Gray Triggerfish Ageing Error

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SEDAR43-WP-13

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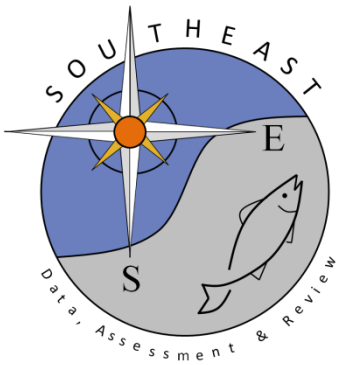

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Introduction

Determining sustainability in fish stocks relies on estimates of growth, age at maturity, longevity, natural mortality, and recruitment variability; all of which rely on an accurate estimate of age. In situations where age estimates are both imprecise and biased, an ageing error matrix can be incorporated into the modeling process (Methot 2000, 2009; Punt et al., 2008; Gertseva and Cope, 2011). It is recommended that a reference collection of known ages be routinely read by multiple readers from multiple ageing facilities to fully capture the imprecision and bias associated with traditional ageing estimations into the ageing error matrix. The reference collection needs to include samples that fully represent the range of ages (especially the older fish) and with sufficient sample sizes per age class to enable appropriate statistical analysis (Campana, 2001; Punt et al., 2008). The objectives of this report are to describe the reference collection used for calculating the ageing error matrices for Gray Triggerfish and to provide the results of multiple ageing facilities and multiple readers variation.

Methods

Reference Collection

The Gray Triggerfish reference collection composed of thin sectioned dorsal spines (n=115) and was assembled in 2011. Dorsal spines were selected from Gray Triggerfish from a wide range of lengths (75-580 mm FL) and ages (1-12 yr)(Figure 1). Prior to the creation of the reference collection, NMFS Panama City Laboratory (NMFS-PC) ageing facility completed a 100% reader overlap of all dorsal spines, and final ages provided for the assessment reflected ages agreed by both readers. Gray Triggerfish have mainly been aged by three readers from the NMFS-PC Laboratory (78%, 2003-2013)(Table 1). State agencies in the Gulf of Mexico have provided additional ages (22%, 2007-2012). Ideally, reference collections should be read annually or prior to the interpretation of ageing structures after a prolonged time lapse between readings. The Gray Triggerfish reference collection has only been read by all state agencies and NMFS Panama City in 2012.

Calculating Ageing Error

By including ageing error in the model process, the imprecision and bias associated with having multiple readers providing ages can be taken into consideration. Ageing error was estimated by calculating the standard deviation at age between pairs of readers or ageing facilities. For some years, more than 2 readers or ageing facilities provided ages and for these time periods an average standard deviation age among pairs of readers/ageing facilities were calculated.

Results and Discussion

Ageing error was calculated between each pair of readers, between each pair of ageing facilities and an average ageing error among pairs of ageing facilities was calculated to estimate an overall average ageing error matrix (Table 2, Figure 2). Ageing errors were calculated for two different time periods for NMFS-PC using two different sets of dorsal spines, reflecting a change in the secondary reader. The first time period (2003-2010) ageing error was based on the individual readings per reader for all dorsal spines and the second time period individual readings of the reference collection per reader measured ageing error. The Mississippi Department of Marine Resources Mississippi (MSDMR) only provided a few ages (n=5) and therefore, were not included in pair-wise comparison among ageing facilities. Regardless of the pair of readers or ageing facility, ageing error increased with age (Table 2, Figure 2).

Literature Cited

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Table 1. Multiple ageing facilities contributed Gray Triggerfish ages to SEDAR43. Listed are the percentages of ages contribution by ageing facility and by year (2003-2013). NMFS PC-National Marine Fisheries Service, Panama City Laboratory; FWRI – Florida Fish and Wildlife Research Institute, ALMR – Alabama Marine Resources Division, MSDMR - Mississippi Department of Marine Resources, LADWF - Louisiana Department of Wildlife and Fisheries, TXPWD - Texas Parks and Wildlife Department.

Year	NMFS-PC	FWRI	ALMR	MSDMR	LADWF	TXPWD
2003	100.0%					
2004	100.0%					
2005	100.0%					
2006	96.0%	4.0%				
2007	42.3%	5.7%	8.7%	0.8%	28.5%	14.0%
2008	74.8%		4.5%	0.2%	20.5%	
2009	77.0%		5.9%		11.0%	6.1%
2010	75.9%	18.0%	5.2%		0.7%	0.2%
2011	64.3%	7.4%	19.7%		6.3%	2.4%
2012	75.9%	10.1%	9.4%		2.8%	1.9%
2013	91.0%	2.6%	4.5%		0.0%	2.0%
Total	78.1%	4.9%	6.9%	0.1%	7.1%	3.0%

Table 2. Average standard deviation (std dev) and sample size (n) by age for NMFS PC readers, among ageing facilities, and overall for Gray Triggerfish from the Gulf of Mexico. *Based on the readings of the Gray Triggerfish reference collection.

	NMFS-PC 2003-2010		NMFS-PC 2011-2013*		All ageing Facilities*		Overall*	
Age	n	std dev	n	std dev	n	std dev	n	std dev
0	25	0.6782	3	0.5774	3	0.0930	3	0.3352
1	122	0.6039	6	0.9832	7	0.5953	7	0.7893
2	217	0.7590	15	0.7432	14	0.7430	15	0.7431
3	561	0.7440	19	0.7609	25	0.7836	22	0.7722
4	496	0.9183	22	0.5602	26	0.9313	24	0.7457
5	440	1.1102	23	0.8528	22	1.0452	23	0.9490
6	255	1.4698	11	1.0787	6	0.9818	8	1.0302
7	127	1.8706	8	1.0690	5	1.1352	6	1.1021
8	67	2.0686	1		2	0.8535	2	0.8535
9	45	1.7900	3	1.5275	1	1.8856	2	1.7066
10+	27	1.5046	4	0.7071	2	2.5241	3	1.6156

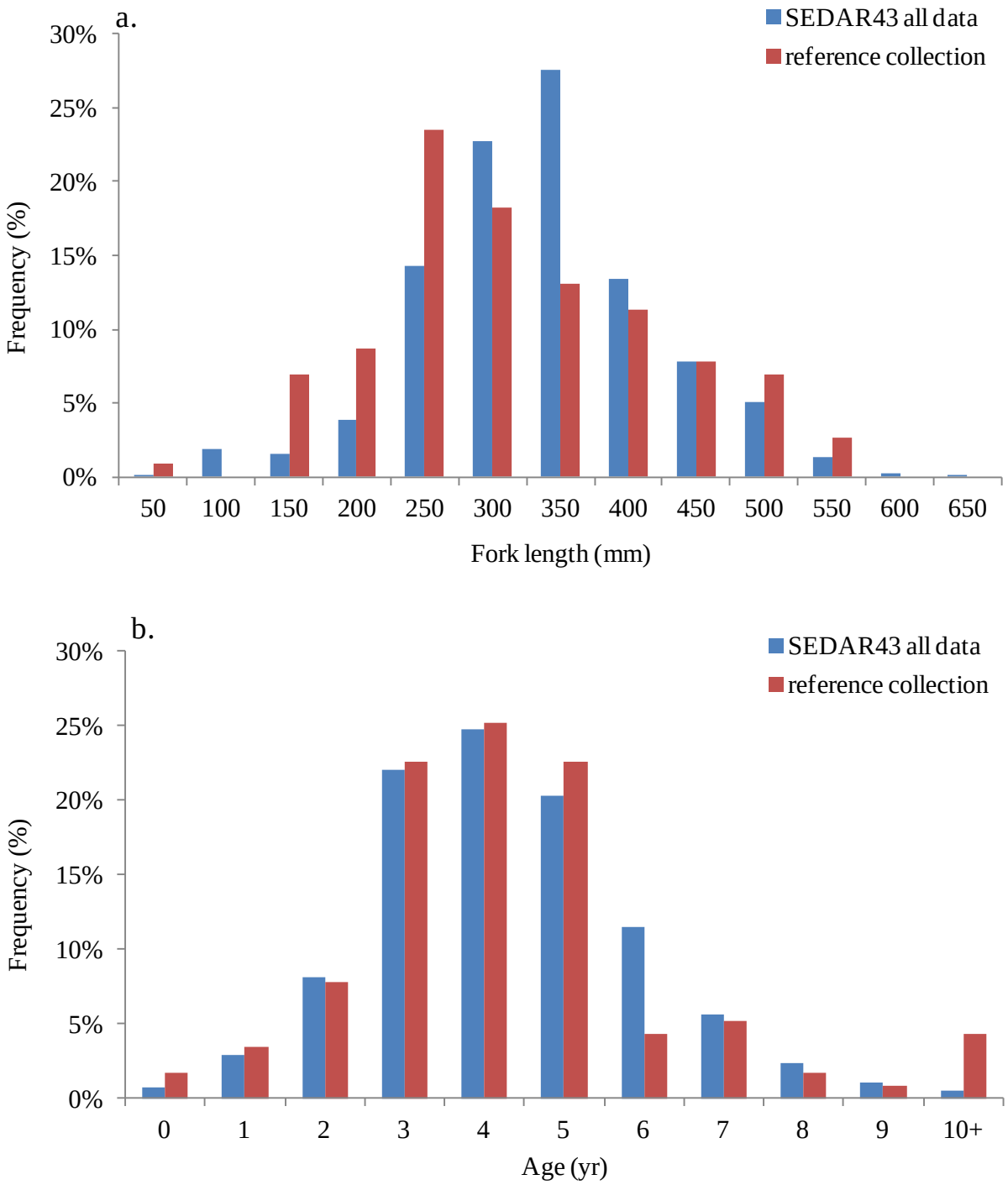

Figure 1. Comparison of the (a) length and (b) age frequency between the Gray Triggerfish reference collection samples (n=115) versus all the data used in SEDAR43 (n=5762).

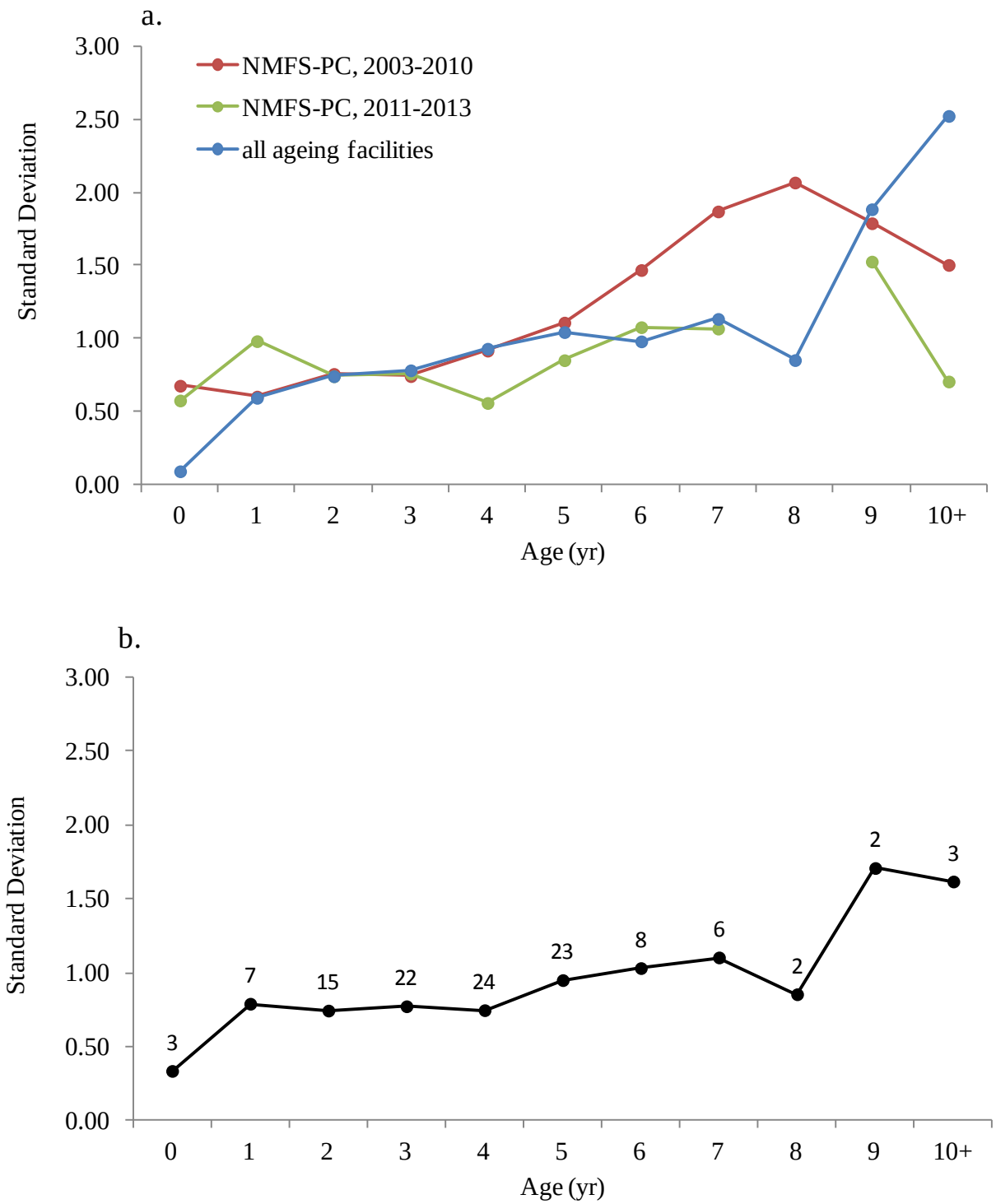

Figure 2. Standard deviation by age for Gray Triggerfish by (a) particular time periods that reflect changes in readers/ageing facilities and (b) overall average for all time periods and readers/ageing facilities (sample sizes above data points).