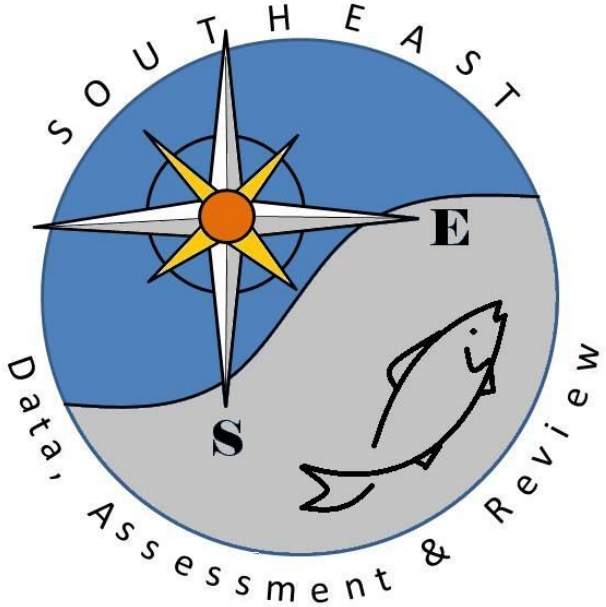
Age Composition of Red Snapper Bycatch in the Gulf of Mexico Shrimp Fishery, 1997-2011

Brian C. Linton

SEDAR31-AW05

11 January 2013



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Please cite as:

Linton, B.C. 2013. Age Composition of Red Snapper Bycatch in the Gulf of Mexico Shrimp Fishery, 1997-2011. SEDAR31-AW05. SEDAR, North Charleston, SC. 14 pp.

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Sustainable Fisheries Division Contribution SFD-2013-001

Estimates of the age composition of red snapper bycatch in the shrimp fishery were obtained using the methods developed by Kate Andrews and John Walter for the 2009 Gulf of Mexico red snapper assessment update (SEDAR 2009).

The data are from the shrimp fishery observer program (housed at the NMFS laboratory in Galveston, TX). These data are sample lengths (mm) from the bycatch of young red snapper and are available for years 1997 through 2011. For this analysis, the length data were partitioned into 'cells' using the following associated strata: year, trimester, and zone (East or West). The data are recorded as fork lengths, standard lengths, and total lengths, and we chose to use fork lengths arbitrarily. As proportions are being examined, the type of length measurement used will not matter quantitatively. The separation of seasons into trimesters and the areas into zone is consistent with the manner in which shrimp bycatch is estimated (Linton 2012).

The observer data comes from both experimental tows—shrimp tows with BRDs—and control tows—shrimp tows without BRDs. There were some observed differences between the experimental and control length frequencies in some years. However, for consistency with bycatch age composition obtained by Scott Nichols for use in SEDAR 7 (Nichols 2004) and by Andrews and Walter for use in the 2009 assessment update (SEDAR 2009), both sets of data were used.

The observer length frequencies were split into ages 0, 1 and 2+ based upon visual observation of modes similar to the method employed by Nichols (2004) (Figure 1). Modes were clearly identifiable in some trimesters and years. When a break point between age classes was not clear, the decision to break the distribution of lengths into age classes was often based upon an inspection of adjacent years. When a cell had no observed length frequencies, the cut points were filled with values from either the former or the subsequent year values from the same zone and trimester combination, with preference given to the former year value (Tables 1-2). The annual proportions at age were computed using the median bycatch estimates by trimester. The proportion per "cell" is multiplied by the catch in that cell divided by the sum of the bycatch in that year across all strata. The resulting fractions at ages 0, 1 and 2+ indicate that most bycatch is on age 0's, with some variability from year to year (Table 3 and Figures 2-3).

References

Linton, B. 2012. Shrimp fishery bycatch estimates for Gulf of Mexico red snapper, 1972-2011. NOAA Southeast Fisheries Science Center, Miami Laboratory. SEDAR31-DW-30.

Nichols, S. 2004. Estimating catch at age for red snapper in the shrimp fleet bycatch. NOAA Southeast Fisheries Science Center, Pascagoula Laboratory. SEDAR7-AW-20.

Southeast Data, Assessment, and Review (SEDAR). 2009. Stock assessment of red snapper in the Gulf of Mexico: SEDAR update assessment. Southeast Data, Assessment, and Review, Charleston, SC.

Table 1. List of break point calculations and the corresponding proportions at age for the eastern Gulf. Age 0 and Age 1 terminal size columns are the cutoffs used for the length distribution to differentiate Age 0's, Age 1's, and Age 2+'s. The Fill? column indicates whether the terminal size was determined from the data in that cell or borrowed from a neighboring cell based on the criteria defined in the text. The sample sizes are the number of fish measured in that stratum.

			Terminal sizes			Sample sizes				Proportions		
Year	Zone	Trimester	Age 0	Age 1	Fill?	Age 0	Age 1	Age 2	Total	Age 0	Age 1	Age 2
1997	East	1	150	250	yes with 2000	0	0	0	0	0.6182	0.3455	0.0364
1997	East	2	150	250	yes with 1999	0	1	0	1	0.0000	1.0000	0.0000
1997	East	3	150	250	yes with 1999	0	0	0	0	1.0000	0.0000	0.0000
1998	East	1	150	250	yes with 2000	0	0	0	0	0.6182	0.3455	0.0364
1998	East	2	150	250	yes with 1999	0	0	0	0	0.8676	0.1176	0.0147
1998	East	3	150	250	yes with 1999	0	0	0	0	1.0000	0.0000	0.0000
1999	East	1	150	250	yes with 2000	0	0	0	0	0.6182	0.3455	0.0364
1999	East	2	150	250	no	59	8	1	68	0.8676	0.1176	0.0147
1999	East	3	150	250	no	20	0	0	20	1.0000	0.0000	0.0000
2000	East	1	150	250	no	34	19	2	55	0.6182	0.3455	0.0364
2000	East	2	100	250	no	688	1,972	21	2,681	0.2566	0.7355	0.0078
2000	East	3	180	250	no	1,523	59	25	1,607	0.9477	0.0367	0.0156
2001	East	1	150	250	yes with 2000	0	0	0	0	0.6182	0.3455	0.0364
2001	East	2	100	250	no	695	680	5	1,380	0.5036	0.4928	0.0036
2001	East	3	100	250	no	1,811	431	11	2,253	0.8038	0.1913	0.0049
2002	East	1	200	250	no	705	19	117	841	0.8383	0.0226	0.1391
2002	East	2	200	250	no	3,892	132	94	4,118	0.9451	0.0321	0.0228
2002	East	3	180	250	no	5,417	140	54	5,611	0.9654	0.0250	0.0096
2003	East	1	130	250	no	444	202	80	726	0.6116	0.2782	0.1102
2003	East	2	150	250	no	1,757	679	93	2,529	0.6947	0.2685	0.0368
2003	East	3	150	250	no	1,702	220	37	1,959	0.8688	0.1123	0.0189
2004	East	1	160	250	no	2,063	247	66	2,376	0.8683	0.1040	0.0278
2004	East	2	160	250	no	874	163	16	1,053	0.8300	0.1548	0.0152

2004	East	3	180	250	no	2,918	100	13	3,031	0.9627	0.0330	0.0043
2005	East	1	160	250	no	468	58	16	542	0.8635	0.1070	0.0295
2005	East	2	170	250	no	108	81	2	191	0.5654	0.4241	0.0105
2005	East	3	175	250	no	262	198	13	473	0.5539	0.4186	0.0275
2006	East	1	130	250	no	106	37	6	149	0.7114	0.2483	0.0403
2006	East	2	200	250	no	150	6	0	156	0.9615	0.0385	0.0000
2006	East	3	175	250	no	2,347	78	4	2,429	0.9662	0.0321	0.0016
2007	East	1	200	250	no	268	11	20	299	0.8963	0.0368	0.0669
2007	East	2	120	250	no	875	88	18	981	0.8919	0.0897	0.0183
2007	East	3	180	250	no	217	25	32	274	0.7920	0.0912	0.1168
2008	East	1	150	250	no	542	31	1	574	0.9443	0.0540	0.0017
2008	East	2	215	250	no	131	5	2	138	0.9493	0.0362	0.0145
2008	East	3	150	250	no	240	163	70	473	0.5074	0.3446	0.1480
2009	East	1	150	250	no	66	15	0	81	0.8148	0.1852	0.0000
2009	East	2	160	250	no	103	29	6	138	0.7464	0.2101	0.0435
2009	East	3	170	250	no	441	6	2	449	0.9822	0.0134	0.0045
2010	East	1	115	250	no	407	691	4	1,102	0.3693	0.6270	0.0036
2010	East	2	180	250	no	13	0	2	15	0.8667	0.0000	0.1333
2010	East	3	145	250	no	351	45	6	402	0.8731	0.1119	0.0149
2011	East	1	165	250	no	1,096	2	0	1,098	0.9982	0.0018	0.0000
2011	East	2	215	250	no	117	16	7	140	0.8357	0.1143	0.0500
2011	East	3	95	250	no	44	111	1	156	0.2821	0.7115	0.0064

Table 2. List of break point calculations and the corresponding proportions at age for the western Gulf. Age 0 and Age 1 terminal size columns are the cutoffs used for the length distribution to differentiate Age 0's, Age 1's, and Age 2+'s. The Fill? column indicates whether the terminal size was determined from the data in that cell or borrowed from a neighboring cell based on the criteria defined in the text. The sample sizes are the number of fish measured in that stratum.

			Terminal sizes			Sample sizes				Proportions		
Year	Zone	Trimester	Age 0	Age 1	Fill?	Age 0	Age 1	Age 2	Total	Age 0	Age 1	Age 2
1997	West	1	160	250	yes with 1998	0	0	0	0	0.7283	0.2661	0.0056
1997	West	2	170	250	no	38	15	0	53	0.7170	0.2830	0.0000
1997	West	3	120	250	no	179	29	0	208	0.8606	0.1394	0.0000
1998	West	1	160	250	no	654	239	5	898	0.7283	0.2661	0.0056
1998	West	2	130	250	yes with 1999	0	0	0	0	0.8509	0.1456	0.0035
1998	West	3	170	250	yes with 1999	0	0	0	0	0.9418	0.0538	0.0043
1999	West	1	160	250	yes with 1998	0	0	0	0	0.7283	0.2661	0.0056
1999	West	2	130	250	no	12,976	2,221	53	15,250	0.8509	0.1456	0.0035
1999	West	3	170	250	no	24,521	1,402	113	26,036	0.9418	0.0538	0.0043
2000	West	1	180	250	no	3,320	358	13	3,691	0.8995	0.0970	0.0035
2000	West	2	125	250	no	5,053	2,122	51	7,226	0.6993	0.2937	0.0071
2000	West	3	150	250	no	26,158	5,880	288	32,326	0.8092	0.1819	0.0089
2001	West	1	160	250	no	541	112	4	657	0.8234	0.1705	0.0061
2001	West	2	100	250	no	1,834	7,689	341	9,864	0.1859	0.7795	0.0346
2001	West	3	150	250	no	14,287	2,868	305	17,460	0.8183	0.1643	0.0175
2002	West	1	200	250	no	1,649	155	91	1,895	0.8702	0.0818	0.0480
2002	West	2	130	250	no	6,450	7,926	668	15,044	0.4287	0.5269	0.0444
2002	West	3	150	250	no	29,531	4,011	623	34,165	0.8644	0.1174	0.0182
2003	West	1	170	250	no	473	78	31	582	0.8127	0.1340	0.0533
2003	West	2	150	250	no	789	1,090	128	2,007	0.3931	0.5431	0.0638
2003	West	3	150	250	no	13,800	2,764	270	16,834	0.8198	0.1642	0.0160
2004	West	1	160	250	no	3,761	467	65	4,293	0.8761	0.1088	0.0151
2004	West	2	100	250	no	616	9,006	96	9,718	0.0634	0.9267	0.0099

2004	West	3	150	250	no	3,609	2,596	62	6,267	0.5759	0.4142	0.0099
2005	West	1	150	250	no	487	454	32	973	0.5005	0.4666	0.0329
2005	West	2	100	250	no	273	10,302	276	10,851	0.0252	0.9494	0.0254
2005	West	3	140	250	no	5,816	2,194	145	8,155	0.7132	0.2690	0.0178
2006	West	1	160	250	no	646	325	27	998	0.6473	0.3257	0.0271
2006	West	2	120	250	no	964	4,490	213	5,667	0.1701	0.7923	0.0376
2006	West	3	160	250	no	15,961	1,248	56	17,265	0.9245	0.0723	0.0032
2007	West	1	175	250	no	955	79	3	1,037	0.9209	0.0762	0.0029
2007	West	2	100	250	no	1,153	2,950	79	4,182	0.2757	0.7054	0.0189
2007	West	3	150	250	no	30,824	7,292	1,219	39,335	0.7836	0.1854	0.0310
2008	West	1	185	250	no	8,209	565	321	9,095	0.9026	0.0621	0.0353
2008	West	2	135	250	no	3,464	5,108	387	8,959	0.3867	0.5702	0.0432
2008	West	3	150	250	no	8,134	4,536	676	13,346	0.6095	0.3399	0.0507
2009	West	1	200	250	no	8,593	853	475	9,921	0.8661	0.0860	0.0479
2009	West	2	120	250	no	1,919	1,525	219	3,663	0.5239	0.4163	0.0598
2009	West	3	210	250	no	26,193	251	102	26,546	0.9867	0.0095	0.0038
2010	West	1	205	250	no	6,836	74	44	6,954	0.9830	0.0106	0.0063
2010	West	2	85	250	no	14	2,987	114	3,115	0.0045	0.9589	0.0366
2010	West	3	150	250	no	23,093	5,959	325	29,377	0.7861	0.2028	0.0111
2011	West	1	140	250	no	3,930	3,750	172	7,852	0.5005	0.4776	0.0219
2011	West	2	75	250	no	415	3,092	175	3,682	0.1127	0.8398	0.0475
2011	West	3	160	250	no	13,332	2,108	220	15,660	0.8513	0.1346	0.0140

Table 3. Annual proportions at age for Gulf of Mexico red snapper bycatch in the shrimp fishery by zone (East and West).

		Proportions		
Year	Zone	Age 0	Age 1	Age 2
1997	East	0.7410	0.2570	0.0019
1998	East	0.9354	0.0579	0.0066
1999	East	0.8950	0.0945	0.0105
2000	East	0.5754	0.4112	0.0134
2001	East	0.6529	0.3409	0.0062
2002	East	0.9565	0.0263	0.0172
2003	East	0.7838	0.1815	0.0348
2004	East	0.8932	0.0947	0.0121
2005	East	0.6059	0.3688	0.0253
2006	East	0.9510	0.0453	0.0036
2007	East	0.8715	0.0865	0.0419
2008	East	0.8402	0.1169	0.0429
2009	East	0.9681	0.0264	0.0055
2010	East	0.5312	0.4582	0.0106
2011	East	0.7511	0.2287	0.0202
1997	West	0.8120	0.1874	0.0005
1998	West	0.9187	0.0769	0.0043
1999	West	0.8936	0.1021	0.0043
2000	West	0.7899	0.2021	0.0080
2001	West	0.6436	0.3357	0.0208
2002	West	0.7788	0.1962	0.0250
2003	West	0.7717	0.2064	0.0220
2004	West	0.4397	0.5502	0.0101
2005	West	0.4829	0.4960	0.0211
2006	West	0.8069	0.1836	0.0095
2007	West	0.7218	0.2509	0.0273

2008	West	0.6128	0.3424	0.0449
2009	West	0.8799	0.1008	0.0193
2010	West	0.7284	0.2580	0.0136
2011	West	0.6664	0.3118	0.0218

Figure 1. Length frequencies from shrimp trawl observer data (both experimental and control data) by year, zone and trimester. Lengths are in millimeters and bins are 5 mm. Age classes are depicted by color; age 0-no color, age 1-blue and age 2-red. Sample sizes are numbers of fish measured each year.

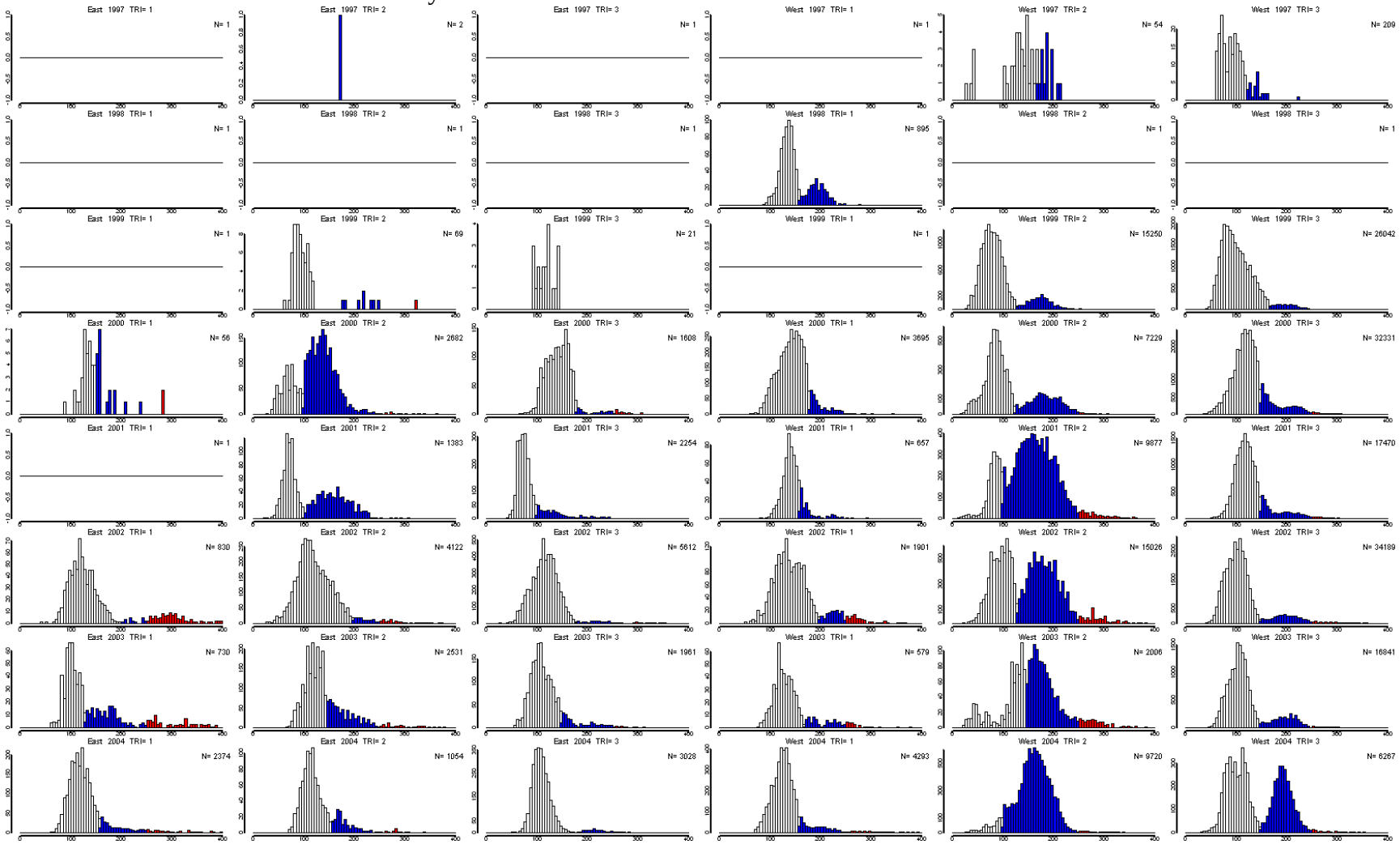

Figure 1 (continued).

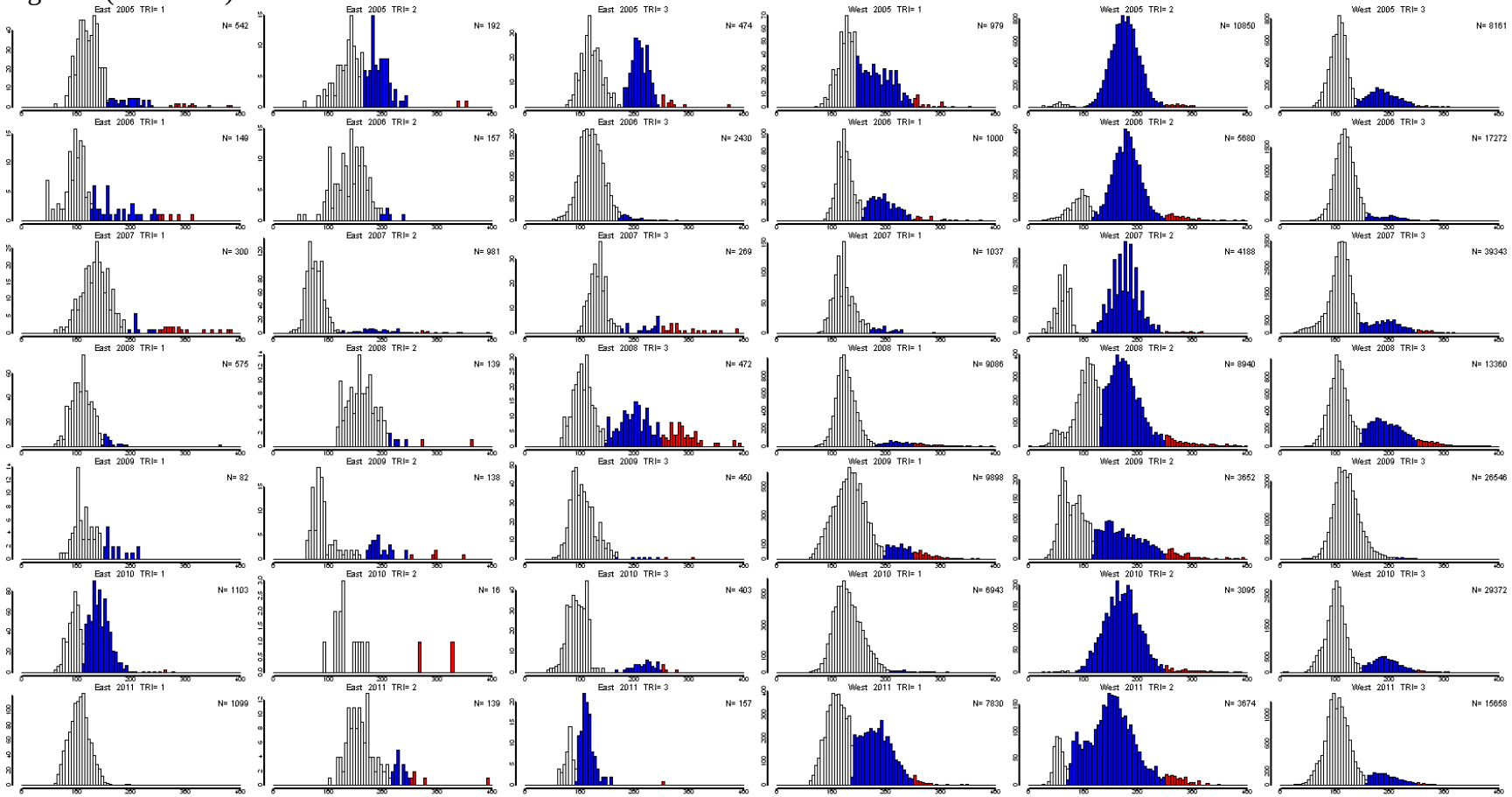

Figure 2. The proportions at age 0 and age 1 of red snapper bycatch from the shrimp trawl fishery in the western Gulf of Mexico by year.

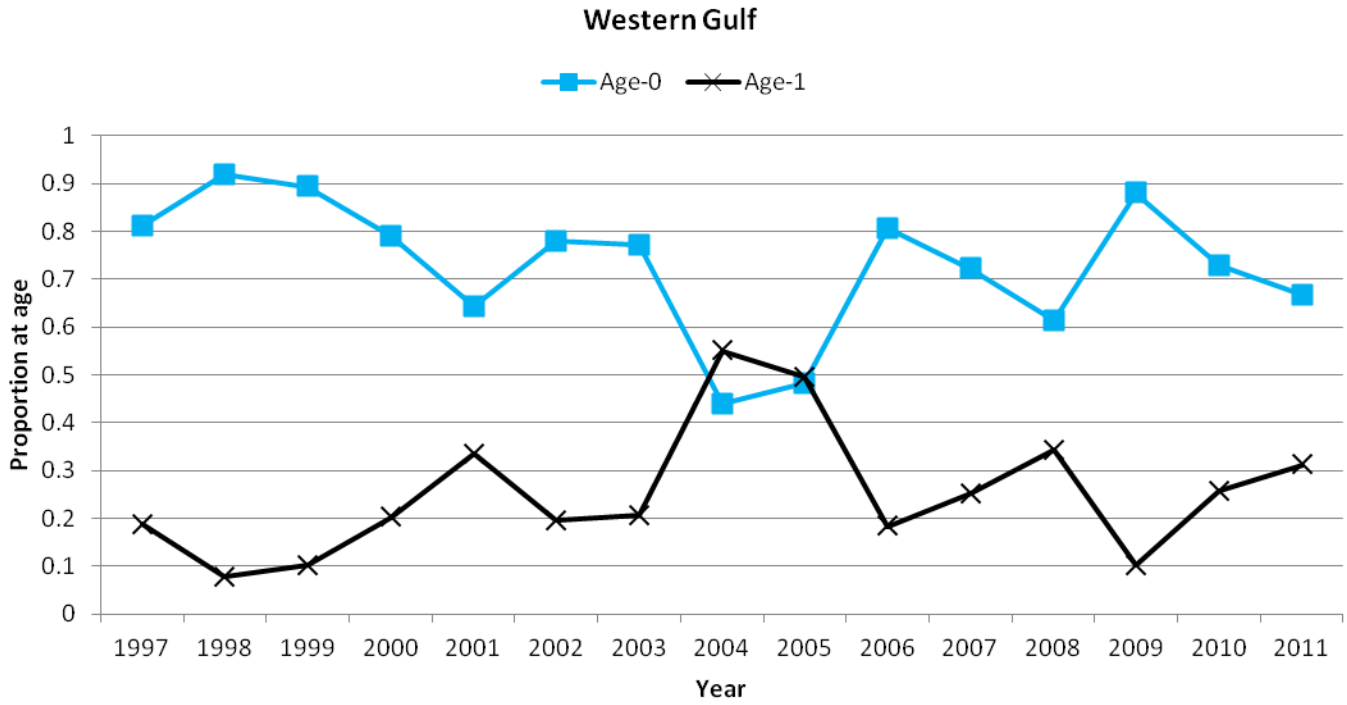

Figure 3. The proportions at age 0 and age 1 of red snapper bycatch from the shrimp trawl fishery in the eastern Gulf of Mexico by year.