 and 2007 to 0.202 in 2010. B2 differences were larger in comparison, ranging from 0.025 in 2006 to 0.349 in 2010.

Table 2. Annual MRFSS and MRIP Mean B1 and B2-catch per trip for Massachusetts PR Mode with Differences

Year	MRFSS B1 Mean/Trip	MRIP B1 Mean/Trip	B1 Difference (MRFSS – MRIP)	MRFSS B2 Mean/Trip	MRIP B2 Mean/Trip	B2 Difference (MRFSS – MRIP)
2004	0.104	0.077	+0.027	0.296	0.217	+0.079
2005	0.148	0.101	+0.047	0.407	0.251	+0.156
2006	0.020	0.016	+0.004	0.126	0.101	+0.025
2007	0.056	0.052	+0.004	0.246	0.172	+0.074
2008	0.088	0.051	+0.037	0.306	0.219	+0.086
2009	0.067	0.056	+0.011	0.240	0.161	+0.079
2010	0.325	0.123	+0.202	0.657	0.308	+0.349
2004-2010	0.123	0.069	+0.054	0.347	0.201	+0.145

The systematic differences in mean B1-catch per trip were a direct result of differences between sites in Massachusetts where trips with cod B1-catch were encountered and sites with no B1 cod intercepts. While fewer in number, sites with B1 cod trips were far more productive, averaging 455 intercepts from 2004-2010 compared to only 43 intercepts in the same time period for the zero sites (Table 3). Further, B1 cod sites had higher pressure categories, on average, compared to zero sites. These two factors resulted in catch data from cod sites having more relative weight or influence in MRFSS estimation, where B1 cod site data received almost 56% of the relative weight. In revised MRIP estimation, catch

data from B1 cod sites received less than 45% of the sample weight, indicating that B1 cod site catch data had been overrepresented, or up-weighted, in MRFSS estimation by approximately 11%.

Table 3. Massachusetts Site Characteristics for Sites with Atlantic Cod B1-catch and Zero Sites with no B1-catch, 2004-2010

	Unique Site Count	Avg. Intercepts per Site	Avg. Site-Day Pressure Category	% of Total MRFSS Relative Weighting	% of Total MRIP Sample Weight	Difference in % (MRFSS – MRIP)
B1 Cod Sites	16	455	3.52	55.9	44.7	+11.2
Zero Sites	127	43	2.48	44.1	55.3	-11.2

Differences between sites with B2 cod catch trips and zero sites without B2 cod trips were very similar to those reported for B1. B2 cod sites were more productive from 2004-2010 averaging 329 intercepts compared to just 41 at the zero sites. The average site-day pressure category for B2 cod sites was 3.49 compared to 2.39 at zero sites. Under MRFSS estimation, catch data from B2 cod sites received almost 61% of the relative weighting from 2004-2010. In revised MRIP estimation, the same catch data received just under 51% of the total sample weighting, indicating that MRFSS had overrepresented the catch data from B2 cod sites by 10%.

Table 4. Massachusetts Site Characteristics for Sites with Atlantic Cod B2-catch and Zero Sites with no B2-catch, 2004-2010

	Unique Site Count	Avg. Intercepts per Site	Avg. Site-Day Pressure Category	% of Total MRFSS Relative Weighting	% of Total MRIP Sample Weight	Difference in % (MRFSS – MRIP)
B2 Cod Sites	24	329	3.49	60.8	50.8	+10
Zero Sites	119	41	2.39	39.2	49.2	-10

### Mid Atlantic Region: Striped bass

In the Mid Atlantic region, revised MRIP estimates of striped bass observed harvest (A-catch) were systematically larger than the original MRFSS estimates in New York from 2004-2010. Over this time period, the annual differences varied somewhat from the smallest difference in 2009 to the largest differences in 2007 and 2008 (Figure 1). The total difference in A-catch between MRFSS and MRIP 2004-2010 estimates was almost 335 thousand fish (Table 5). Private boat fishing mode (PR) accounted for 52% of the difference followed by charter boat (CH) mode and shore (SH) mode both at 24%.

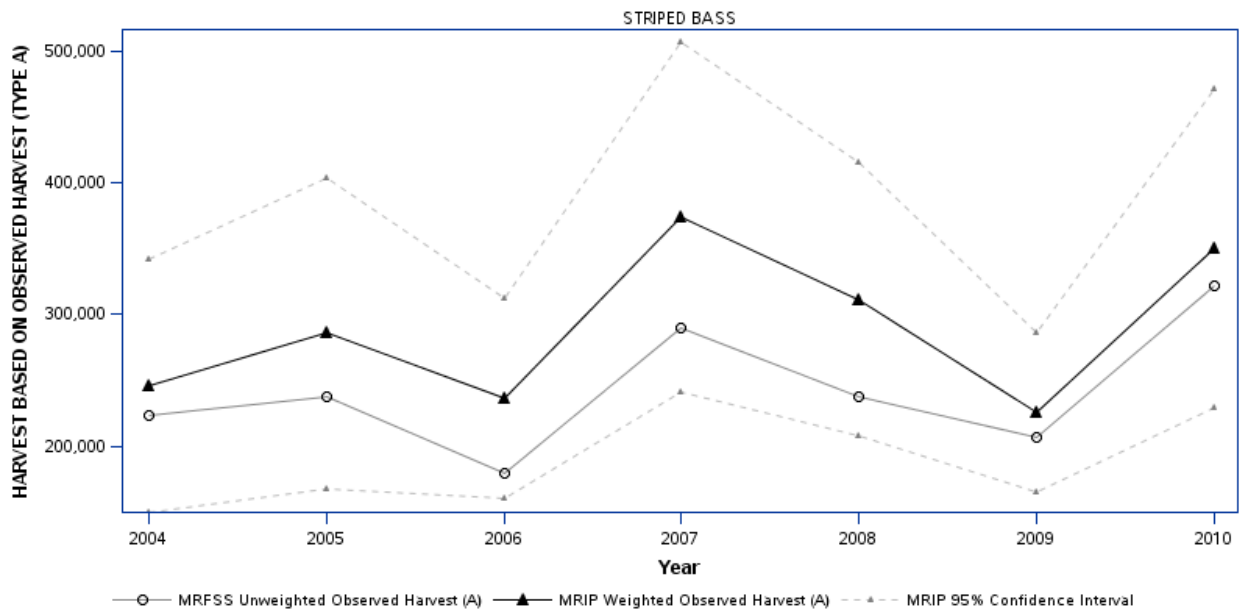


Figure 2. MRFSS and MRIP Striped Bass Observed Harvest (A-catch) estimates for New York, 2004-2010

Table 5. MRFSS and MRIP Striped Bass A-Catch Estimates in New York, 2004-2010, with Differences by Mode

		A Observed Harvest (No. Fish)	
MRIP		2,031,047	
MRFSS		1,696,517	
Differences (MRFSS – MRIP)			
Total		-334,529	
By Mode	Shore	-81,433	(24%)
	Charter	-80,092	(24%)
	Private	-173,004	(52%)

For PR mode, mean A-catch per trip was inversely related to site pressure category. Pressure category 0 had the largest mean catch rate of 0.238 whereas the highest pressure category, 6, had a mean catch per trip of 0 (Table 6). In MRFSS estimation, striped bass catch data from lower pressure category sites were underrepresented relative to data from higher category sites. Lower category site data received too little weighting while higher category site data received too much. Revised MRIP estimation corrected the underrepresentation and shifted sample weighting from higher to lower pressure categories. In doing so, the higher catch rates in lower categories were up-weighted while lower catch rates in higher categories were down-weighted. Ultimately, the shift in weighting resulted in higher MRIP PR mode A-catch estimates.

Table 6. MRIP PR Mode Striped Bass A-Catch Rates in New York by Site Pressure Category with % of Total MRIP and MRFSS Weight, 2004-2010

Pressure Category	Mean A-Catch Rate	% of Total MRIP Sample Weight	% of Total MRFSS Relative Weight	Difference in % (MRFSS – MRIP)
0	0.238	7.4	4.7	-2.7
1	0.114	13.6	8.5	-5.1
2	0.062	29.2	23.2	-6.0
3	0.054	25.0	26.3	+1.3
4	0.031	17.4	24.4	+6.9
5	0.015	6.5	11.3	+4.8
6	0	0.9	1.7	+0.8

For CH mode, mean catch per trip varied from 2004-2010. MRIP A-catch rates were higher than MRFSS in four years but lower in the remaining three years (Table 7). However, MRIP CH effort estimates were higher in five of the seven years. The largest increases in effort occurred in 2005, 2007, and 2008, which corresponded to larger MRIP A-catch rates. The general increase in CH effort resulted from differences in proportions of off-frame CH vessels (vessels not listed in the For-hire Survey vessel directory) at low and high pressure sites. Lower pressure sites had larger numbers of off-frame CH intercepted vessels relative to high pressure sites. Under MRFSS, the low pressure site data had been underrepresented by more than 3% compared to MRIP (Table 8). The net result was that MRIP weighting increased the CH effort expansion factors thereby increasing both the effort and catch estimates for years where there were not offsetting decreases in catch rates.

Table 7. Annual MRFSS and MRIP Mean Striped Bass A-catch per trip and Effort for New York CH Mode with Differences as a Percentage of the MRFSS Estimates

Year	MRFSS A Mean/Trip	MRIP A Mean/Trip	%Difference (MRFSS–MRIP)	MRFSS Effort	MRIP Effort	%Difference (MRFSS–MRIP)
2004	0.272	0.180	+37.6	397,003	191,842	+51.7
2005	0.152	0.218	-43.1	286,969	355,243	-23.8
2006	0.113	0.119	-5.8	239,981	194,147	+19.1
2007	0.283	0.538	-90.1	283,421	430,952	-52.1
2008	0.122	0.168	-38.3	121,666	183,847	-51.1
2009	0.177	0.169	+4.5	185,850	189,953	-2.21
2010	0.235	0.166	+29.5	192,225	195,914	-1.92

Table 8. New York MRIP CH Mode Effort Expansion by Collapsed Site Pressure Category with % of Total MRIP and MRFSS Weight, 2004-2010

Pressure Category	Expansion Factor	% of Total MRIP Sample Weights	% of Total MRFSS Relative Weighting	Difference (MRFSS – MRIP)
Low: 0-3	1.22	76.4	73.1	-3.3
High: 4-7	1.06	23.6	26.9	+3.3

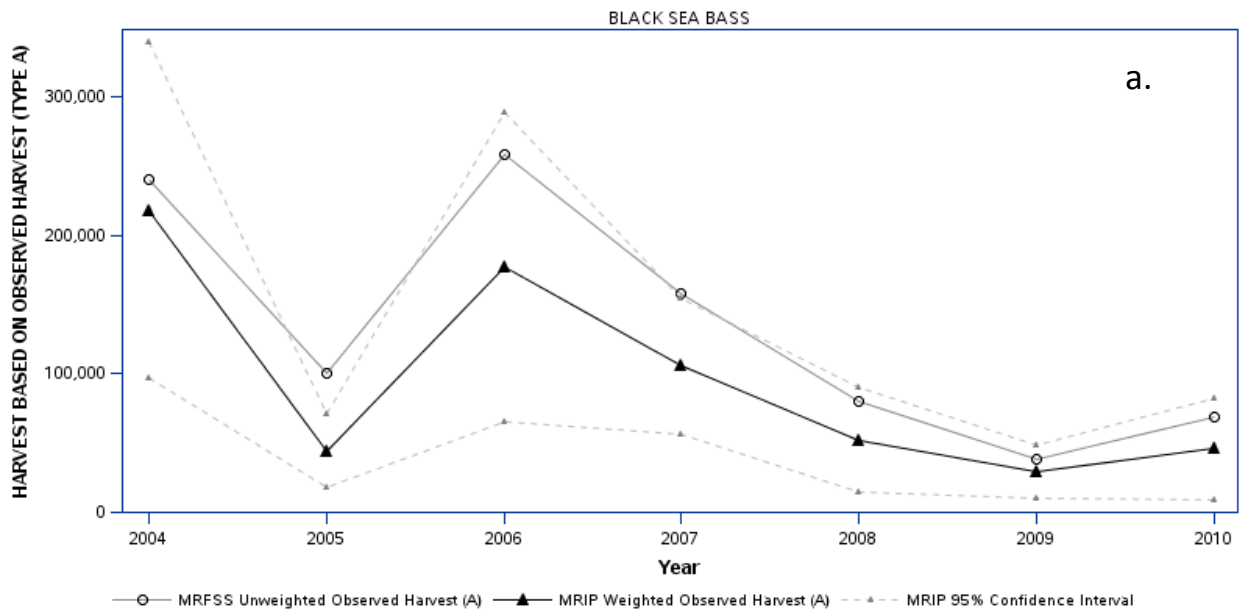
SH mode accounted for approximately 24% of the increase in MRIP A-catch estimates. Mean A-catch rates were higher at lower pressure category sites compared to higher pressure sites (Table 9). Under MRFSS, the higher catch data from the lower pressure category sites were underrepresented, or down-weighted, by over 5% while the lower catch rate data were overrepresented by the same percentage. This difference led to an overall increase in SH mode striped bass A-catch estimates in New York.

Table 9. New York MRIP SH Mode Striped Bass A-Catch Rates by Collapsed Site Pressure Category with % of Total MRIP and MRFSS Weight, 2004-2010

Pressure Category	Mean A-Catch Rate	% of Total MRIP Sample Weights	% of Total MRFSS Relative Weighting	Difference (MRFSS – MRIP)
Low: 0-3	0.023	79.6	74.4	-5.2
High: 4-7	0.013	20.4	25.6	+5.2

### South Atlantic Region: Black Sea Bass

In the South Atlantic region, revised MRIP estimates of black sea bass observed harvest (A-catch) and unobserved releases (B2-catch) were systematically smaller than the original MRFSS estimates in South Carolina from 2004-2010. Over this time period, the A-catch differences were relatively consistent with differences more recent years being somewhat smaller than earlier years (Figure 3a). For B2-catch, differences were more variable ranging from the smallest in 2008 to the largest in 2007 (Figure 3b).





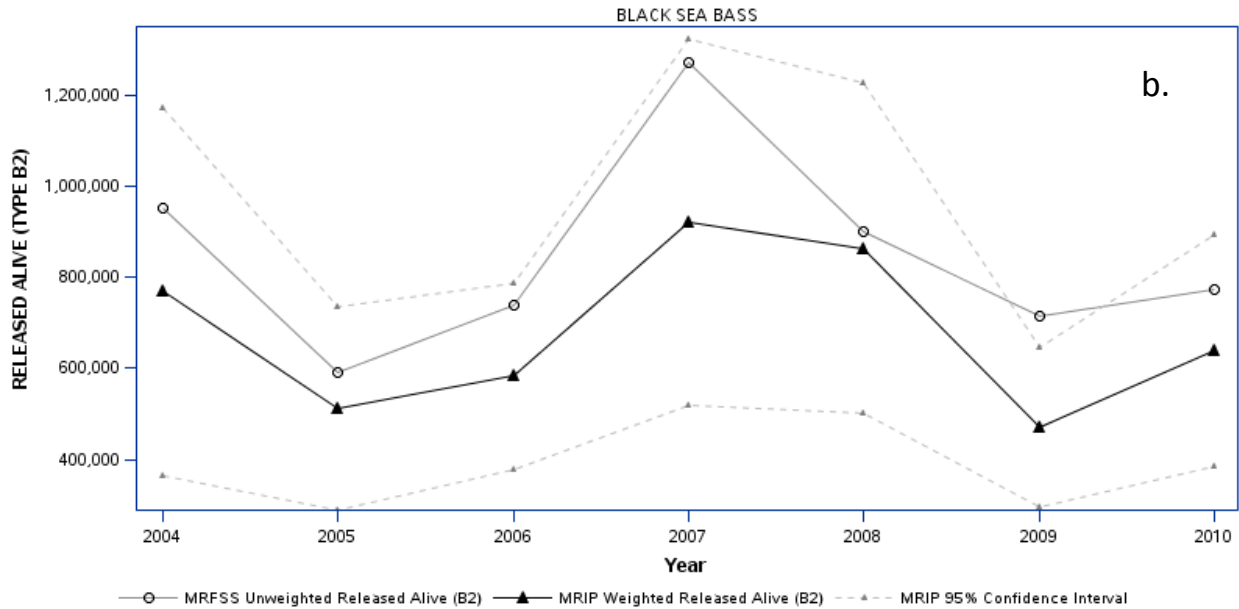


Figure 3. MRFSS and MRIP black sea bass catch estimates for South Carolina, 2004-2010. Panels: (a) Observed harvest A-catch, (b) Released alive B2-catch

The total difference in A-catch between South Carolina MRFSS and MRIP 2004-2010 estimates was just over 272 thousand fish (Table 10). For B2-catch, the total difference was approximately 1.2 million fish. Private boat fishing mode (PR) accounted for over 90% of the differences in both A and B2-catch. Given the relatively minor differences in shore and charter modes, the remaining analysis focuses on PR mode.

Table 10. MRFSS and MRIP Black Sea Bass A and B2-Catch Estimates in South Carolina, 2004-2010, with Differences by Mode

	A Observed Harvest (No. Fish)		B2 Unobserved Releases (No. Fish)	
MRFSS	944,013		5,943,138	
MRIP	671,884		4,760,639	
Differences (MRFSS – MRIP)				
Total	272,129		1,182,498	
By Mode	Shore	-208 (-0.1%)	-19,307 (-1.6%)	
	Charter	26,733 (9.8%)	63,935 (5.4%)	
	Private	245,604 (90.3%)	1,137,870 (96.2%)	

Total and annual differences in black sea bass PR A and B2-catch estimates were primarily due to differences in mean catch rate estimates. In almost every year, MRIP mean A and B2-catch per trip estimates were smaller than MRFSS (Table 11), the one exception being A-catch in 2010 when the MRIP and MRFSS means were very similar. Differences in A-catch means ranged from -0.001 in 2010 to 0.070 in 2006. B2 differences were slightly larger in comparison, ranging from 0.031 in 2008 to 0.340 in 2007.

Table 11. Annual MRFSS and MRIP Mean A and B2-catch per trip for South Carolina PR Mode with Differences

Year	MRFSS A Mean/Trip	MRIP A Mean/Trip	A Difference (MRFSS – MRIP)	MRFSS B2 Mean/Trip	MRIP B2 Mean/Trip	B2 Difference (MRFSS – MRIP)
2004	0.183	0.139	+0.044	0.843	0.657	+0.183
2005	0.075	0.034	+0.041	0.481	0.436	+0.045
2006	0.208	0.139	+0.070	0.641	0.516	+0.125
2007	0.111	0.058	+0.053	1.112	0.772	+0.340
2008	0.059	0.042	+0.017	0.763	0.732	+0.031
2009	0.018	0.013	+0.005	0.594	0.365	+0.229
2010	0.021	0.022	-0.001	0.623	0.513	+0.110
2004-2010	0.090	0.060	+0.031	0.674	0.532	+0.142

The systematic differences in mean A-catch per trip were a direct result of differences between sites in South Carolina where trips with black sea bass A-catch were encountered and sites with no black sea bass A-catch intercepts. While fewer in number, sites with A-catch trips were far more productive averaging 687 intercepts from 2004-2010 compared to only 217 intercepts in the same time period for the zero sites (Table 12). Further, A-catch sites had a slightly higher average pressure category, 4.62, compared to zero sites at 4.12. These two factors resulted in catch data from A-catch sites having more relative weight or influence in MRFSS estimation, where A-catch site data received over 51% of the relative weight. In revised MRIP estimation, the same catch data received just under 45% of the sample weight, indicating that A-catch data had been overrepresented, or up-weighted, in MRFSS estimation by approximately 7%.

Table 12. South Carolina Site Characteristics for Sites with Black Sea Bass (BSB) A-catch and Zero Sites with no A-catch, 2004-2010

	Unique Site Count	Avg. Intercepts per Site	Avg. Site-Day Pressure Category	% of Total MRFSS Relative Weighting	% of Total MRIP Sample Weights	Difference (MRFSS – MRIP)
A BSB Sites	58	687	4.62	51.6	44.7	+6.9
Zero Sites	164	217	4.12	48.4	55.3	-6.9

Differences between sites with B2 black sea bass catch trips and zero sites without B2 black sea bass trips were very similar to those reported for A-catch. B2-catch sites were more productive from 2004-2010 averaging 456 intercepts compared to just 252 at the zero sites (Table 13). Although the difference was very minor, B2-catch sites still had a higher average site-day pressure category. Under MRFSS estimation, catch data from B2-catch sites received over 56% of the relative weighting from 2004-2010. In revised MRIP estimation, the same catch data received just over 50% of the total sample weighting, indicating that MRFSS had overrepresented the catch data from B2 black sea bass sites by about 6%.

Table 13. South Carolina Site Characteristics for Sites with Black Sea Bass B2-catch and Zero Sites with no B2-catch, 2004-2010

	Unique Site Count	Avg. Intercepts per Site	Avg. Site-Day Pressure Category	% of Total MRFSS Relative Weighting	% of Total MRIP Sample Weights	Difference (MRFSS – MRIP)
B2 BSB Sites	96	456	4.39	56.5	50.1	+6.4
Zero Sites	126	252	4.37	43.5	49.9	-6.4

### Gulf of Mexico Region: Red snapper

In the Gulf of Mexico region, revised MRIP estimates of red snapper observed harvest (A-catch) were generally larger than the original MRFSS estimates for the West coast of Florida from 2004-2010. Over this time period, the annual differences were variable with MRIP estimates exceeding MRFSS estimates in six out of seven years (Figure 4). The total difference in A-catch between MRFSS and MRIP 2004-2010 estimates was nearly 563 thousand fish (Table 14). Private boat fishing mode (PR) accounted for over 96% of the difference.

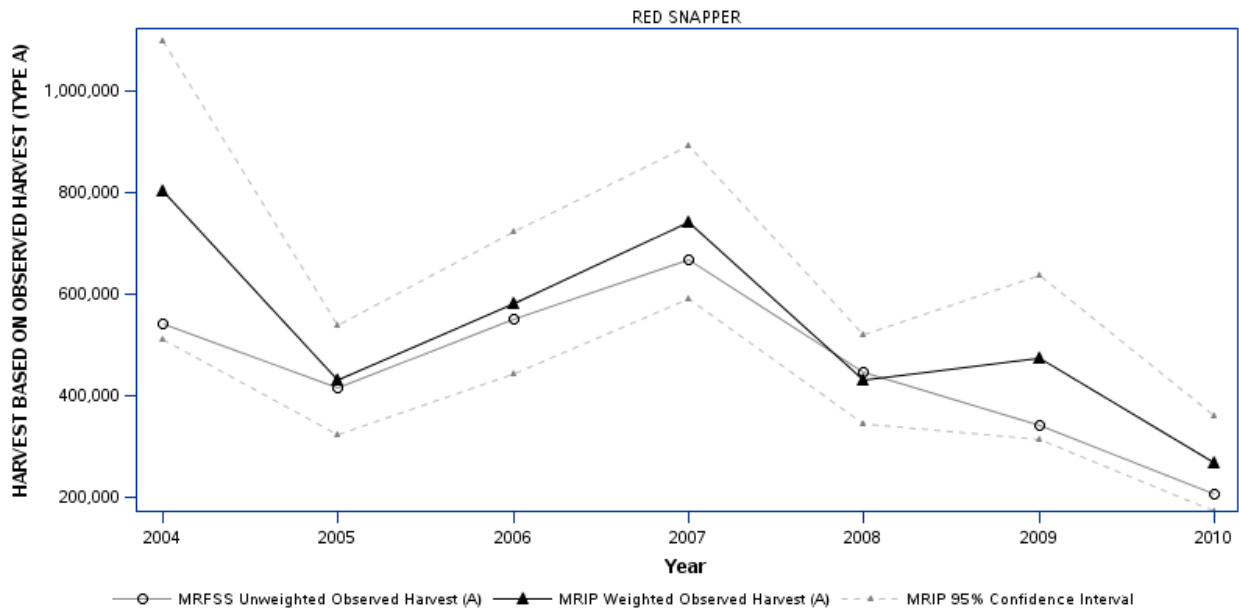


Figure 4. MRFSS and MRIP Red Snapper Observed Harvest (A-catch) estimates for the West coast of Florida, 2004-2010

Table 14. MRFSS and MRIP Red Snapper A-Catch Estimates in West coast of Florida, 2004-2010, with Differences by Mode

		A Observed Harvest (No. Fish)	
MRIP		3,731,019	
MRFSS		3,168,070	
Differences (MRFSS – MRIP)			
	Total	-562,946	
	By Mode		
	Shore	-729	(0.1%)
	Charter	-19,028	(3.4%)
	Private	-543,189	(96.5%)

PR mode mean A-catch per trip was higher on average for trips intercepted at lower pressure category sites compared to higher pressure sites. Mean A-catch rate at sites with pressure categories 0-3 was 0.047 compared to 0.026 at sites in higher pressure categories 4-7 (Table 15). In MRFSS estimation, A-catch data from lower pressure category sites were underrepresented relative to data from higher category sites. Lower category site data received too little weighting while higher category site data received too much. Revised MRIP estimation corrected the underrepresentation increasing the proportion of total weight in lower pressure categories from 26% in MRFSS to 38%. In doing so, the higher catch rate, 0.047, in lower categories was up-weighted while the lower catch rate, 0.026, in higher categories was down-weighted. Ultimately, the shift in weighting resulted in higher MRIP PR mode A-catch estimates for red snapper.

Table 15. MRIP PR Mode Red Snapper A-Catch Rates in West coast of Florida by Collapsed Site Pressure Category with % of Total MRIP and MRFSS Weight, 2004-2010

Pressure Category	Mean A-Catch Rate	% of Total MRIP Sample Weights	% of Total MRFSS Relative Weighting	Difference (MRFSS – MRIP)
Low: 0-3	0.047	38.0	26.2	-11.8
High: 4-7	0.026	62.0	73.8	+11.8

Revised MRIP estimates of red snapper unobserved harvest (B1-catch) and unobserved releases (B2-catch) were also generally larger than the original MRFSS estimates for the West coast of Florida from 2004-2010. MRIP B1-catch estimates were larger in every year except 2010 (Figure 5a). MRIP B2-catch estimates were larger than MRFSS in every year with differences in more recent years (2008-2010) being somewhat smaller than in earlier years (Figure 5b).

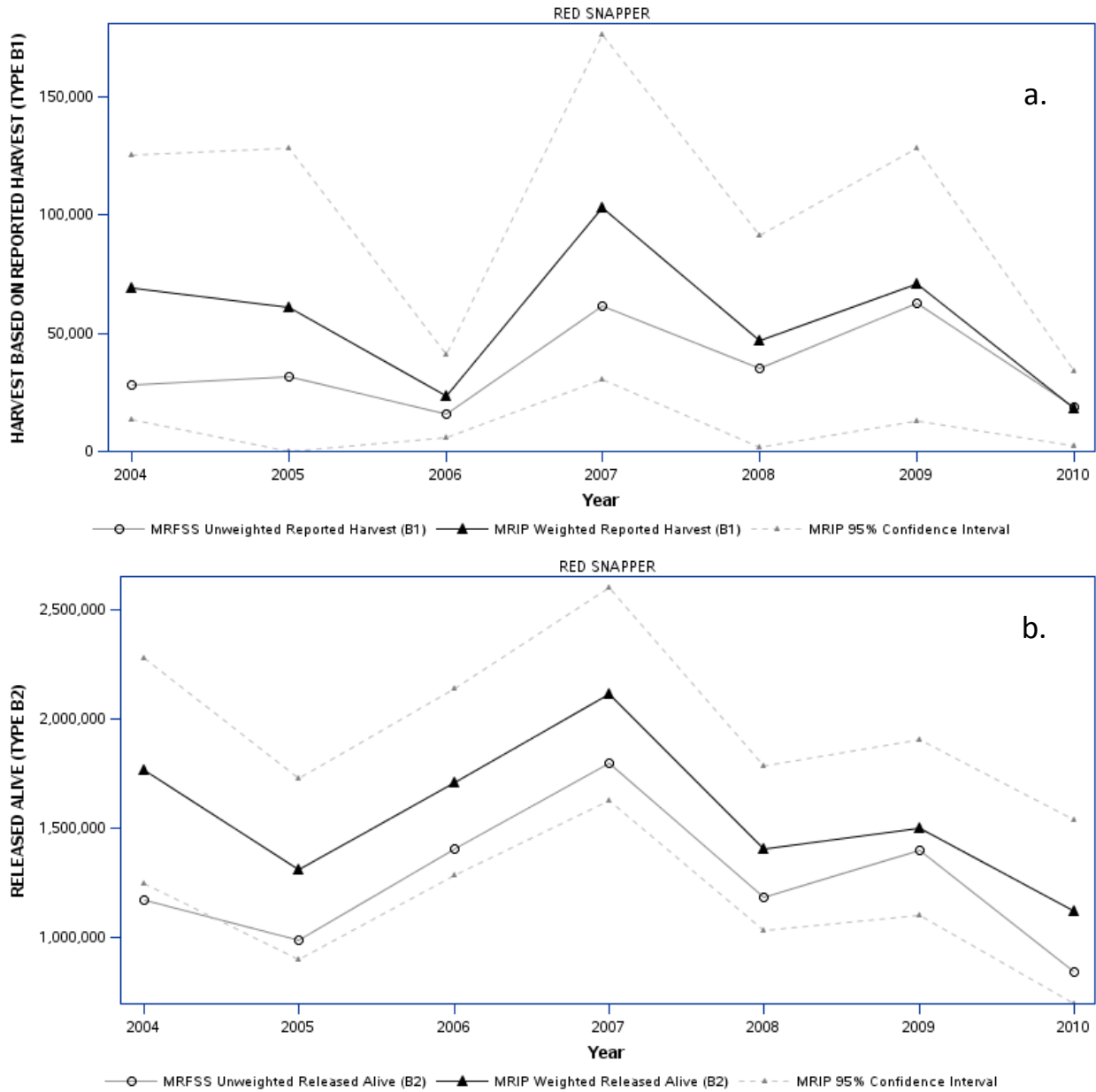


Figure 5. MRFSS and MRIP red snapper catch estimates for the West coast of Florida, 2004-2010. Panels: (a) Reported harvest B1-catch, (b) Released alive B2-catch

The total difference in red snapper B1-catch estimates between MRFSS and MRIP 2004-2010 was just over 139 thousand fish (Table 16). For B2-catch, the total difference was over 2.1 million fish. Private boat fishing mode (PR) accounted for all of the increases in B1 and B2-catch estimates.

Table 16. MRFSS and MRIP Red Snapper B1 and B2-Catch Estimates in West coast of Florida, 2004-2010, with Differences by Mode

	B1 Unobserved Harvest (No. Fish)		B2 Unobserved Releases (No. Fish)	
MRIP	392,643		10,920,365	
MRFSS	253,589		8,772,851	
Differences (MRFSS – MRIP)				
Total	-139,057		-2,147,517	
By Mode	Shore	0	+15,585	(-0.7%)
	Charter	+1,828 (-1%)	+15,228	(-0.7%)
	Private	-140,885 (101%)	-2,178,330	(101.4%)

As with A-catch, red snapper mean B1 and B2-catch per trip were higher on average for trips intercepted at lower pressure category sites compared to higher pressure sites. Mean B1-catch rate at sites with pressure categories 0-3 was 0.009 compared to 0.004 at sites in higher pressure categories 4-7 (Table 17). For B2-catch, the means were 0.185 and 0.089 for low and high pressure sites, respectively. Revised MRIP estimation increased the proportion of total survey weight in lower pressure categories from 26% in MRFSS to 38%, an increase of approximately 12%. Shifting weight from lower to higher catch rates resulted in higher MRIP PR mode B1 and B2-catch estimates for red snapper.

Table 17. MRIP PR Mode Red Snapper B1 and B2-Catch Rates in West coast of Florida by Collapsed Site Pressure Category with % of Total MRIP and MRFSS Weight, 2004-2010

Pressure Category	Mean B1-Catch Rate	Mean B2-Catch Rate	% of Total MRIP Sample Weights	% of Total MRFSS Intercept Weighting	Difference (MRFSS – MRIP)
Low: 0-3	0.009	0.185	38.0	26.2	-11.8
High: 4-7	0.004	0.089	62.0	73.8	+11.8

## Summary & Conclusions

A primary change made in the transition from MRFSS to MRIP estimation was the incorporation of complex sample weights. Complex sample weights were incorporated to more accurately represent the multistage cluster design of the intercept survey. A major aspect of the intercept survey design that was ignored in MRFSS estimation was the unequal selection probabilities of site-day sample assignments. These unequal probabilities were calculated from the site pressure categories where higher pressure categories equated to higher selection probabilities. As selection probabilities are the inverse or reciprocal of sample weights, the higher pressure category sites should have received less weight than the lower pressure sites. However, this was not the case because MRFSS estimation assumed simple random sampling and equal weighting. Further, trips intercepted at high activity sites, where many interviews were obtained, were generally overrepresented under MRFSS relative to trips intercepted at low activity sites where far fewer interviews were obtained during 2004-2010.

For this change to result in systematic differences in catch estimates for a given species, the catch data for that species must, in general, have been correlated or associated with site-day selection probability

(and therefore site pressure category). When catch data are associated with site pressure category, mean catch per trip will differ systematically between higher and lower pressure sites. In cases where catch rates at low pressure sites were less than high pressure sites, MRFSS estimation overestimated catch estimates by down-weighting the lower catch rates at lower pressure sites. When catch rates were higher at low pressure sites compared to high pressure sites, then MRFSS underestimated catch estimates.

In the four example cases reviewed, PR mode catch data appeared to be associated with site pressure category. For Atlantic cod and black sea bass, catch rates were lower at low pressure sites than at high pressure sites. Since sample weight was shifted from high to low pressure sites in MRIP estimation, resulting catch estimates for Atlantic cod and black sea bass decreased relative to MRFSS estimates. Conversely, striped bass and red snapper catch rates were higher at low pressure sites, so their MRIP estimates increased from MRFSS when sample weight shifted from high to low pressure sites.

For New York CH mode, striped bass catches changed due in part to variable increases in catch rates coinciding with more systematic increases in effort. These increases in effort resulted from off-frame CH vessels being intercepted more frequently at low pressure sites relative to higher pressure sites. MRFSS had underrepresented these off-frame trips at the lower pressure sites leading to an underestimation of the CH effort expansion factors. MRIP weighting corrected the underrepresentation of lower pressure site data resulting in larger CH effort expansion factors and effort estimates and larger catch estimates in years where increased effort was not offset by decreased catch rate.

While it appears that the change in sample weights from MRFSS to MRIP were the primary cause of systematic differences in these four examples, the effects of removing alternate mode data (another substantial change from MRFSS to MRIP) should still be considered for other species. Further, results here indicate that PR mode generally accounted for most systematic differences. That may hold for other species as well, but differences in all modes should be evaluated for other species, particularly those with sizeable catches from inland waters where SH mode would be more prevalent.