AN UPDATE TO THE AGE COMPOSITION, GROWTH, AND DENSITY-DEPENDENT MORTALITY IN JUVENILE RED SNAPPER ESTIMATED FROM OBSERVER DATA FROM THE GULF OF MEXICO PENAEID SHRIMP FISHERY

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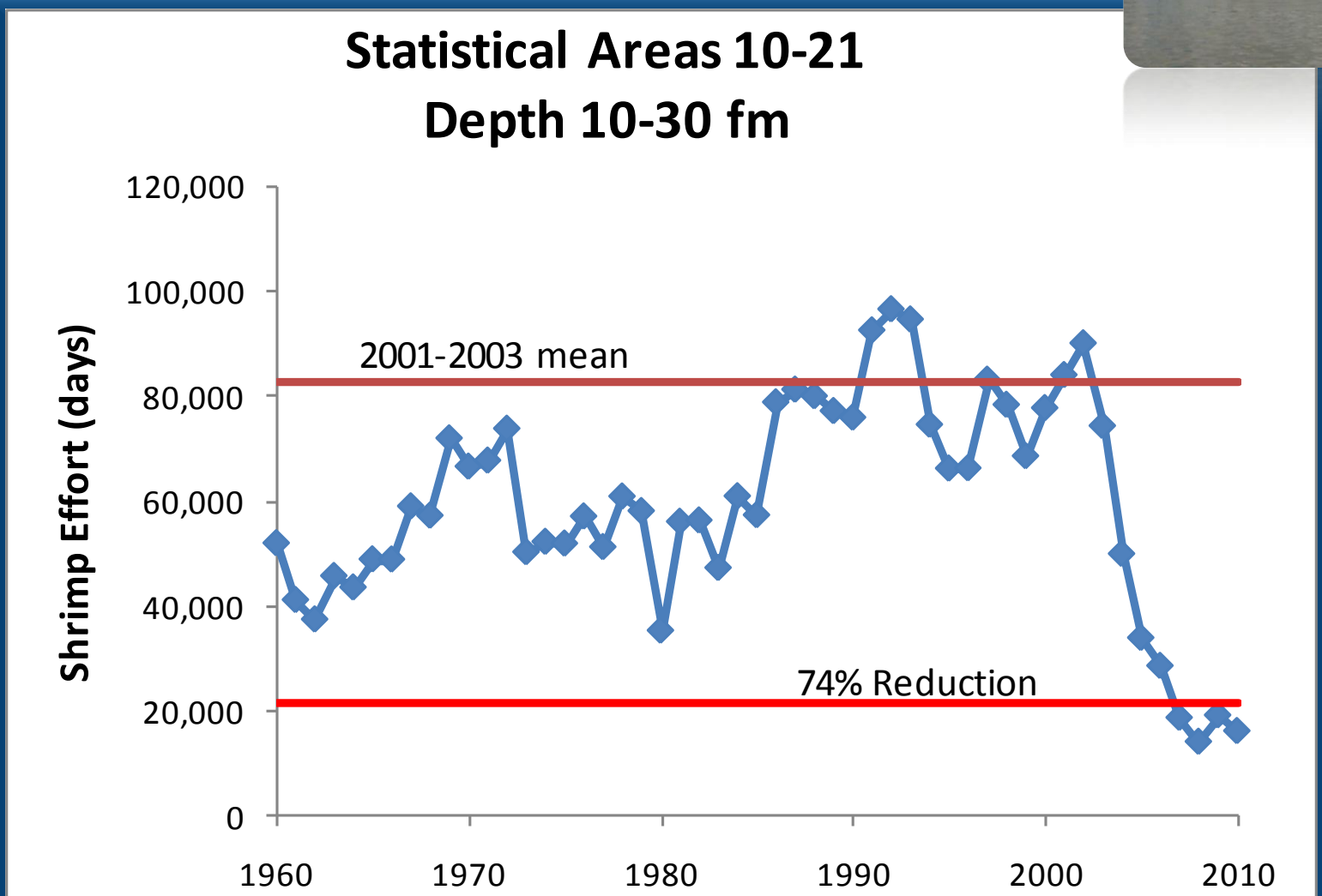
UPDATE - Methods

- Same analytical approach as used in the NAJFM article
- Paper data set as of Sep. 2007
- Update Dec-09 data set as of Dec. 2009
- Update Jul-12 data set as of July 2012

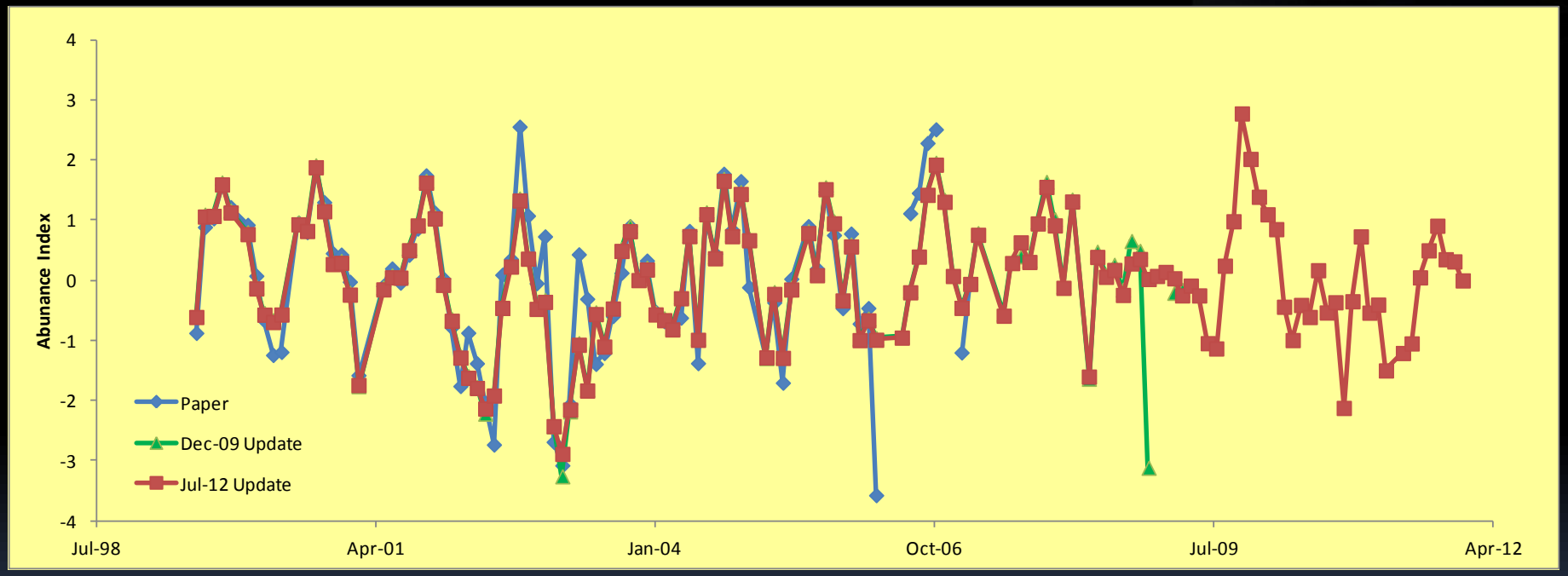
UPDATE - Additional Data

- Time series extended to Dec. 2011 (Jul-12 Update)
- 25 months added to the series since the last update in Dec-09 (now 138 months in the data series)
- 391,533 measured juvenile red snapper in current length frequency series

10-30 Fathom Effort Trend (1960-2010)



UPDATE – Abundance Index (standardized CPUE)



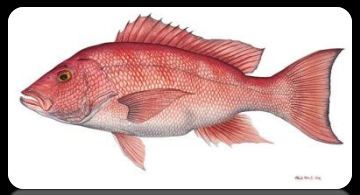
UPDATE – Model Evaluation

- **The results still support density-dependent mortality for juvenile red snapper.**

Model Option	No. Param.	Function	AIF	BPF
VonB Growth & Density Dependent Mortality	186	20477.8	1.0000	1.0000
Linear Growth & Density Dependent Mortality	186	20486.3	0.0002	0.0003
VonB Growth & Density Independent Mortality	185	20493.2	<0.0001	<0.0001

- **The likelihood that the density-independent model is "better" than the density-dependent model is less than 1 in a million.**

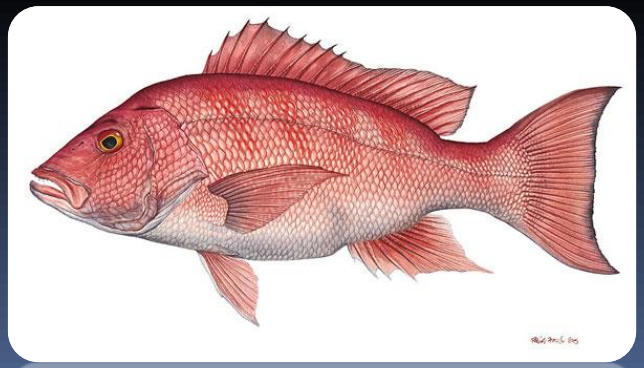
UPDATE – Parameter Estimates



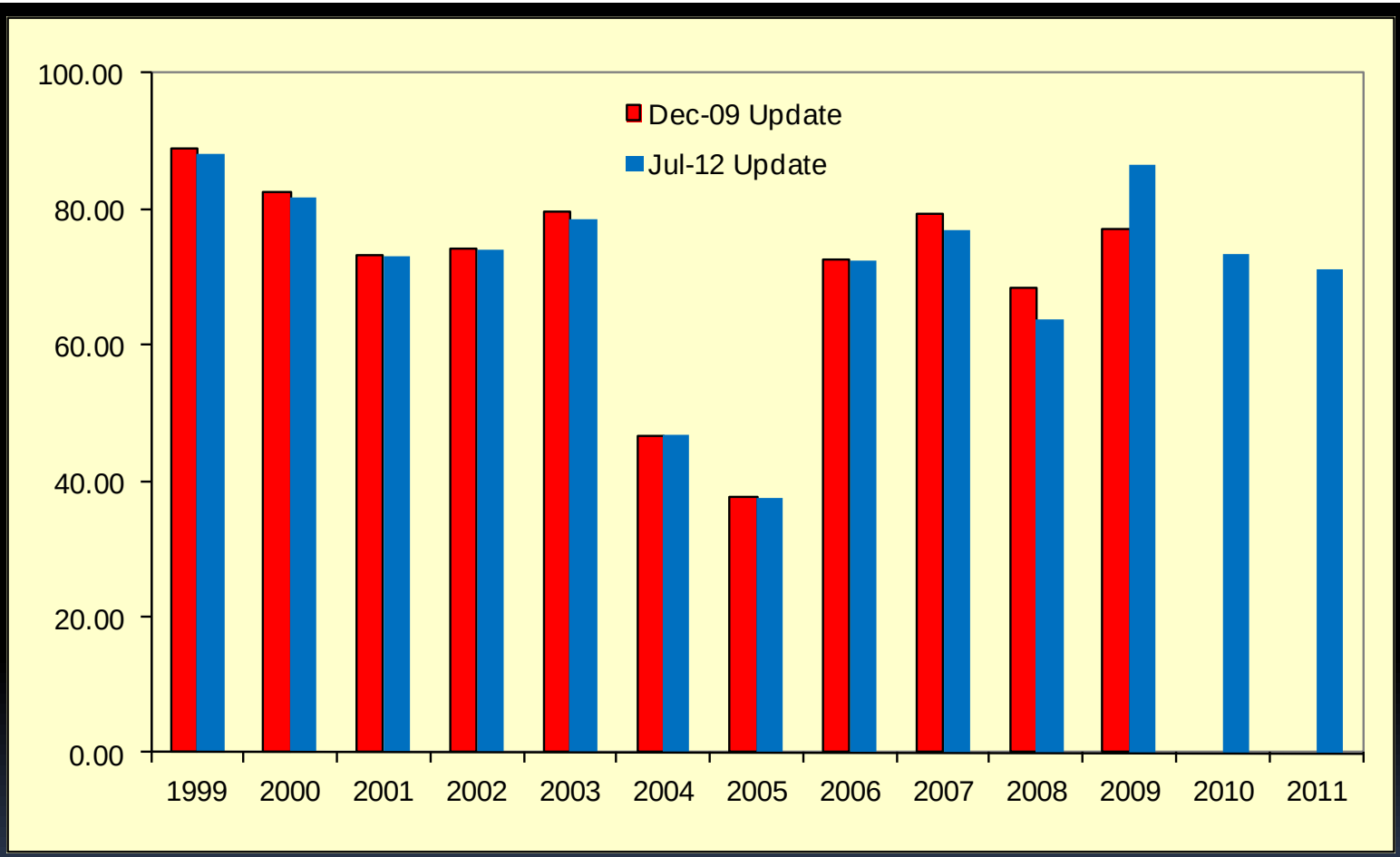
Parameter	Paper	Dec-09	Jul-12
K – VB growth	0.21	0.28	0.37
δ – density dep.	1.82	3.73	2.42
Z_0 – age-0 mort.	2.16	1.64	1.26
Z_1 – age-1 mort.	1.25	1.18	0.88

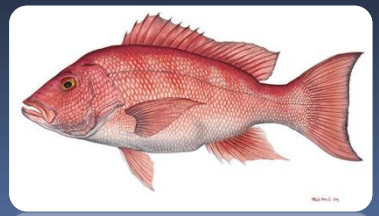
UPDATE – Age Composition

	Jan-Apr				May-Aug				Sep-Dec			
Year	Age-0	Age-1	n	SE	Age-0	Age-1	n	SE	Age-0	Age-1	n	SE
1999	-	-	-	-	86.0	14.0	14,183	2.53	89.4	10.6	26,051	1.94
2000	76.0	24.0	3,695	5.42	67.2	32.8	7,233	4.25	85.7	14.3	32,181	2.16
2001	88.5	11.5	657	5.78	47.7	52.3	9,823	3.01	86.6	13.4	17,457	2.38
2002	77.0	23.0	1,893	5.62	40.8	59.2	15,015	3.69	87.9	12.1	35,473	1.84
2003	85.0	15.0	584	5.86	27.5	72.5	1,973	4.53	84.6	15.4	16,439	2.38
2004	90.8	9.2	4,225	2.55	19.4	80.6	9,547	1.35	58.3	41.7	6,268	3.84
2005	62.8	37.2	979	7.30	8.8	91.2	10,714	1.64	72.4	27.6	8,163	3.37
2006	67.8	32.2	979	6.16	19.5	80.5	5,684	3.50	90.7	9.3	16,534	2.42
2007	89.7	10.3	1,038	3.83	33.4	66.6	4,190	4.63	81.1	18.9	39,241	2.14
2008	88.3	11.7	9,101	3.29	40.8	59.2	8,804	1.93	62.6	37.4	13,276	3.50
2009	75.6	24.4	9,917	3.74	67.4	32.6	3,398	4.35	93.4	6.6	26,252	1.78
2010	92.5	7.5	7,001	2.43	39.9	60.1	3,108	2.52	39.3	60.7	878	5.53
2011	61.6	38.4	1,621	6.16	30.1	69.9	3,607	3.65	82.8	17.2	14,351	2.52
Mean	**82.5**	**17.5**	**41,690**	**1.47**	**43.1**	**56.9**	**97,279**	**0.94**	**84.1**	**15.9**	**252,564**	**0.81**

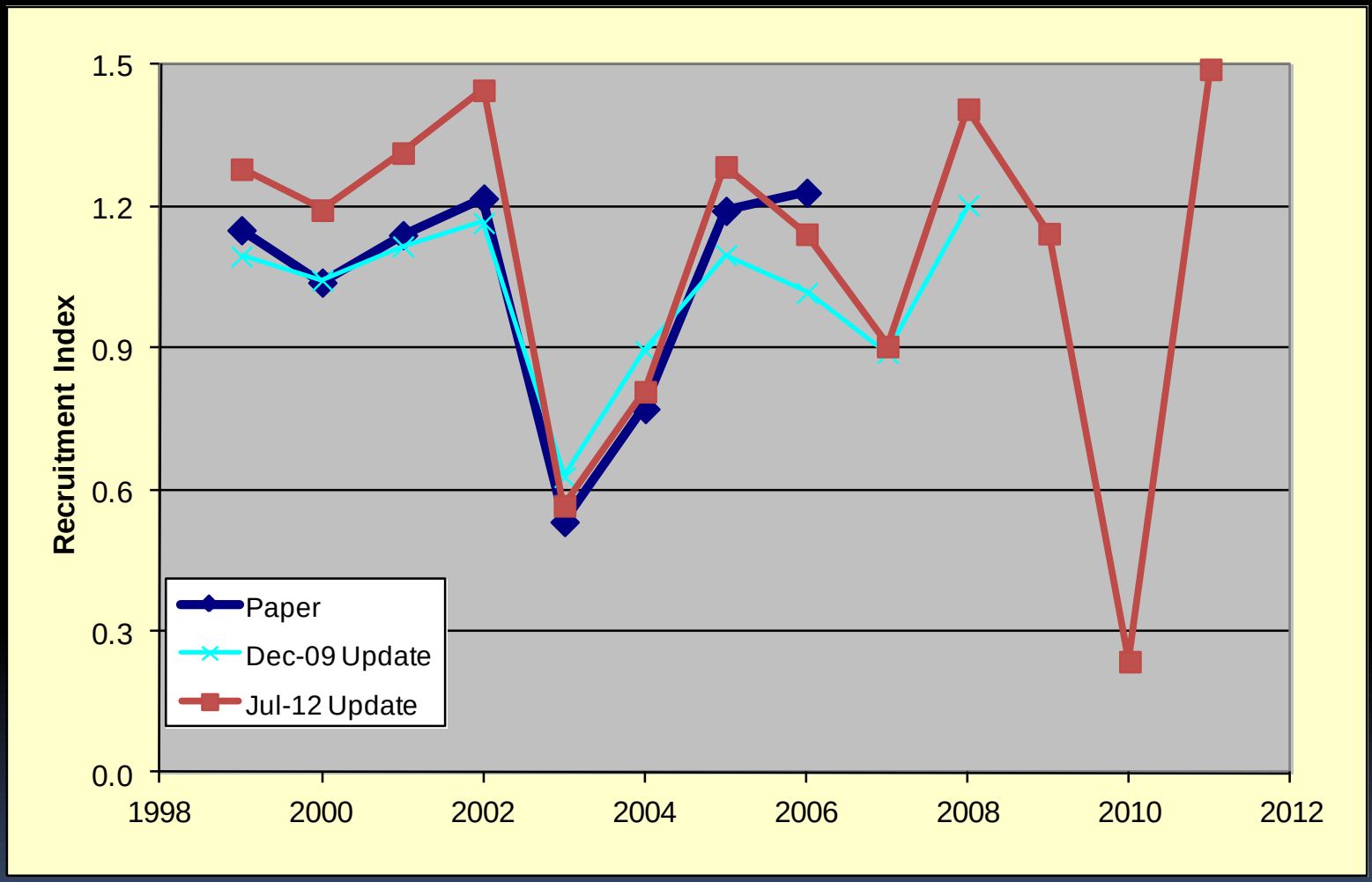


UPDATE – Age-0 Percentage of Bycatch

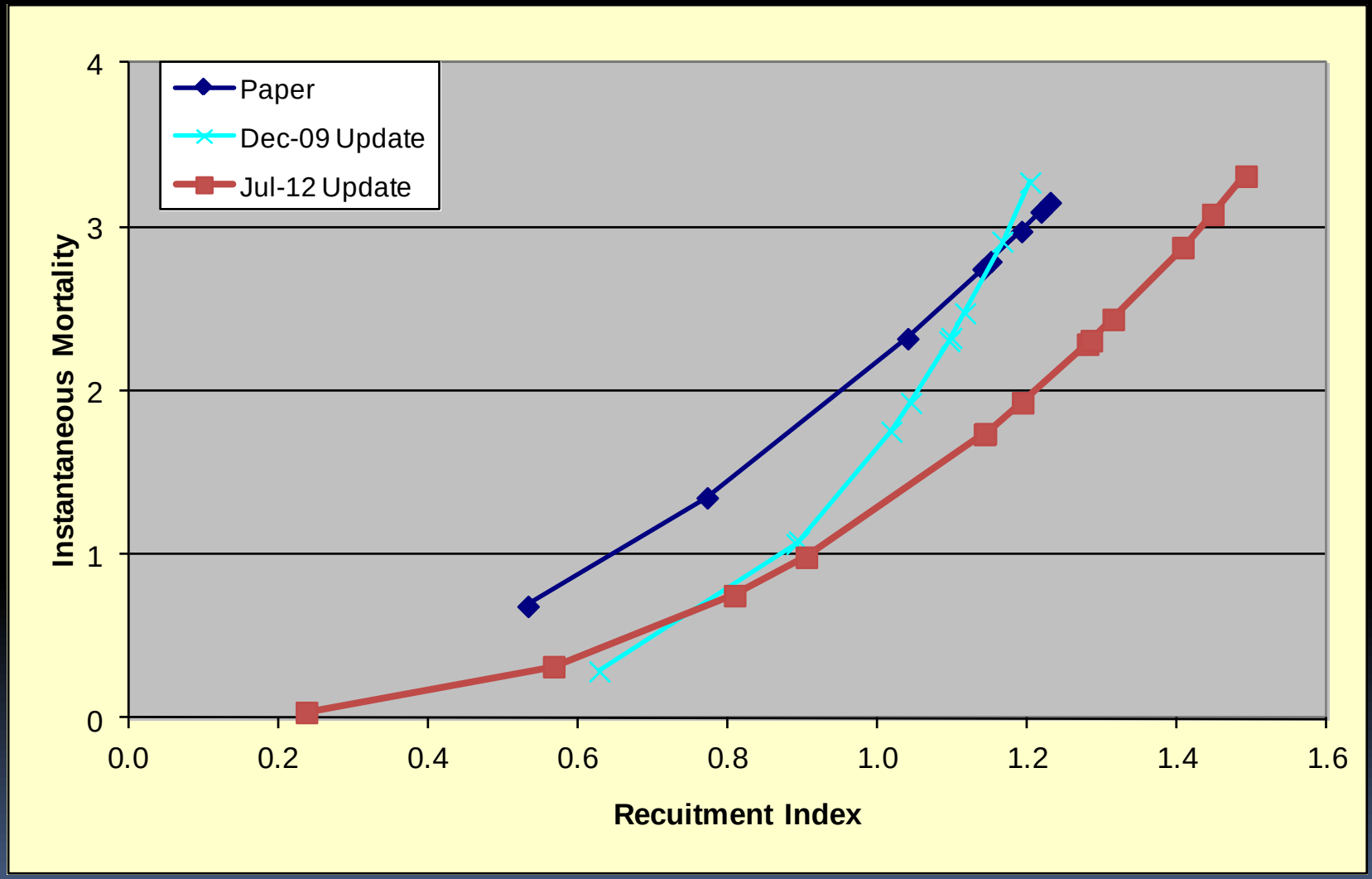




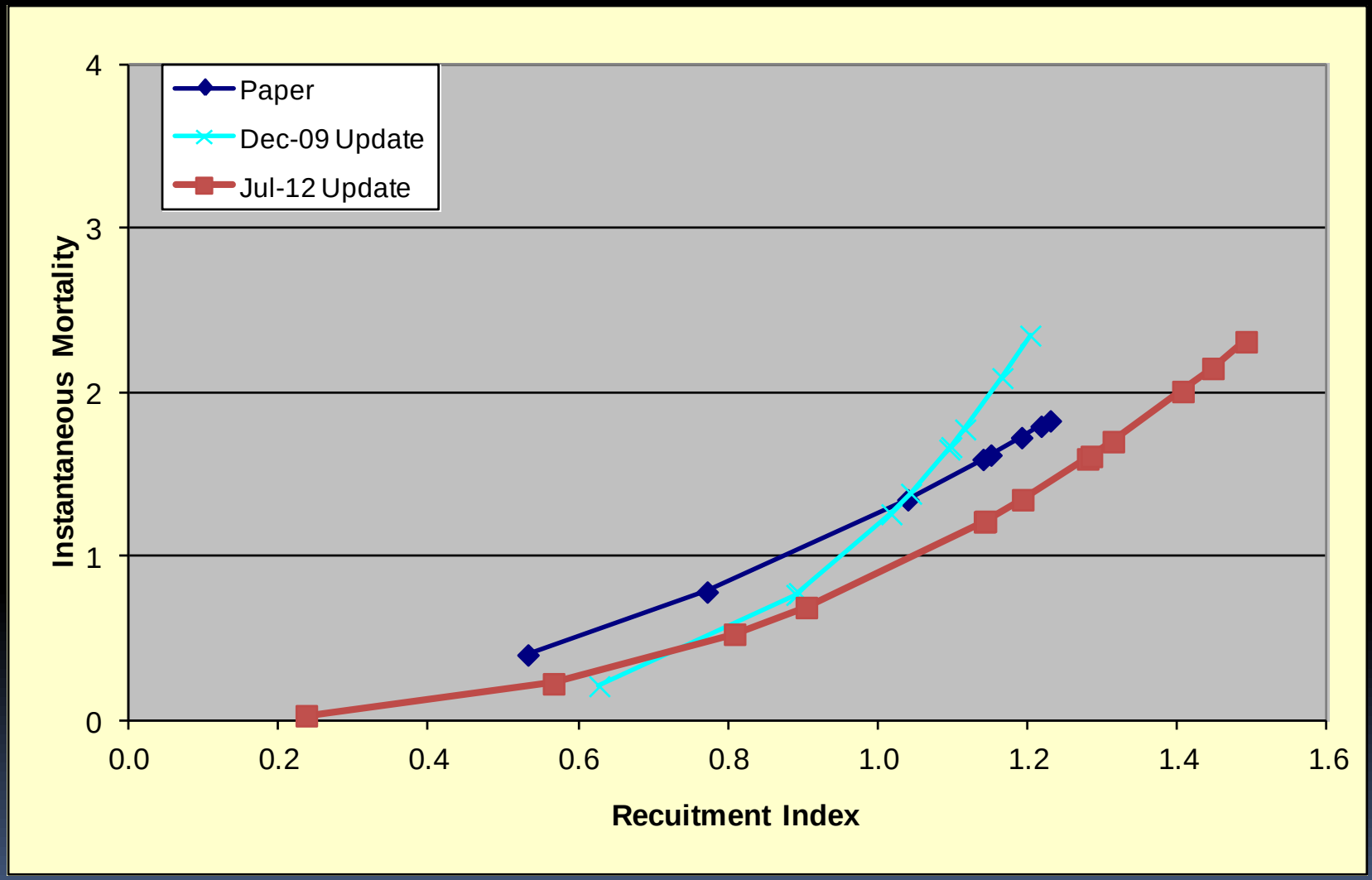
UPDATE – Recruitment Index



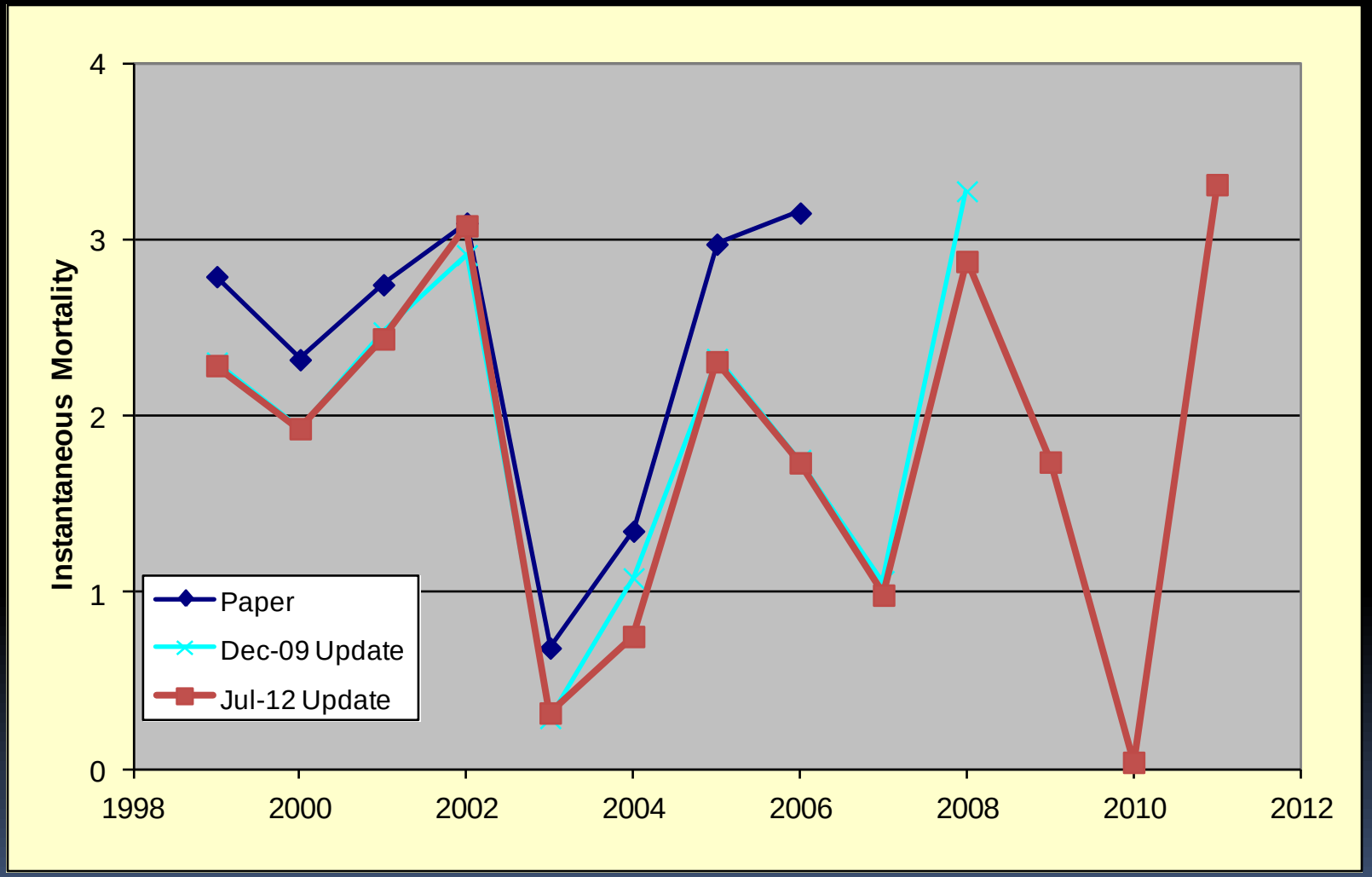
UPDATE – Age-0 mortality as a function of recruitment



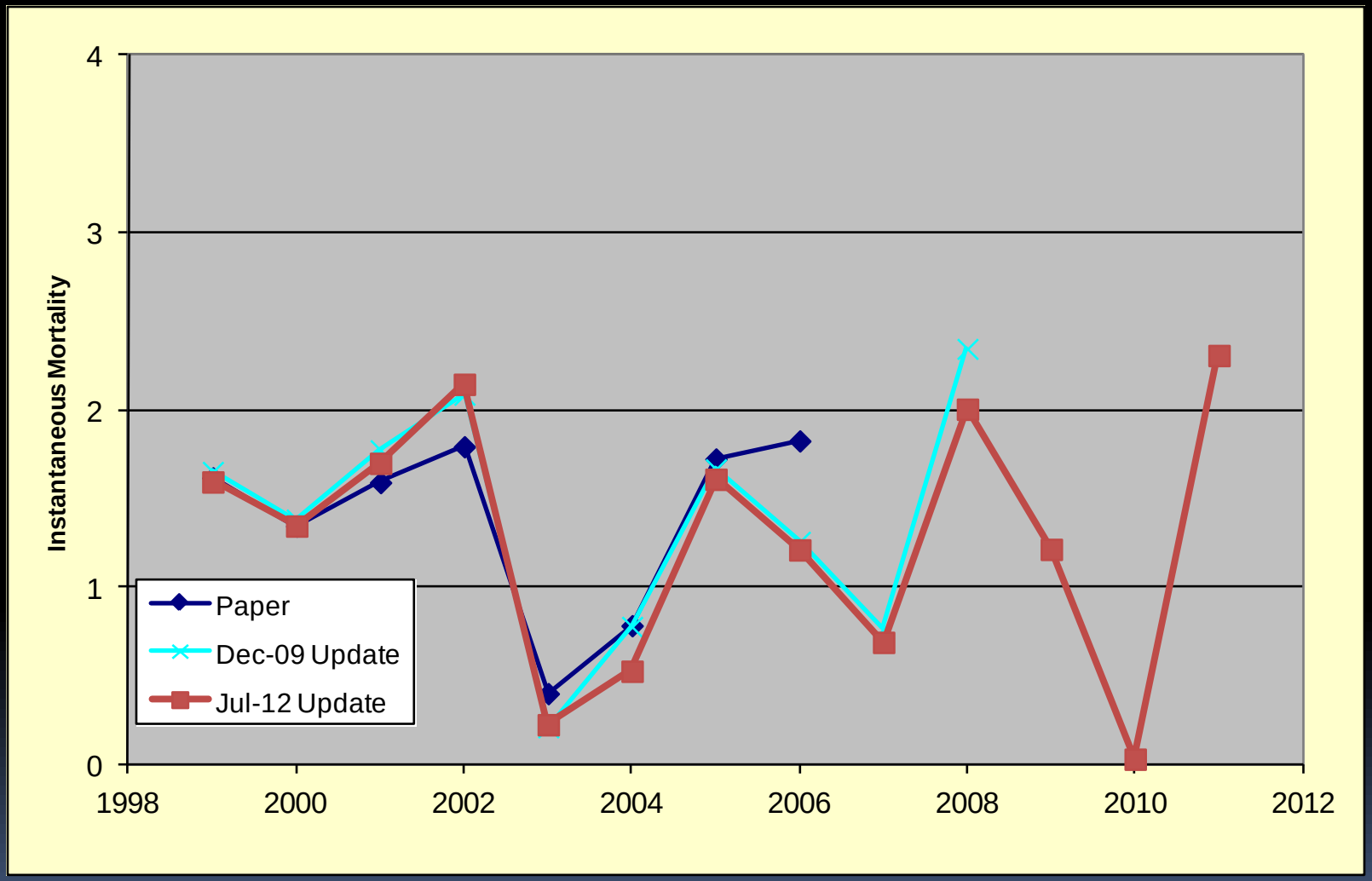
UPDATE – Age-1 mortality as a function of recruitment



UPDATE – Age-0 Mortality



UPDATE – Age-1 Mortality



CONCLUSIONS

- Abundance index has no trend over time despite substantial decrease in shrimp effort
- Evidence for density-dependent mortality is stronger (10,000 : 1 in paper now exceeds 1,000,000 : 1 with update)
- Age composition of bycatch consistent for the updates
- Mortality by year and age-class very similar for the updates (function of mean mortality, abundance and degree of density dependence)