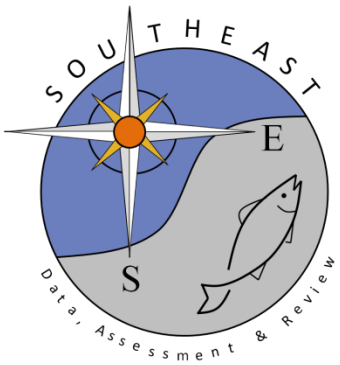
Modifications to the Southeast Reef Fish Survey Chevron Trap Age Compositions for Red Snapper and Gray Triggerfish

Joseph C. Ballenger and Tracey I. Smart

SEDAR41-RW07

Submitted: 31 March 2016

Report documents modifications made to both the Red Snapper and Gray Triggerfish age compositions during the 2016 SEDAR 41 Review Workshop made in light of developments during the Review Workshop.



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Modifications to the Southeast Reef Fish Survey Chevron Trap Age Compositions for Red Snapper and Gray Triggerfish

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Identification of Issue

During the 2016 SEDAR 41 Review Workshop (RW; March 15-18, 2016) convened to review the preliminary base runs of both the Red Snapper and Gray Triggerfish stock assessment an issue was identified with the age compositions provided by the Marine Resources Monitoring, Assessment and Prediction Program (MARMAP; 1990-2008) and the Southeast Reef Survey (SERFS; 2009-2015) for their fishery-independent chevron trap survey (see the SEDAR 41 working papers DW52, DW53, and DW54 for original age compositions). The issue was identified due to extensive discussions concerning the terminal year (2014) age-1 recruitment of Red Snapper being predicted by the Red Snapper base model (see SEDAR 41 South Atlantic Red Snapper Assessment Report Figure 15). The base model run being considered by the RW panel indicated age-1 recruitment in 2014 exceeded predicted age-1 recruitment from all previous years where recruitment was modeled. At the RW, panel members and SCDNR personnel attempted to verify the 2014 age-1 recruitment estimate via examination of newly available 2015 Red Snapper age compositions from the SERFS chevron trap survey. During examinations it was discovered that, inadvertently, the age compositions (see DW53 and DW54) provided for Red Snapper were based on ages derived from annulus counts, not calendar age that take edge type and period of annulus formation into account when assigning individual fish to correct year classes. Upon further examination of the Gray Triggerfish age compositions, the same issue was discovered for this species (see DW52). At the SEDAR 41 Data Workshop (DW; August 4-6, 2015) the life history working group recommended the use of calendar age (or derivatives thereof) for the development of life history parameters and age compositions for both species (see SEDAR 41 South Atlantic Red Snapper DW Report and SEDAR 41 South Atlantic Gray Triggerfish DW Report). It is important to note that the data provided during the DW were accurate with respect to number of fish and number of traps represented by the age compositions annually, with the only difference being the aging metric used during the development of the age compositions.

Concern

The concern with using age compositions based on annulus counts, rather than calendar age, is that you are potentially assigning a portion of your available samples to the incorrect year class. Further, rather than being random in nature, the incorrect assignment is biased due to the method of adjusting annulus counts to calendar ages.

The annulus count to calendar age conversion is based on a species-specific timing of annulus formation and the type of edge (opaque, narrow translucent, or wide translucent) observed from an aging structure obtained from individual fish. If an individual fish is caught prior to the time of annulus formation and their aging structure possesses a wide translucent margin, their calendar age is calculated as annulus count + 1. All other fish have a calendar age that equals annulus count. Hence, depending on the period of year when fish retained for development of age compositions are collected, a significant portion of fish will have a calendar age that is one greater than the annulus count.

By initially using annulus counts the base models from the assessment workshop may have had less power to detect apparent year class strength based on the combined age compositions from all surveys. Year class strength, as suggested by age compositions, ultimately influences the model estimated year-specific recruitment estimates in a statistical catch-at-age stock assessment model. Further, model

estimated selectivity patterns for the chevron trap survey may have been biased low (higher selectivity at younger ages) based on the initial age compositions based on annulus counts.

Red Snapper

For the SEDAR 41 assessment of Red Snapper the MARMAP and SERFS survey provided age compositions from the chevron trap survey spanning 2005-2014. This full time series was used in a sensitivity analysis, while a restricted age composition representing data from 2010-2014 was used in the base model run.

The Red Snapper age compositions provided during the DW, which were based on annulus counts, can be found in **Table 1**. During the RW, SCDNR personnel provided Red Snapper calendar age compositions for the period 2005-2014 to the assessment lead (**Table 2**). These calendar age compositions were calculated using the criteria defined in SEDAR 24 working paper DW10. The correction primarily affected the calculated proportion at age for Red Snapper with calendar ages of 0-10, particularly at ages 3 and 4 in 2011 (**Table 3**, Figure 1 and **Figure 2**).

Gray Triggerfish

For the SEDAR 41 assessment of Gray Triggerfish the MARMAP and SERFS programs provided age compositions from the chevron trap survey spanning the years 1991 to 2014. This full time series was used in the base model run.

The Gray Triggerfish age compositions provided during the DW, which were based on annulus counts, can be found in Table 4. During the RW, SCDNR personnel provided Gray Triggerfish calendar age compositions for the period 1991-2014 to the assessment lead (Table 5). These calendar age compositions were calculated using the criteria defined in the SEDAR 41 DW Report.

In the case of Gray Triggerfish, this correction affected a higher percentage of the age samples collected by the MARMAP chevron trap survey for the years 1991-2007 (Table 6 and Figure 3). This is because from 1991-2007 the MARMAP program sub-sampled catch for aging using a tally sheet to collect a specific number of Gray Triggerfish from a given length bin. During this period, tally sheets were used for a number of species to facilitate the construction of a robust age-length key for priority species. This tally did not have an inherent temporal component, thus MARMAP field staff retained all individual Gray Triggerfish needed, based on the length tally, until the target number of fish for that length bin were retained. Hence, for the most common lengths encountered, and thus the most common ages encountered, the majority of specimens retained for life history studies and the development of age compositions derived from early in the sampling season. Given that a calendar age conversion is necessary for fish collected between January and June that have a translucent margin, a larger proportion of fish collected from 1991-2007 were subject to a calendar age conversion. To estimate the final age composition in this period, SCDNR staff used an age-length key to estimate the age composition of the population using the observed length composition. In contrast, from 2008-2014 MARMAP and SERFS biologists retained a random sample of (or all) encountered Gray Triggerfish from throughout the sampling season. Thus, the potential for needing a calendar age conversion was more in

line with that observed for Red Snapper, resulting in less of an effect of the conversion on the corrected age compositions (Table 6 and Figure 3).

Table 1: *Age compositions of Red Snapper collected by the SERFS chevron trap survey from 2005-2014. These age compositions are based on annulus count and were originally reported in SEDAR 41 DW53. Value represents proportion at age, such that each column sums to 1.*

	Year									
Age	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0163	0.0016
1	0.0000	0.6667	0.0345	0.0690	0.0000	0.0060	0.0250	0.0505	0.2147	0.1626
2	0.0000	0.1667	0.9310	0.4483	0.1818	0.1317	0.0583	0.3774	0.3125	0.4244
3	0.4167	0.0000	0.0345	0.4483	0.3636	0.4850	0.3333	0.1538	0.1114	0.2244
4	0.2500	0.1667	0.0000	0.0345	0.3636	0.2335	0.3833	0.0889	0.0435	0.0341
5	0.0833	0.0000	0.0000	0.0000	0.0000	0.1138	0.1417	0.1875	0.1005	0.0163
6	0.0833	0.0000	0.0000	0.0000	0.0000	0.0120	0.0417	0.0769	0.0924	0.0325
7	0.1667	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0288	0.0571	0.0407
8	0.0000	0.0000	0.0000	0.0000	0.0909	0.0060	0.0000	0.0024	0.0163	0.0390
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0083	0.0072	0.0000	0.0130
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0027	0.0000
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0120	0.0000	0.0000	0.0082	0.0016
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0054	0.0049
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0072	0.0027	0.0000
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0027	0.0033
15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0048	0.0027	0.0000
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0054	0.0000
17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000	0.0000
19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000	0.0016
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0083	0.0024	0.0000	0.0000
22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0027	0.0000
25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000	0.0000
26	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0027	0.0000
Traps	**7**	**5**	**8**	**11**	**9**	**73**	**70**	**148**	**139**	**150**
Fish	**12**	**6**	**29**	**29**	**11**	**167**	**120**	**416**	**368**	**615**

Table 2: *Age compositions of Red Snapper collected by the SERFS chevron trap survey from 2005-2014. These age compositions are based on calendar age and were originally presented during the SEDAR 41 RW. Value represents proportion at age, such that each column sums to 1.*

	Year									
Age	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.0000	0.6667	0.0000	0.0345	0.0000	0.0060	0.0250	0.0385	0.1766	0.1398
2	0.0000	0.0000	0.9655	0.4138	0.1818	0.0659	0.0250	0.3221	0.2364	0.4081
3	0.3333	0.1667	0.0345	0.5172	0.3636	0.5329	0.0833	0.2139	0.2038	0.2195
4	0.3333	0.1667	0.0000	0.0345	0.3636	0.2455	0.6083	0.0385	0.0707	0.0748
5	0.0833	0.0000	0.0000	0.0000	0.0000	0.1198	0.1583	0.2188	0.0625	0.0163
6	0.0833	0.0000	0.0000	0.0000	0.0000	0.0120	0.0750	0.0817	0.0842	0.0260
7	0.1667	0.0000	0.0000	0.0000	0.0000	0.0000	0.0083	0.0433	0.0951	0.0374
8	0.0000	0.0000	0.0000	0.0000	0.0909	0.0000	0.0000	0.0096	0.0299	0.0407
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0060	0.0000	0.0048	0.0054	0.0244
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0083	0.0024	0.0027	0.0016
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0027	0.0016
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0120	0.0000	0.0000	0.0082	0.0049
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0072	0.0027	0.0000
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0054	0.0016
15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0027	0.0016
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0054	0.0000
17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0048	0.0000	0.0016
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0083	0.0024	0.0000	0.0000
22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0027	0.0000
26	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0027	0.0000
Traps	**7**	**5**	**8**	**11**	**9**	**73**	**70**	**148**	**139**	**150**
Fish	**12**	**6**	**29**	**29**	**11**	**167**	**120**	**416**	**368**	**615**

Table 3: *Differences in calculated proportion at age for the age compositions based on calendar age and annulus count for Red Snapper. Differences are calculated as age and year specific proportion at age based on calendar age – age and year specific proportion at age based on annulus counts. Black boxes with white text indicate cells where proportion at age estimated based on calendar age is less than that estimated based on annulus count. Gray boxes with black text indicate cells where proportion at age estimated based on calendar age is greater than that estimated based on annulus count. Cells missing data represent combinations where there was no change in year specific proportion at age.*

	Year									
Age	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
0									-0.0163	-0.0016
1			-0.0345	-0.0345				-0.0120	-0.0380	-0.0228
2		-0.1667	0.0345	-0.0345		-0.0659	-0.0333	-0.0553	-0.0761	-0.0163
3	-0.0833	0.1667		0.0690		0.0479	-0.2500	0.0601	0.0924	-0.0049
4	0.0833					0.0120	0.2250	-0.0505	0.0272	0.0407
5						0.0060	0.0167	0.0313	-0.0380	
6							0.0333	0.0048	-0.0082	-0.0065
7							0.0083	0.0144	0.0380	-0.0033
8						-0.0060		0.0072	0.0136	0.0016
9						0.0060	-0.0083	-0.0024	0.0054	0.0114
10						0.0000	0.0083	0.0024		0.0016
11						-0.0120			-0.0054	
12						0.0120			0.0027	
13										
14									0.0027	-0.0016
15								-0.0024		0.0016
16								0.0024		
17										
18								-0.0024		
19								0.0024		
20										
21										
22										
23										
24									-0.0027	
25									0.0027	
26										

Table 4: *Age compositions of Gray Triggerfish collected by the SERFS chevron trap survey from 1991-2014. These age compositions are based on annulus count and were originally reported in SEDAR 41 DW52. Value represents proportion at age, such that each column sums to 1.*

	Year																							
Age	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
0	0.0077	0.0242	0.0195	0.0021	0.0000	0.0016	0.0000	0.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0047	0.0028	0.0000	0.0000	0.0441	0.0042	0.0152	0.0030	0.0044	0.0099	0.0225
1	0.5321	0.2222	0.1368	0.1535	0.1016	0.0664	0.0585	0.0265	0.1238	0.0909	0.2333	0.1923	0.0811	0.1916	0.0167	0.0699	0.0426	0.1066	0.1807	0.1675	0.1095	0.0466	0.1078	0.1148
2	0.2751	0.2995	0.3225	0.2559	0.2351	0.1977	0.1743	0.1117	0.1980	0.1705	0.2148	0.3022	0.1757	0.2850	0.0864	0.1290	0.2017	0.1654	0.3824	0.3503	0.1746	0.1707	0.2937	0.2449
3	0.0643	0.1932	0.2932	0.2985	0.2946	0.2888	0.3027	0.3049	0.2525	0.3068	0.2370	0.1676	0.2973	0.2991	0.2201	0.3011	0.2756	0.2463	0.2689	0.2690	0.2781	0.2239	0.2926	0.2684
4	0.0694	0.1787	0.1107	0.1748	0.2017	0.2502	0.2537	0.3049	0.1931	0.2235	0.2037	0.1401	0.1622	0.1308	0.3538	0.1774	0.2472	0.1765	0.1050	0.1168	0.1923	0.2506	0.1353	0.1670
5	0.0206	0.0483	0.0912	0.0725	0.1089	0.1231	0.1367	0.1742	0.1485	0.1250	0.0778	0.1044	0.2297	0.0467	0.1727	0.2097	0.1335	0.1287	0.0336	0.0609	0.1361	0.1863	0.0990	0.0922
6	0.0154	0.0242	0.0195	0.0192	0.0174	0.0361	0.0376	0.0360	0.0545	0.0455	0.0037	0.0412	0.0270	0.0140	0.0780	0.0591	0.0511	0.0478	0.0210	0.0000	0.0533	0.0399	0.0253	0.0502
7	0.0103	0.0097	0.0065	0.0213	0.0232	0.0246	0.0230	0.0322	0.0248	0.0189	0.0222	0.0412	0.0270	0.0280	0.0529	0.0323	0.0284	0.0441	0.0000	0.0051	0.0237	0.0288	0.0198	0.0256
8	0.0000	0.0000	0.0000	0.0021	0.0102	0.0098	0.0136	0.0038	0.0000	0.0152	0.0074	0.0082	0.0000	0.0000	0.0084	0.0000	0.0199	0.0294	0.0000	0.0051	0.0178	0.0288	0.0121	0.0102
9	0.0051	0.0000	0.0000	0.0000	0.0073	0.0016	0.0000	0.0019	0.0050	0.0038	0.0000	0.0000	0.0000	0.0000	0.0056	0.0108	0.0000	0.0037	0.0042	0.0051	0.0118	0.0089	0.0022	0.0031
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0027	0.0000	0.0000	0.0000	0.0108	0.0000	0.0037	0.0000	0.0051	0.0000	0.0022	0.0000	0.0000
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0028	0.0000	0.0000	0.0037	0.0000	0.0000	0.0000	0.0044	0.0022	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0044	0.0000	0.0010
Traps	**47**	**70**	**112**	**142**	**134**	**166**	**164**	**118**	**60**	**86**	**78**	**102**	**33**	**74**	**99**	**64**	**96**	**64**	**79**	**97**	**116**	**190**	**281**	**304**
Fish	**389**	**207**	**307**	**469**	**689**	**1219**	**958**	**528**	**202**	**264**	**270**	**364**	**74**	**214**	**359**	**186**	**352**	**272**	**238**	**197**	**338**	**451**	**909**	**976**

Table 5: *Age compositions of Gray Triggerfish collected by the SERFS chevron trap survey from 1991-2014. These age compositions are based on calendar age and were originally presented during the SEDAR 41 RW. Value represents proportion at age, such that each column sums to 1.*

	Year																							
Age	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
0	0.0103	0.0192	0.0195	0.0021	0.0044	0.0016	0.0031	0.0057	0.0050	0.0076	0.0296	0.0083	0.0000	0.0514	0.0028	0.0000	0.0085	0.0037	0.0000	0.0000	0.0030	0.0000	0.0000	0.0000
1	0.0591	0.0240	0.0227	0.0085	0.0116	0.0033	0.0021	0.0057	0.0000	0.0000	0.0074	0.0028	0.0000	0.0140	0.0000	0.0108	0.0000	0.1287	0.1723	0.1371	0.0976	0.0355	0.0781	0.0994
2	0.4756	0.2067	0.1169	0.1450	0.1003	0.0673	0.0532	0.0189	0.1188	0.0798	0.1963	0.1791	0.0811	0.1355	0.0167	0.0591	0.0341	0.1581	0.3571	0.3503	0.1746	0.1596	0.2596	0.2080
3	0.2699	0.2981	0.3214	0.2559	0.2195	0.1936	0.1743	0.1117	0.1980	0.1711	0.2148	0.3030	0.1757	0.2804	0.0864	0.1290	0.2017	0.2610	0.2983	0.3147	0.2781	0.2262	0.3223	0.2889
4	0.0643	0.1923	0.2922	0.2985	0.2951	0.2888	0.3027	0.3049	0.2525	0.3080	0.2370	0.1680	0.2973	0.2991	0.2201	0.3011	0.2756	0.1875	0.1008	0.1117	0.1982	0.2461	0.1617	0.1977
5	0.0694	0.1779	0.1104	0.1748	0.2020	0.2502	0.2537	0.3049	0.1931	0.2243	0.2037	0.1405	0.1622	0.1308	0.3538	0.1774	0.2472	0.1287	0.0462	0.0660	0.1391	0.1996	0.1067	0.1066
6	0.0206	0.0481	0.0909	0.0725	0.1090	0.1231	0.1367	0.1742	0.1485	0.1255	0.0778	0.1047	0.2297	0.0467	0.1727	0.2097	0.1335	0.0478	0.0210	0.0000	0.0562	0.0421	0.0330	0.0523
7	0.0154	0.0240	0.0195	0.0192	0.0174	0.0361	0.0376	0.0360	0.0545	0.0456	0.0037	0.0413	0.0270	0.0140	0.0780	0.0591	0.0511	0.0441	0.0000	0.0051	0.0237	0.0399	0.0187	0.0297
8	0.0103	0.0096	0.0065	0.0213	0.0233	0.0246	0.0230	0.0322	0.0248	0.0190	0.0222	0.0413	0.0270	0.0280	0.0529	0.0323	0.0284	0.0294	0.0000	0.0051	0.0148	0.0288	0.0143	0.0133
9	0.0000	0.0000	0.0000	0.0021	0.0102	0.0098	0.0136	0.0038	0.0000	0.0152	0.0074	0.0083	0.0000	0.0000	0.0084	0.0000	0.0199	0.0037	0.0042	0.0051	0.0148	0.0111	0.0033	0.0020
10	0.0051	0.0000	0.0000	0.0000	0.0073	0.0016	0.0000	0.0019	0.0050	0.0038	0.0000	0.0000	0.0000	0.0000	0.0056	0.0108	0.0000	0.0037	0.0000	0.0051	0.0000	0.0022	0.0000	0.0010
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0028	0.0000	0.0000	0.0000	0.0108	0.0000	0.0037	0.0000	0.0000	0.0000	0.0022	0.0022	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0028	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0067	0.0000	0.0010
Traps	**47**	**70**	**112**	**142**	**134**	**166**	**164**	**118**	**60**	**86**	**78**	**102**	**33**	**74**	**99**	**64**	**96**	**64**	**79**	**97**	**116**	**190**	**281**	**304**
Fish	**389**	**208**	**308**	**469**	**688**	**1219**	**958**	**528**	**202**	**263**	**270**	**363**	**74**	**214**	**359**	**186**	**352**	**272**	**238**	**197**	**338**	**451**	**909**	**976**

Table 6: *Differences in calculated proportion at age for the age compositions based on calendar age and annulus count for Gray Triggerfish. Differences are calculated as age and year specific proportion at age based on calendar age – age and year specific proportion at age based on annulus counts. Black boxes with white text indicate cells where proportion at age estimated based on calendar age is less than that estimated based on annulus count. Gray boxes with black text indicate cells where proportion at age estimated based on calendar age is greater than that estimated based on annulus count. Cells missing data represent combinations where there was no change in year specific proportion at age.*

	Year																							
Age	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
0	0.0026	-0.0049	-0.0001		0.0044		0.0031	0.0019	0.0050	0.0076	0.0296	0.0083		0.0467			0.0085	-0.0404	-0.0042	-0.0152		-0.0044	-0.0099	-0.0225
1	-0.4730	-0.1982	-0.1141	-0.1450	-0.0900	-0.0632	-0.0564	-0.0208	-0.1238	-0.0909	-0.2259	-0.1896	-0.0811	-0.1776	-0.0167	-0.0591	-0.0426	0.0221	-0.0084	-0.0305	-0.0118	-0.0111	-0.0297	-0.0154
2	0.2005	-0.0928	-0.2056	-0.1109	-0.1348	-0.1304	-0.1211	-0.0928	-0.0792	-0.0906	-0.0185	-0.1231	-0.0946	-0.1495	-0.0696	-0.0699	-0.1676	-0.0074	-0.0252			-0.0111	-0.0341	-0.0369
3	0.2057	0.1048	0.0283	-0.0426	-0.0752	-0.0952	-0.1284	-0.1932	-0.0545	-0.1357	-0.0222	0.1354	-0.1216	-0.0187	-0.1337	-0.1720	-0.0739	0.0147	0.0294	0.0457		0.0022	0.0297	0.0205
4	-0.0051	0.0136	0.1815	0.1237	0.0933	0.0386	0.0491		0.0594	0.0845	0.0333	0.0279	0.1351	0.1682	-0.1337	0.1237	0.0284	0.0110	-0.0042	-0.0051	0.0059	-0.0044	0.0264	0.0307
5	0.0488	0.1296	0.0192	0.1023	0.0932	0.1272	0.1169	0.1307	0.0446	0.0993	0.1259	0.0361	-0.0676	0.0841	0.1811	-0.0323	0.1136		0.0126	0.0051	0.0030	0.0133	0.0077	0.0143
6	0.0051	0.0239	0.0714	0.0533	0.0916	0.0870	0.0992	0.1383	0.0941	0.0800	0.0741	0.0635	0.2027	0.0327	0.0947	0.1505	0.0824				0.0030	0.0022	0.0077	0.0020
7	0.0051	0.0144	0.0130	-0.0021	-0.0058	0.0115	0.0146	0.0038	0.0297	0.0267	-0.0185	0.0001		-0.0140	0.0251	0.0269	0.0227					0.0111	-0.0011	0.0041
8	0.0103	0.0096	0.0065	0.0192	0.0131	0.0148	0.0094	0.0284	0.0248	0.0039	0.0148	0.0331	0.0270	0.0280	0.0446	0.0323	0.0085				-0.0030		0.0022	0.0031
9	-0.0051			0.0021	0.0029	0.0082	0.0136	0.0019	-0.0050	0.0114	0.0074	0.0083			0.0028	-0.0108	0.0199				0.0030	0.0022	0.0011	-0.0010
10	0.0051				0.0073	0.0016		0.0019	0.0050	0.0038		-0.0027			0.0056									0.0010
11												0.0028			-0.0028	0.0108						-0.0022		
12															0.0028							0.0022		

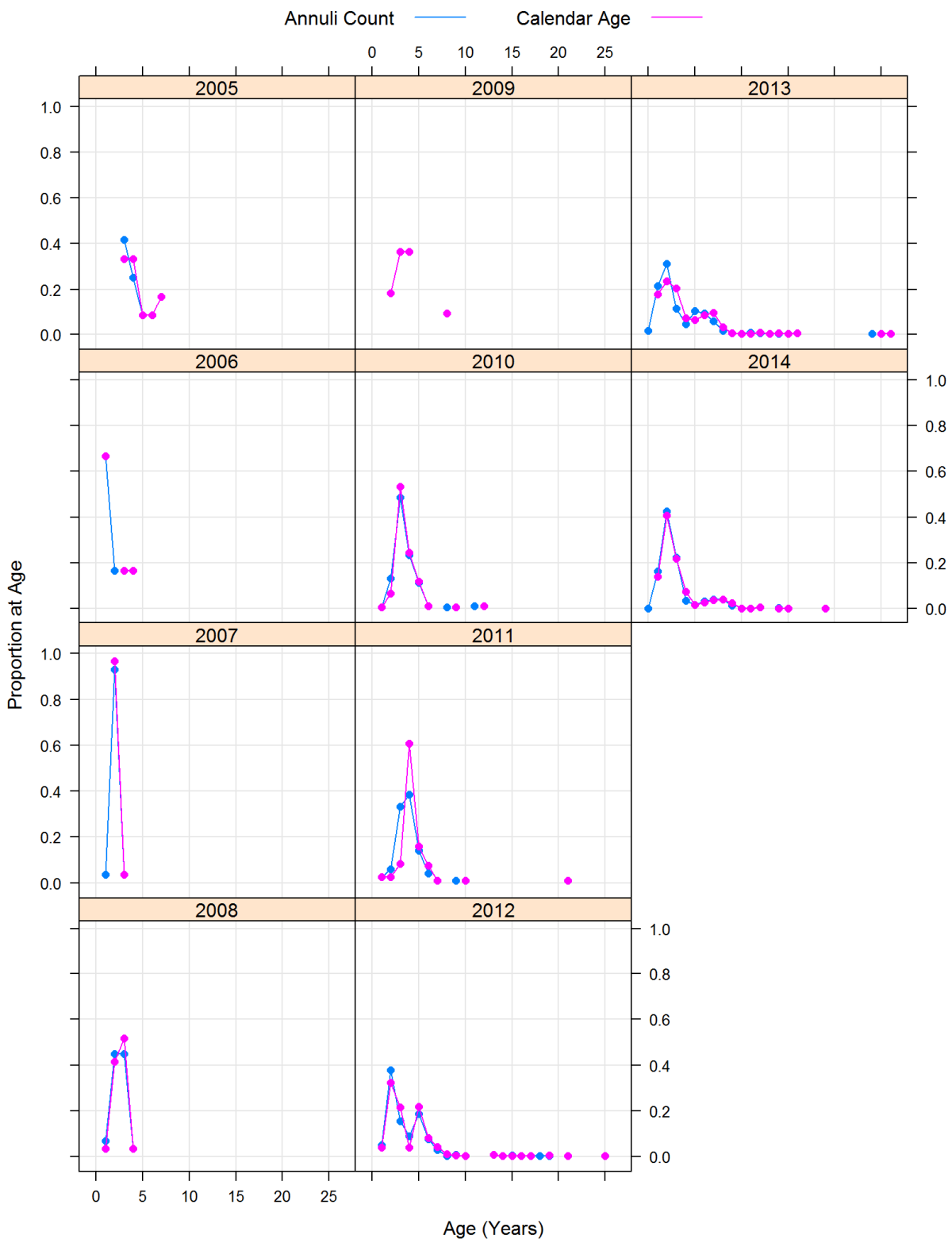

Figure 1: *Age compositions of Red Snapper captured via the SERFS chevron trap survey from 2005-2014. Depicted are the age compositions as estimated based on annulus count and calendar age. Note that the age compositions based on calendar age are shifted to slightly older ages, most notably in 2011.*

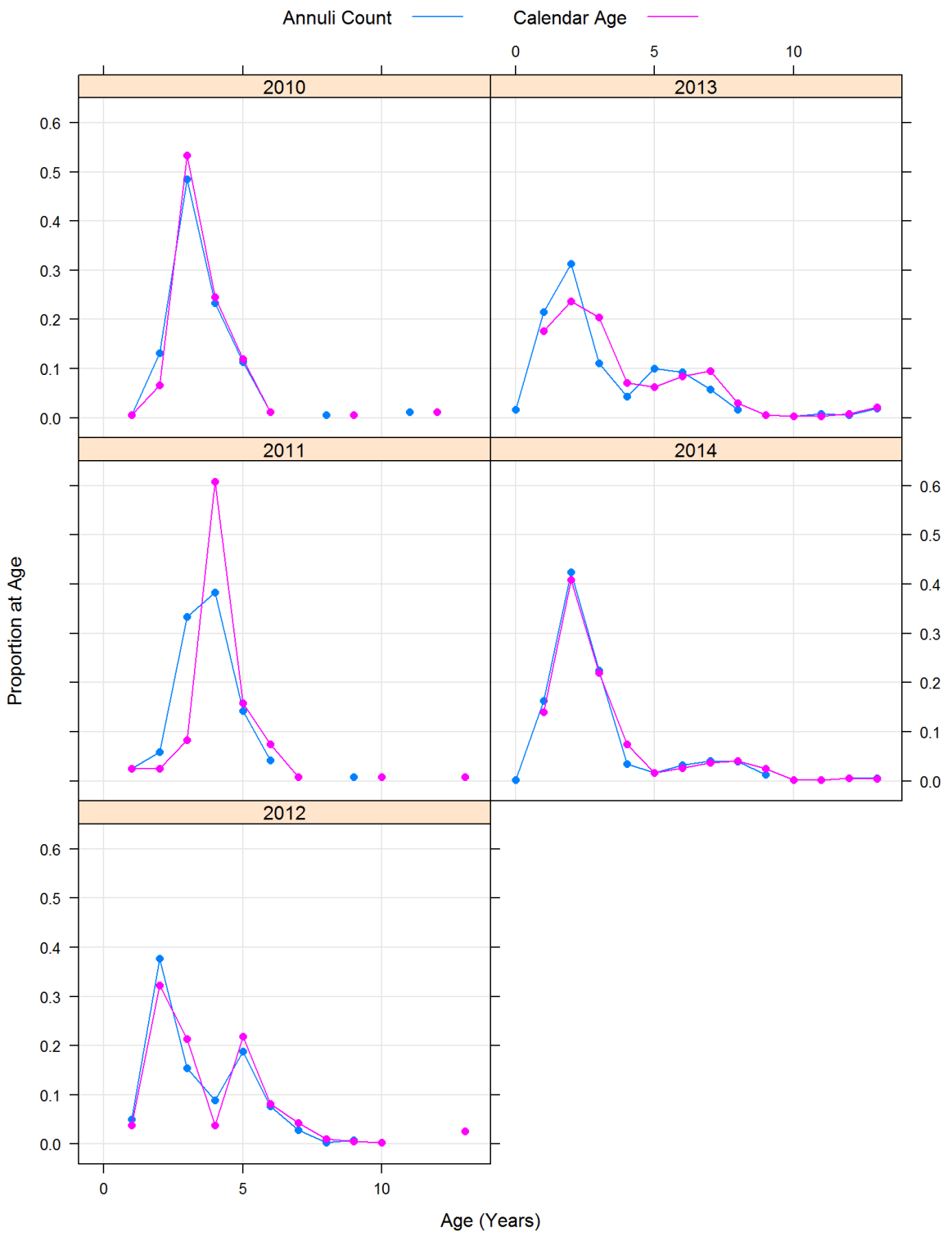

Figure 2: *Age compositions of Red Snapper captured via the SERFS chevron trap survey from 2010-2014 with age 13 compositions representing the proportion of fish age-13+ in a given year. Depicted are the age compositions as estimated based on annulus count and calendar age. Note that the age compositions based on calendar age are shifted to slightly older ages, most notably in 2011.*

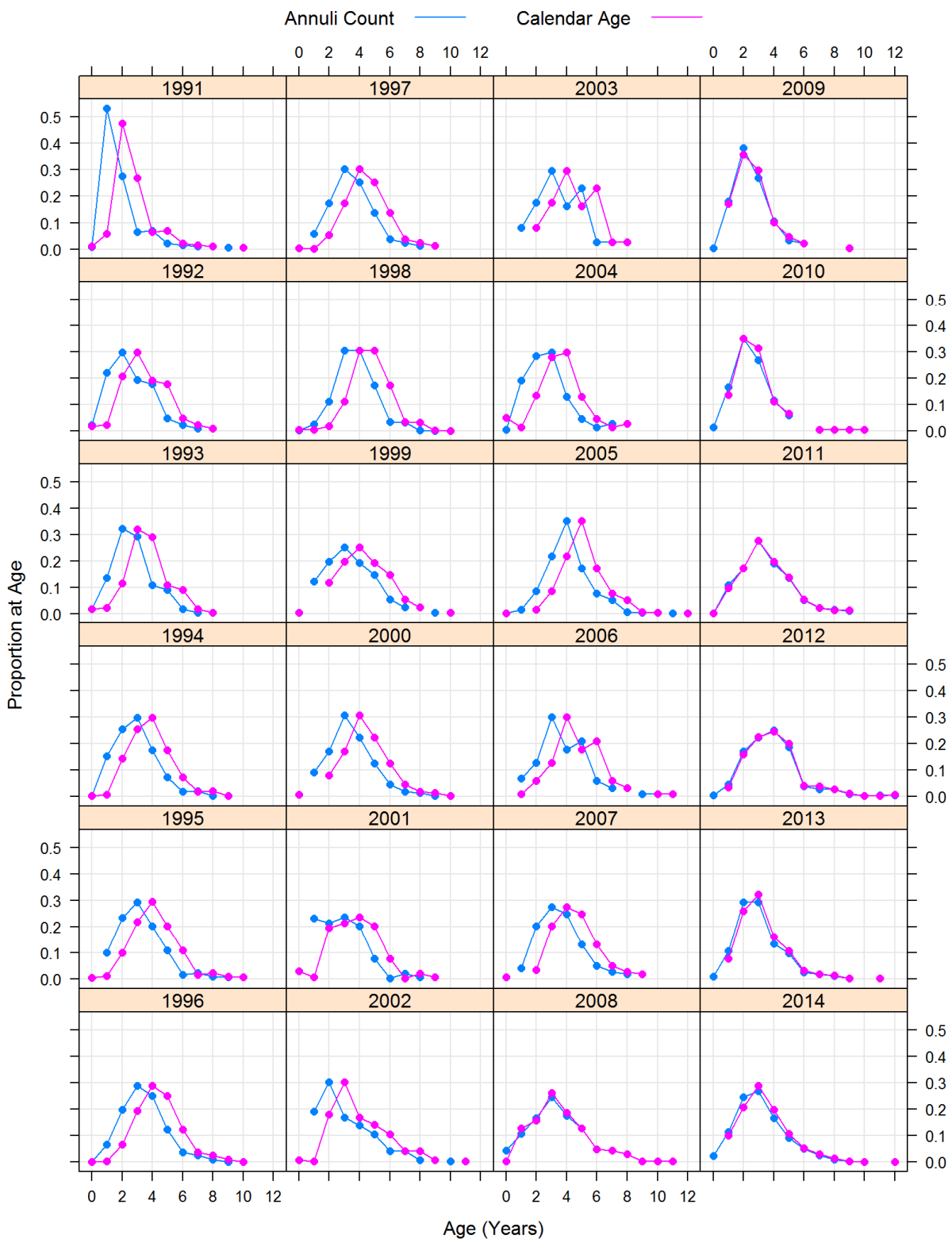

Figure 3: *Age compositions of Gray Triggerfish captured via the SERFS chevron trap survey from 1991-2014. Depicted are the age compositions as estimated based on annulus count and calendar age. Note that the age compositions based on calendar age are shifted to older ages for the years 1991-2007.*