

Addendum to- Red snapper (*Lutjanus campechanus*) otolith aging summary 1980 & 1991-2002 (SEDAR7-DW-33).

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GLM Analysis of Predicted TL at Age

A GLM analysis was performed on otolith data from Panama City Laboratory (NOAA) to determine factors that significantly explained variability in size at age, and to compare LS means between different geographic regions. The data were restricted to ages 2-5 in order to have sufficient numbers of samples at age. Analyses were conducted separately for each age. The following factors were examined: Location (city landed), Year, Mode (Commercial, Charter Party, Headboat, Private, Scientific Survey, Tournament), SizeReg, Season (May-Sep, Oct-Apr), and Sex. The Mode category Tournament, which predominantly represented 2 landing locations in LA, was dropped on the basis that it might be biased to larger sized fish. SizeReg refers to the minimum size imposed on the commercial and recreational fisheries for the year in which the fish was sampled (it was applied on an annual basis because size limit changes generally occurred early each year). Locations with fewer than 90 observations were dropped from the analysis.

Factors were retained in the model if Type III sums of squares were significant. Across all ages, the factors Location, Year, and Mode were significant in explaining the variability in predicted total length at age. The LSMEANS option in PROC GLM (SAS Institute, Inc. 1999) was used to obtain least square mean predicted size at age for the factor Location. Least squares means (LS means) are means that have been adjusted for the other factors in the model (SAS Institute, Inc. 1999). The estimated LS means and 95% confidence limits are plotted in Figure 1, and are ordered by Location in an East to West direction. The number of red snapper included in each analysis is shown for each age and location in Table 1. No consistent geographic trend or gradient in size at age is apparent, the slopes of the fitted trendlines are nearly flat, and the R^2 values indicate a very poor agreement for a linear trend in size by Location.

A second analysis was performed at the scale of State. This analysis incorporated data from Panama City Laboratory and LSU data. The same factors were retained for the GLM as described above. The predicted size at age 2 shows a negative trend (Figure 2) when moving from the eastern Gulf of Mexico to the west (Florida to Texas), and the R^2 indicates moderately good agreement with a linear trend in size by state. For ages 3, 4, and 5, the trend is not well defined and the R^2 values do not indicate that the trend in size at age by state is linear. Table 2 shows the number of aged red snapper by state and age included in these analyses.

References

SAS Institute Inc. 1999. SAS/STAT User's Guide, Version 8. SAS Institute Inc.: Cary, NC. 3884 pp.

Table 1. Number of observations per Age/Location in Panama City Lab database. Data were restricted to ages 2-5 and to locations with more than 90 total observations.

Location	2	3	4	5	Grand Total
Biloxi,MS	55	26	22	1	104
Chauvin,LA	23	286	246	122	677
Cocodrie,LA	3	41	50	10	104
Corpus Christi,TX	95	27	10	7	139
Dauphin Island,AL	2	76	85	16	179
Destin,FL	106	362	189	14	671
Empire,LA	34	86	46	20	186
Galveston,TX	748	495	81	31	1355
Grand Isle,LA	1	36	36	23	96
Gulf Breeze,FL	8	107	1		116
Gulf Shores,AL	74	55	72	30	231
Leeville,LA	17	71	49	39	176
Orange Beach,AL	77	453	402	52	984
Panama City,FL	888	1329	580	193	2990
Panhandle,FL	176	187	41	10	414
Pensacola,FL	61	97	48	11	217
Port Aransas,TX	10	71	56	30	167
Port Fourchon,LA	8	91	50	30	179
Grand Total	2386	3896	2064	639	8985

Table 2. Number of observations per Age/State in the combined Panama City Lab and LSU databases. Data were restricted to ages 2-5.

Location	2	3	4	5	Grand Total
AL	218	984	1266	334	2802
FL	1290	2330	932	267	4819
LA	835	3265	2693	1145	7938
MS	60	29	34	6	129
TX	1164	1150	547	174	3035
Grand Total	3567	7758	5472	1926	18723

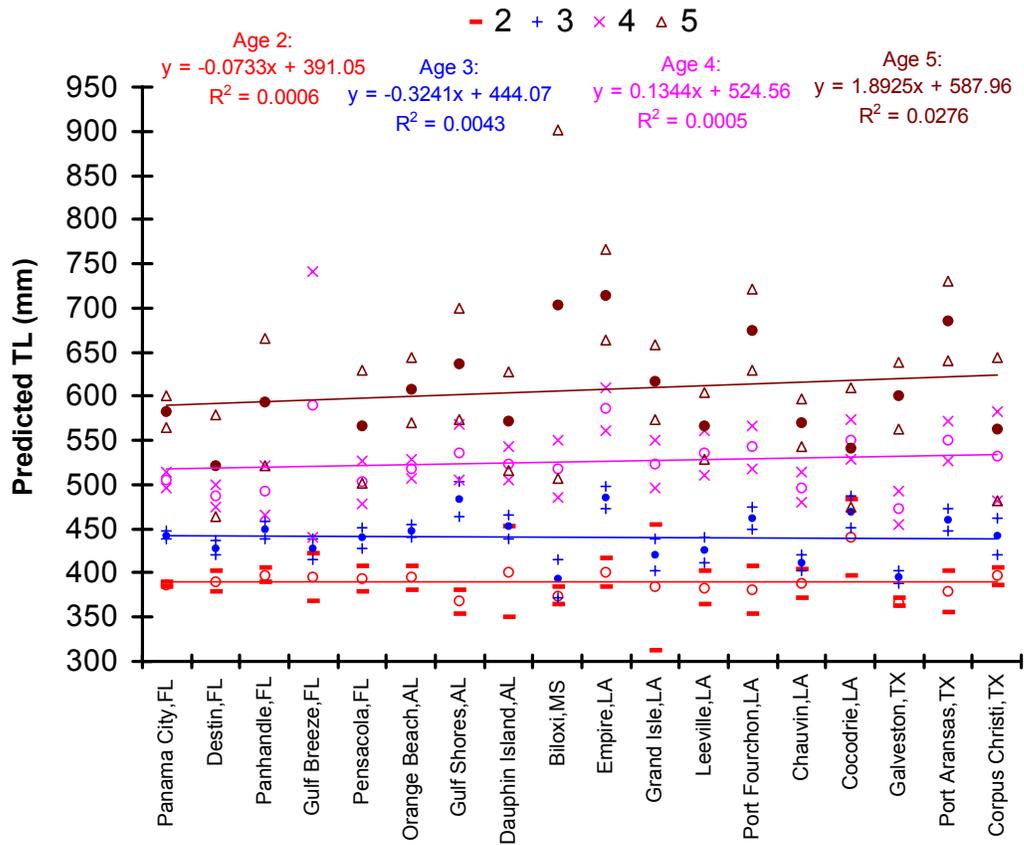


Figure 1. LS mean size at age, sorted by location from Eastern Gulf to Western Gulf. Circles (open or closed) are the mean predicted total length (mm). The 95% CL on each mean is given by the age-specific symbols in the legend at the top of the figure.

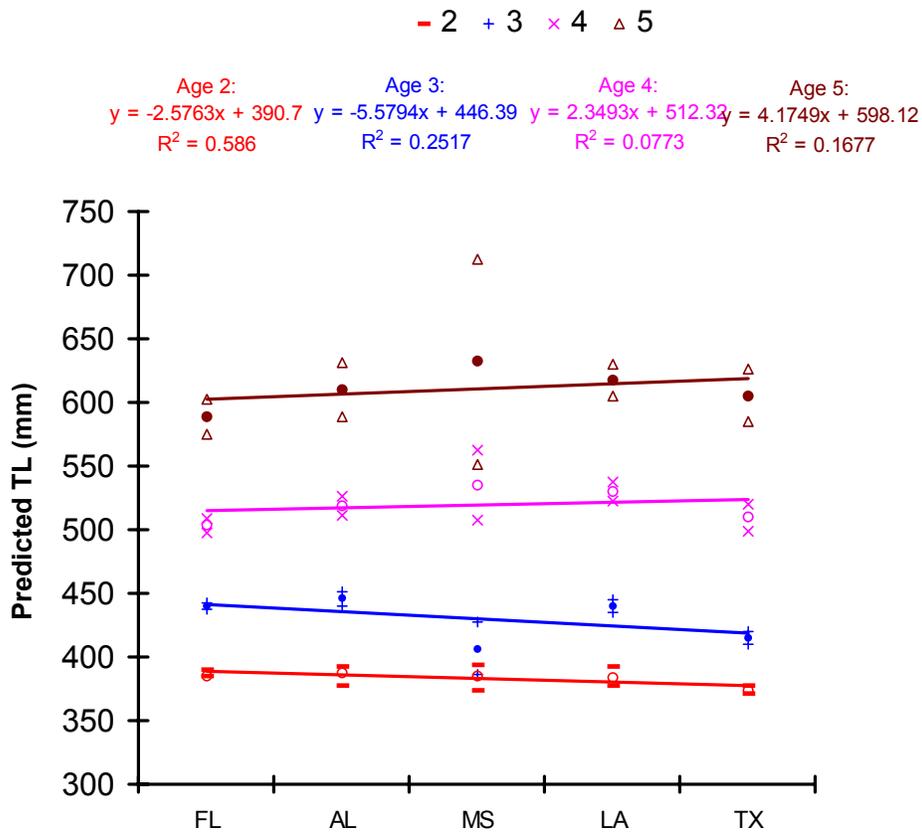


Figure 2. Predicted LS mean size (TL, mm) at age by state, arranged from eastern to western Gulf of Mexico. The 95% CL on each mean is given by the age-specific symbols in the legend at the top of the figure.