Fishery Independent Chevron Trap Index Information for the SEDAR 53 Red Grouper Standard Assessment

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With SEFIS data provided by Christina Schobernd

SEDAR53-WP04

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This is SEDAR53-WP04
and MARMAP/SEA<AP-SA Reef Fish Survey Technical Report # 2016-008

The combined MARMAP, SEAMAP-SA, and SEFIS Fishery Independent Reef Fish Survey information for the SEDAR 53 Red Grouper Standard Assessment were submitted to the SEDAR 53 data complier and assessment lead on September 9, 2016. These data included the updated chevron trap (CHV) index (File name: (SCDNR) SEDAR53 fish indep CHV index GLM_INPUT 9-11-16.xlsx), the accompanying age and length compositions, and trip information (File name: (SCDNR) SEDAR53 fish indep CHV index Age and Length Comps 9-1-16.xlsx). We also provided a figure with the index time series. Ages, lengths, and percentage positive traps were updated through the terminal year (2015) and included data from 1990 through 2015 from the chevron trap catches.

Based on the TORs of this standard assessment, as well as panel discussions during various assessment webinars the provided information:

- Included age data based in increment count for consistency with SEDAR 19 (Table 1 A, B and D),
- Included lengths in mm total length in 10 mm (midpoint) bins, e.g. the first bin range is 235-244 mm (Table 1 C and D),
- Did not include an update on reproductive information, growth parameters, meristic conversions, or other life history information.
- Included an index of relative abundance based on a delta GLM standardization (Table 2 and Figure 1). See further details below.

Table 1A Length compositions

Count in Length Bins by Year																											
	Year																										
Total Length (10 mm bins)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
240			1																								1
250																											
260																											
270			1												1												2
280															1												1
290			1												3												4
300														1	3												4
310													1	2	2												5
320			1	2			2	1						1	2					1							10
330			1									1															2
340								1					2			1								1			5
350				1				3				1	1		1	1								1			9
360				2				1				2									1			1			7
370				2					1			1		2			1	1			2			1			11
380				4				1	1			4	1		1				1					1		1	15
390								2	1			1	1	1	1	1					2						10
400				2				1		1		2		1	1	4					1			1			14
410					1			2	1	3		2		1	1		2				2						15
420								3	1	1		3		4	2	2	2				5			3	1		27
430		1		2	2				1		1		1	1		1	3							1			14
440					4			5	3				1	1			3				1			2			20
450								1	7			1				1	6	1			1			2			20
460					3		1	1	5			1	4	2	1		2	2		1	1		1	4			29
470					4			1	7						2		5	2			1	2		2			26
480			1		3			3	9			1	2	2			2	4		1	3	1		1	1	1	35
490			1	1	2			2	8	1			3	1	2						1		1	1			24
500			1		4			2	8	2			3		4	1					2		3	3			33
510					2		1	3		2	1	1	5	1	3			3				2	1	1	1		27
520			1			2			3	5			2		2	1		6			1			2			25
530			1		3	1			3	4	1		2	2	1		2	4					1		1		26
540		1		1	1			1		4	1	1		2				3			1	1	1				18
550			3						4	5			2	1			2	1									18
560									2	1			1		1	1		4	3			1	3	1			18
570		1	1		1				4	1		2		1	1	1	1	2		1			1	1		1	20
580				1		2			1	1	1			1			1	1	1		1	1	2				14
590									1	3				2	1	1		1	2			1			1	1	14
600				2		2		1		2	1		1	2		1			1				1		1		15
610			1			1					2			2	1	2	2		1		1		1				14
620	1									2		1						1	1				1	1			8
630									2		5					1		1	3			1	1				14
640										3	3			1		4	1		1	2				1		1	17
650							1				3	2		1					2	3			1	1			14
660	1					1	1	1		2	1	1					3	1	3	1	1		1	1			19
670										1	2	2				3	2			2			1		2	1	16
680							1			2	6	1			1	1	2		1	1					4	1	21
690								2	2		1										1			2	3		11
700							2				5	4					1		1	1		2		1	2		19
710								1	1	1			2						1	1	5		1		2	1	16
720									1		2	2						1	1	1	1	1			2		12
730											2		1					1		2	2		1		2	1	12
740																									2		2
750							1		1			1						1		1	1				2	2	10
760													1						1			2	3			2	9
770																					2	1	3		1	1	8
780								1		1				1	1	1						1	1	3		4	14
790																							1		1	2	4
800																		1					2	1	1	2	7
810																	1	1					1		2	4	9
820																							1	1	2	1	5
830																							2			1	3
840																								1	1		2
850																							2			1	3
860																							1		1	1	3
870																											
880																									2		2
890																						1					1
Grand Total	2	3	15	20	30	9	10	40	78	48	38	38	37	37	40	29	44	43	24	19	40	18	40	43	38	30	813

Table 1B Length compositions in proportion.

Proportion of Length Bins by Year																											
	Year																										
Total Length (10 mm bins)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
240	0	0	0.0667	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0012
250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
260	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
270	0	0	0.0667	0	0	0	0	0	0	0	0	0	0	0	0.0250	0	0	0	0	0	0	0	0	0	0	0	0.0025
280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0250	0	0	0	0	0	0	0	0	0	0	0	0.0012
290	0	0	0.0667	0	0	0	0	0	0	0	0	0	0	0	0.0750	0	0	0	0	0	0	0	0	0	0	0	0.0049
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0270	0.0750	0	0	0	0	0	0	0	0	0	0	0	0.0049
310	0	0	0	0	0	0	0	0	0	0	0	0	0.0270	0.0541	0.0500	0	0	0	0	0	0	0	0	0	0	0	0.0062
320	0	0	0.0667	0.1	0	0	0.2000	0.025	0	0	0	0	0	0.0270	0.0500	0	0	0	0	0.0526	0	0	0	0	0	0	0.0123
330	0	0	0.0667	0	0	0	0	0	0	0	0	0.0263	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0025
340	0	0	0	0	0	0	0	0.025	0	0	0	0	0.0541	0	0	0.0345	0	0	0	0	0	0	0	0.0233	0	0	0.0062
350	0	0	0	0.05	0	0	0	0.075	0	0	0	0.0263	0.0270	0	0.0250	0.0345	0	0	0	0	0	0	0	0.0233	0	0	0.0111
360	0	0	0	0.1	0	0	0	0.025	0	0	0	0.0526	0	0	0	0	0	0	0	0	0.0250	0	0	0.0233	0	0	0.0086
370	0	0	0	0.1	0	0	0	0	0.0128	0	0	0.0263	0	0.0541	0	0	0.0227	0.0233	0	0	0.0500	0	0	0.0233	0	0	0.0135
380	0	0	0	0.2	0	0	0	0.025	0.0128	0	0	0.1053	0.0270	0	0.0250	0	0	0	0.0417	0	0	0	0	0.0233	0	0.0333	0.0185
390	0	0	0	0	0	0	0	0.05	0.0128	0	0	0.0263	0.0270	0.0270	0.0250	0.0345	0	0	0	0	0.0500	0	0	0	0	0	0.0123
400	0	0	0	0.1	0	0	0	0.025	0	0.021	0	0.0526	0	0.0270	0.0250	0.1379	0	0	0	0	0.0250	0	0	0.0233	0	0	0.0172
410	0	0	0	0	0.0333	0	0	0.05	0.0128	0.063	0	0.0526	0	0.0270	0.0250	0	0.0455	0	0	0	0.0500	0	0	0	0	0	0.0185
420	0	0	0	0	0	0	0	0.075	0.0128	0.021	0	0.0789	0	0.1081	0.0500	0.0690	0.0455	0	0	0	0.1250	0	0	0.0698	0.0263	0	0.0332
430	0	0.3333	0	0.1	0.0667	0	0	0	0.0128	0	0.0263	0	0.0270	0.0270	0	0.0345	0.0682	0	0	0	0	0	0	0.0233	0	0	0.0172
440	0	0	0	0	0.1333	0	0	0.125	0.0385	0	0	0	0.0270	0.0270	0	0	0.0682	0	0	0	0.0250	0	0	0.0465	0	0	0.0246
450	0	0	0	0	0	0	0	0.025	0.0897	0	0	0.0263	0	0	0	0.0345	0.1364	0.0233	0	0	0.0250	0	0	0.0465	0	0	0.0246
460	0	0	0	0	0.1000	0	0.1000	0.025	0.0641	0	0	0.0263	0.1081	0.0541	0.0250	0	0.0455	0.0465	0	0.0526	0.0250	0	0.025	0.0930	0	0	0.0357
470	0	0	0	0	0.1333	0	0	0.025	0.0897	0	0	0	0	0	0.0500	0	0.1136	0.0465	0	0	0.0250	0.1111	0	0.0465	0	0	0.0320
480	0	0	0.0667	0	0.1000	0	0	0.075	0.1154	0	0	0.0263	0.0541	0.0541	0	0	0.0455	0.0930	0	0.0526	0.0750	0.0556	0	0.0233	0.0263	0.0333	0.0431
490	0	0	0.0667	0.05	0.0667	0	0	0.05	0.1026	0.021	0	0	0.0811	0.0270	0.0500	0	0	0	0	0	0.0250	0	0.025	0.0233	0	0	0.0295
500	0	0	0.0667	0	0.1333	0	0	0.05	0.1026	0.042	0	0	0.0811	0	0.1000	0.0345	0	0	0	0	0.0500	0	0.075	0.0698	0	0	0.0406
510	0	0	0	0	0.0667	0	0.1000	0.075	0	0.042	0.0263	0.0263	0.1351	0.0270	0.0750	0	0	0.0698	0	0	0	0.1111	0.025	0.0233	0.0263	0	0.0332
520	0	0	0.0667	0	0	0.2222	0	0	0.0385	0.104	0	0	0.0541	0	0.0500	0.0345	0	0.1395	0	0	0.0250	0	0	0.0465	0	0	0.0308
530	0	0	0.0667	0	0.1	0.1111	0	0	0.0385	0.083	0.0263	0	0.0541	0.0541	0.0250	0	0.0455	0.0930	0	0	0	0	0.025	0	0.0263	0	0.0320
540	0	0.3333	0	0.05	0.0333	0	0	0.025	0	0.083	0.0263	0.0263	0	0.0541	0	0	0	0.0698	0	0	0.0250	0.0556	0.025	0	0	0	0.0221
550	0	0	0.2	0	0	0	0	0	0.0513	0.104	0	0	0.0541	0.0270	0	0	0.0455	0.0233	0.0000	0	0	0	0	0	0	0	0.0221
560	0	0	0	0	0	0	0	0	0.0256	0.021	0	0	0.0270	0	0.0250	0.0345	0	0.0930	0.1250	0	0	0.0556	0.075	0.0233	0	0	0.0221
570	0	0.3333	0.0667	0	0.0333	0	0	0	0.0513	0.021	0	0.0526	0	0.0270	0.0250	0.0345	0.0227	0.0465	0	0.0526	0	0	0.025	0.0233	0	0.0333	0.0246
580	0	0	0	0.05	0	0.2222	0	0	0.0128	0.021	0.0263	0	0	0.0270	0	0	0.0227	0.0233	0.0417	0	0.0250	0.0556	0.05	0	0	0	0.0172
590	0	0	0	0	0	0	0	0	0.0128	0.063	0	0	0	0.0541	0.0250	0.0345	0	0.0233	0.0833	0	0	0.0556	0	0	0.0263	0.0333	0.0172
600	0	0	0	0.1	0	0.2222	0	0.025	0	0.042	0.0263	0	0.0270	0.0541	0	0.0345	0	0	0.0417	0	0	0	0.025	0	0.0263	0	0.0185
610	0	0	0.0667	0	0	0.1111	0	0	0	0	0.0526	0	0	0.0541	0.0250	0.0690	0.0455	0	0.0417	0	0.0250	0	0.025	0	0	0	0.0172
620	0.5	0	0	0	0	0	0	0	0	0.042	0	0.0263	0	0	0	0	0	0.0233	0.0417	0	0	0	0.025	0.0233	0	0	0.0098
630	0	0	0	0	0	0	0	0	0.0256	0	0.1316	0	0	0	0	0.0345	0	0.0233	0.1250	0	0	0.0556	0.025	0	0	0	0.0172
640	0	0	0	0	0	0	0	0	0	0.063	0.0789	0	0	0.0270	0	0.1379	0.0227	0	0.0417	0.1053	0	0	0	0.0233	0	0.0333	0.0209
650	0	0	0	0	0	0	0.1000	0	0	0	0.0789	0.0526	0	0.0270	0	0	0	0	0.0833	0.1579	0	0	0.025	0.0233	0	0	0.0172
660	0.5	0	0	0	0	0.1111	0.1000	0.025	0	0.042	0.0263	0.0263	0	0	0	0	0.0682	0.0233	0.1250	0.0526	0.0250	0	0.025	0.0233	0	0	0.0234
670	0	0	0	0	0	0	0	0	0	0.021	0.0526	0.0526	0	0	0	0.1034	0.0455	0	0	0.1053	0	0	0.025	0	0.0526	0.0333	0.0197
680	0	0	0	0	0	0	0.1	0	0	0.042	0.1579	0.0263	0	0	0.025	0.0345	0.0455	0	0.0417	0.0526	0	0	0	0	0.1053	0.0333	0.0258
690	0	0	0	0	0	0	0	0.05	0.0256	0	0.0263	0	0	0	0	0	0	0	0	0	0.0250	0	0	0.0465	0.0789	0	0.0135
700	0	0	0	0	0	0	0.2000	0	0	0	0.1316	0.1053	0	0	0	0	0.0227	0	0.0417	0.0526	0	0.1111	0	0.0233	0.0526	0	0.0234
710	0	0	0	0	0	0	0	0.025	0.0128	0.021	0	0	0.0541	0	0	0	0	0	0.0417	0.0526	0.1250	0	0.025	0	0.0526	0.0333	0.0197
720	0	0	0	0	0	0	0	0	0.0128	0	0.0526	0.0526	0	0	0	0	0	0.0233	0.0417	0.0526	0.0250	0.0556	0	0	0.0526	0	0.0148
730	0	0	0	0	0	0	0	0	0	0	0.0526	0	0.0270	0	0	0	0	0.0233	0	0.1053	0.0500	0	0.025	0	0.0526	0.0333	0.0148
740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0526	0	0.0025
750	0	0	0	0	0	0	0.1000	0	0.0128	0	0	0.0263	0	0	0	0	0	0.0233	0	0.0526	0.0250	0	0	0	0.0526	0.0667	0.0123
760	0	0	0	0	0	0	0	0	0	0	0	0	0.0270	0	0	0	0	0	0.0417	0	0	0.1111	0.075	0	0	0.0667	0.0111
770	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0500	0.0556	0.075	0	0.0263	0.0333	0.0098
780	0	0	0	0	0	0	0	0.025	0	0.0208	0	0	0	0.0270	0.0250	0.0345	0	0	0	0	0	0.0556	0.025	0.0698	0	0.1333	0.0172
790	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.025	0	0.0263	0.0667	0.0049
800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0233	0	0	0	0	0.05	0.0233	0.0263	0.0667	0.0086
810	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0227	0.0233	0	0	0	0	0.025	0	0.0526	0.1333	0.0111
820	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.025	0.0233	0.0526	0.0333	0.0062
830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0	0	0.0333	0.0037
840	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0233	0.0263	0	0.0025
850	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0	0	0.0333	0.0037
860	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.025	0	0.0263	0.0333	0.0037
870	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
880	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0526	0	0.0025
890	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0556	0	0	0	0	0.0012
Grand Total	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 1C Age compositions and proportion of each age class.

Count of Increments by Year

	Year																										
Increments	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
2			5	1			1	4					4	4	9					1	5		1	3		1	39
3		1	1	15			2	14	6	4	1	17	3	10	9	8		1	1	1	16	2		23	4	1	140
4		2	8	1	29	2		16	45	18	2	3	22	6	16	6	27	1		1	3	5	10	4	1	3	231
5			1	3	1	7	3		17	20	12	3	3	15	2	10	6	33			2	3	9	4	1	1	156
6							2	1	1	5	11	5			2	2	9	5	17					3	7	3	73
7								4	4		9	9	2			2	1	1	3	13	3				11	5	67
8									1	1	2		1						2	2	9	3			1	2	24
9													1		1					1	1	3	7			1	15
10							1															1	4	2			8
11								1								1					1		2	3		2	10
12																	1						3		5	2	11
13																		2					1		4	7	14
14														1									1		3	1	6
15																										1	1
16																							1	1			2
17																						1					1
18																							1				1
Grand Total	0	3	15	20	30	9	9	40	74	48	37	37	36	36	39	29	44	43	23	19	40	18	40	43	37	30	799

Proportion of Increments by Year

	Year																										
Increments	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
2			0.333	0.050			0.111	0.100					0.111	0.111	0.231					0.053	0.125		0.025	0.070		0.033	0.049
3		0.333	0.067	0.750			0.222	0.350	0.081	0.083	0.027	0.459	0.083	0.278	0.231	0.276		0.023	0.043	0.053	0.400	0.111		0.535	0.108	0.033	0.175
4		0.667	0.533	0.050	0.967	0.222		0.400	0.608	0.375	0.054	0.081	0.611	0.167	0.410	0.207	0.614	0.023		0.053	0.075	0.278	0.250	0.093	0.027	0.100	0.289
5			0.067	0.150	0.033	0.778	0.333		0.230	0.417	0.324	0.081	0.083	0.417	0.051	0.345	0.136	0.767			0.050	0.167	0.225	0.093	0.027	0.033	0.195
6							0.222	0.025	0.014	0.104	0.297	0.135			0.051	0.069	0.205	0.116	0.739					0.070	0.189	0.100	0.091
7								0.100	0.054		0.243	0.243	0.056			0.069	0.023	0.023	0.130	0.684	0.075				0.297	0.167	0.084
8									0.014	0.021	0.054		0.028						0.087	0.105	0.225	0.167			0.027	0.067	0.030
9													0.028		0.026					0.053	0.025	0.167	0.175			0.033	0.019
10							0.111															0.056	0.100	0.047			0.010
11								0.025								0.034					0.025		0.050	0.070		0.067	0.013
12																	0.023						0.075		0.135	0.067	0.014
13																		0.047					0.025		0.108	0.233	0.018
14														0.028									0.025		0.081	0.033	0.008
15																										0.033	0.001
16																							0.025	0.023			0.003
17																						0.056					0.001
18																							0.025				0.001
Grand Total	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 1D Information and percent positive traps.

SEDAR 53 Red Grouper Length Comps for fishery-independent chevron trap catches.

-Data summarized from TL measurements in SEDAR53.RG.Internal.LH.MASTER.xlsx

-Gear = 324

-PID = P05, T59, or T60

-Years = 1990-2015

- Bins: Mid-point (e.g. first bin is 235-244mm TL)

-Only samples with TL measurements were included.

-**Count in Length Bins by Year**

-Counts of fish within each length bin by year .

-**Proportion of Length Bins by Year**

-Proportion by year of fish within each length bin.

-**# Positive Traps for Length Comps**

-Count of traps by year from which fish with length measurements were taken for the comps

- Compiled by Wally Bubley and Marcel Reichert 8/31/2016

SEDAR 53 Red Grouper Age Comps for fishery-Independent chevron trap catches.

-Data summarized from increment counts in SEDAR53.RG.Internal.LH.MASTER.xlsx

-Gear = 324

-PID = P05, T59, or T60

-Years = 1990-2015

-Only samples with increment counts were included.

-**Count of Increments by Year**

-Counts of fish by year and number of increments.

-**Proportion of Increments by Year**

-Proportion of fish by year and number of increment counts.

-**# Positive Traps for Age Comps**

-Number of traps by year from which fish with age samples were taken for the comps

- Compiled by Wally Bubley and Marcel Reichert 8/31/2016

# Positive Traps for Age Comps	Year																												
Count of Traps	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
	0	3	5	8	10	6	8	23	26	21	24	20	21	18	21	25	18	21	12	18	27	18	36	40	36	23	488

Index information

The raw data file (**Raw Data File.csv**) extracted from a query of our database went through a filtering procedure in R to remove collections that are missing data fields or fall outside normal sampling durations **(<45 minutes or >150 minutes)**, as well as calculate nominal CPUE from each trap in terms of trap hours and create the covariate "season" (year split into two seasons). This filtering and creation procedure produces the data file that is utilized in R for delta GLM analysis (**GLM_INPUT.csv**).

From this step, bins for covariates are created (Table 2) and the depth range of Red Grouper **(20-109m)** was selected so as not to artificially deflate catch estimates by including depths where Red Grouper do not inhabit. This depth range was created by creating depth bins (5m) and including the shallowest and deepest depths Red Grouper have ever been caught, regardless of gear, from our database and adding another 5m depth bin on both ends, to encompass their range with some room for variability.

The resulting relative abundance index has seen a steady decline since 2005 to some of the lowest CPUE in the time series in recent years (see Figure 1 and Table 3).

Table 2: Delta-GLM covariates (and bins used) used in the development of standardized chevron trap CPUE indices.

	Bin #										
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
					Latitude (°N)						
Red Grouper	<=29	30	31	32	33	>=34					
					Depth (m)						
Red Grouper	<25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	>= 60		
					Bottom Temperature (°C)						
Red Grouper	<=20	21-25	>25								
					Season						
Red Grouper[ab]	Spring	Summer									

a – Model selection AIC scores indicated that the covariate should not be included in the final Bernoulli component of the delta-GLM.
b – Model selection AIC scores indicated that the covariate should not be included in the final positive component of the delta-GLM.

Summary of the backwards selection of covariates from Bernoulli Sub-model and Lognormal Sub-model (which was selected over the Gamma distribution), including degrees of freedom, deviance, and Akaike's Information Criteria (AIC) values for Red Grouper.

Removed	df	Deviance	AIC
Bernoulli Sub-model			
season	1	3162.1	3244.1
<none>		3162.0	3246.0
temperature	2	3169.7	3249.7
depth	8	3275.2	3343.2
latitude	5	3635.8	3709.8
Lognormal Sub-Model			
season	1	93.400	655.79
<none>		93.371	657.64
depth	8	97.095	659.59
temperature	2	94.755	660.40
latitude	5	100.688	682.27

Figure 1

Index of relative abundance for Red Grouper based on MARMAP, SEAMAP-SA and SEFIS Fishery independent data. The vertical error bars are ± 1 the 95% conf. interval.

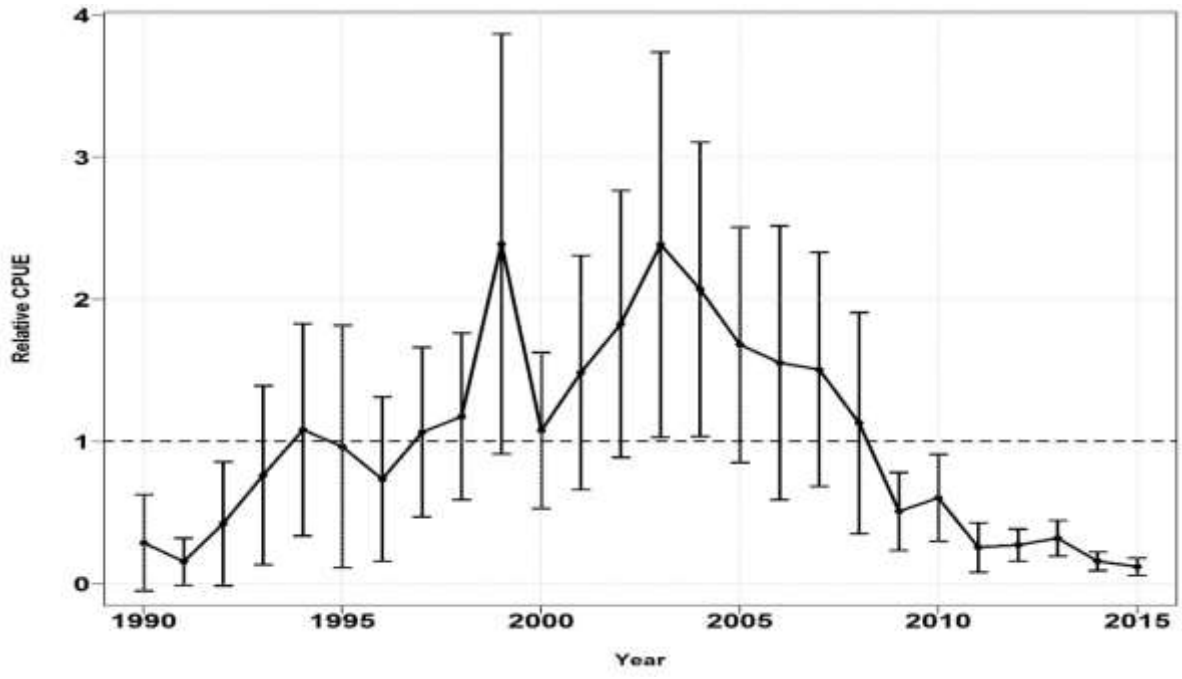

Table 3

Chevron trap nominal CPUE and delta-GLM standardized CPUE for Red Grouper and information associated with chevron trap sets included in standardized CPUE calculation. Both indices were normalized to give relative abundance over time. CV = coefficient of variation, Positive = proportion of included collections positive for the species of interest, n = number of collections which captured individuals, and Normalized = CPUE (number of fish*trap-1*hr-1) normalized to its mean value over the time series.

		Depth		Temperature		Latitude		Date		Nominal CPUE			Delta-GLM Standardized CPUE				
Year	Included Collections	Avg	Range	Avg	Range	Avg	Range	Avg	Range	CPUE	CV	Normalized	Positive	n	CPUE	CV	Normalized
1990	282	35.7	22-93	22.4	18.2-27.8	32.35	30-34	6/1	4/24-8/9	0.01	0.58	0.1	0.01	3	0.009	0.6	0.29
1991	247	35.7	20-95	24.9	15.9-27.5	32.61	31-35	8/7	6/12-9/24	0.01	0.5	0.19	0.02	4	0.005	0.54	0.16
1992	272	34.9	22-62	21.6	16.2-24.5	32.73	30-34	6/5	4/1-8/13	0.04	0.52	0.67	0.02	5	0.013	0.52	0.42
1993	329	38.3	20-94	22.3	17.7-28.2	32.41	30-34	6/23	5/11-8/13	0.04	0.48	0.73	0.02	8	0.024	0.42	0.76
1994	353	41.3	20-93	22.7	18.1-26.9	32.27	31-34	6/22	5/10-8/11	0.05	0.36	0.95	0.03	10	0.034	0.35	1.08
1995	280	38.5	20-60	24.4	20.1-27.9	31.98	30-34	7/4	5/4-10/25	0.02	0.47	0.37	0.02	6	0.03	0.45	0.96
1996	350	38.9	21-100	22.1	14.2-27	32.26	28-34	7/6	4/29-9/16	0.02	0.36	0.29	0.02	8	0.023	0.4	0.74
1997	360	42	21-97	22.4	16.8-27.5	31.84	28-34	7/8	5/5-8/27	0.06	0.3	1.21	0.05	19	0.033	0.28	1.07
1998	386	42.1	20-92	21.2	9.5-28.6	31.97	27-34	6/26	5/5-8/18	0.11	0.25	2.05	0.06	25	0.037	0.25	1.18
1999	203	38	20-75	22.6	17.9-27.3	31.67	27-34	7/19	6/2-9/28	0.13	0.3	2.46	0.09	19	0.074	0.31	2.39
2000	257	39.5	20-101	23.8	18-28.1	32.3	29-34	7/10	5/16-10/17	0.07	0.27	1.32	0.09	22	0.034	0.26	1.08
2001	216	41.5	24-91	23	16-26.7	32.43	28-34	7/17	5/23-9/20	0.1	0.29	1.8	0.08	17	0.046	0.28	1.48
2002	220	40.1	22-94	23.9	15.2-28.3	31.82	28-34	7/25	6/18-9/24	0.11	0.26	2.04	0.09	20	0.057	0.26	1.83
2003	220	40.3	20-92	18.8	13.4-21.8	32.03	27-34	7/20	6/3-8/28	0.1	0.29	1.85	0.08	17	0.074	0.29	2.39
2004	257	43	21-91	20.7	16.7-25.8	32.24	29-34	6/19	5/5-8/4	0.1	0.27	1.83	0.08	21	0.065	0.25	2.07
2005	295	39.1	21-69	22.9	18-28.5	32.02	27-34	7/8	5/3-9/29	0.06	0.21	1.07	0.08	23	0.052	0.25	1.68
2006	287	38.9	20-94	22.3	15-26.6	32.18	27-34	7/21	6/6-9/28	0.1	0.35	1.84	0.06	18	0.048	0.31	1.55
2007	309	39.9	21-92	23	15.3-28.1	32.16	27-34	7/17	5/22-9/24	0.09	0.3	1.66	0.06	19	0.047	0.28	1.51
2008	288	39.2	20-92	21.9	15.2-27.2	32.07	27-34	7/14	5/5-9/30	0.05	0.35	0.98	0.04	12	0.035	0.35	1.13
2009	363	38.6	21-91	22.5	15.4-27.2	32.12	27-34	7/21	5/6-10/1	0.03	0.25	0.55	0.04	16	0.016	0.28	0.51
2010	668	39.7	20-92	22	12.3-29.4	31.39	27-34	8/7	5/4-10/27	0.03	0.24	0.48	0.03	21	0.019	0.26	0.6
2011	668	41.6	20-93	21.5	14.8-28.8	30.81	27-34	7/25	5/19-10/13	0.01	0.3	0.18	0.02	11	0.008	0.35	0.26
2012	1106	41.6	20-106	22	12.9-27.8	31.88	27-35	7/11	4/24-10/10	0.02	0.17	0.44	0.03	37	0.008	0.21	0.27
2013	1308	39	20-100	22	12.4-28.1	31.22	27-35	7/13	4/24-10/4	0.02	0.16	0.38	0.03	39	0.01	0.2	0.32
2014	1435	39.8	20-107	23.3	16.1-29.3	31.95	27-35	7/9	4/23-10/8	0.02	0.17	0.32	0.03	37	0.005	0.21	0.16
2015	1409	39.9	20-106	22.5	13.6-28.4	31.88	27-35	7/4	4/21-10/22	0.01	0.23	0.24	0.02	22	0.004	0.26	0.12