Changes in lengths-at-age and size selectivity of red snappers in the Gulf of Mexico from 2002 to 2011

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Introduction

Estimation of growth curves and lengths-at-age is a crucial component in fish stock assessments. Lengths-at-age derived from growth curves or estimated directly from age samples are used to convert age to length in the statistical-catch-at-age stock assessment models. In the past SEDAR assessments for red snappers, a combined growth curve was estimated from samples collected from landings over many years. Although the changes in lengths-at-age due to changes in size limits were estimated for each year, the assumption was that the underlining lengths-at-age remain relatively constant year over year. This assumption would be true if size selectivity (other than size limit) changed little due to changes in fishing regulations or fishing behavior. However, recent studies (Chih, 2009,2012a) have shown that changes in length frequency distributions caused by factors other than changes in age frequency distributions (e.g., non-random sampling) can create significant differences in estimated growth curves and lengths-at-age. A previous report (Chih, 2012b) showed that there were pronounced changes in length frequency distributions in both recreational and commercial red snapper samples after 2007, when new bag limits, size limit rules and IFQ were put into effect. This report demonstrated that red snapper lengths-at-age changed coincident with the changes in length frequency distributions between years and between different strata within a year after 2007. These results suggested that changes in size selectivity resulting from changes in fishing regulation could be a significant factor in determine length frequency distributions and lengths-at-age and may need to be modeled in stock assessment models.

Methods

Red snapper length samples from commercial fisheries were obtained from the (1) Trip Interview Program (TIP) database, (2) the Gulf Fisheries Information Network (FIN) database and (3) the Panama City Laboratory age data base. All commercial handline

data were grouped into two strata (handline east (HE) and handline west (HW)). The eastern Gulf and western Gulf were defined based on Gulf shrimp grids (grids 1 to 12 for the eastern Gulf and 13 to 21 for the western Gulf). The details for estimation of length frequency distributions for each stratum have been reported elsewhere (Chih, 2012)

Length and otolith samples for recreational fisheries were obtained from (1) the Marine Recreational Fisheries Statistics Survey, (2) the Headboat survey, (3) the Texas Parks and Wildlife Department database, (4) the Gulf FIN database, (5) the Florida Fish and Wildlife Research Institute, and (6) the TIP database. All recreational length data were grouped into two strata (recreational east (RE) and recreational west (RW)). The eastern Gulf included Florida, Alabama and Mississippi, while the western Gulf included Louisiana and Texas. The details for estimation of Length frequency distributions for each stratum have been reported elsewhere (Chih, 2012).

Otolith samples from commercial handline and longline fisheries and from recreational fisheries (private boat, charter boat and head boat) were pooled together to estimate lengths-at-age for individual years. Lengths-at-age for each stratum/year were then estimated by reweighting the lengths-at-age with the length frequency distribution for each stratum/year (data from Chih, 2012). All lengths were total length in inches.

Results & Discussion

Changes in bag limits from 4 to 2 for recreational fisheries resulted in noticeable changes in the lengths-at-age for samples collected from the RE and RW strata after 2007 (Figs 1 & 2, Tables 1 & 2). There were big differences in lengths-at-age between samples collected in 2006 and those collected in 2011. These differences are especially pronounced for samples with ages older than 4. These increases indicated a change in within age size selectivity which is likely due to the bag limit changing from 4 to 2 after 2007. Since most private fishermen want to catch the biggest fish possible, a decrease in the bag limit should lead to an increase in the sizes of fish caught.

The adoption of IFQ also caused a noticeable increase in lengths-at-age (Figs 3&4, Tables 3 & 4) in samples collected from commercial handline fisheries, although the effect was less pronounced than that observed in recreational fisheries. The increase in lengths-at-age was less noticeable in HE than in HW. According to fishermen (personal discussion), there are more large fish available since the IFQ, and those large fish are more capable of competing for bait. As a result, there has been a shift in size selectivity toward larger fish when red snappers are more abundant. The

ultimate consequence of this shift could be a greater percentage of spawners being removed from the overall red snapper population. It should also be noted that commercial fishermen don't intentionally catch larger fish. In fact, the most desirable market size for a red snapper is 14-16 inches (personal discussion with fishermen). Some fishermen, especially those from eastern Gulf, tend to treat red snappers as by-catch and try to avoid areas where there are noticeably larger red snappers so they can catch a more desirable size of fish. These fishing habits may explain partially why changes in size selectivity toward larger fish were less pronounced in the eastern Gulf than in the western Gulf.

Lengths-at-age also differed noticeably between different strata within a year (Fig 5, Tables 1-4). These differences reflected the different effects of changes in fishing regulations between recreational and commercial fisheries on size selectivity.

The changes in the size limit from 15 inches to 13 inches in 2007 did not have a big impact on length frequency distributions (Chih, 2012b). Increases in the proportion of fish under 15 inches were small except for samples collected in 2007 from HE. As a result, the effect of changes in size limits for lengths-at-age were minimal in this report (Figs 1-4).

If we assume growth rates remain relative constant year over year, then these changes in lengths-at-age after 2007 suggest that there are large shifts in size selectivity within ages. Changes in size selectivity can also influence age selectivity and thus changes in both age frequency distributions and length frequency distributions. Since lengths-at-age are used to convert ages to lengths in red snapper stock assessment models, and since the precision of lengths-at-age can have a significant impact on the outcome of stock assessments, it may be more appropriate to estimate lengths-at-age for individual years instead of assuming that lengths-at-age remained relatively unchanged between years and strata.

Conclusions

1. Results from this analysis show that there are significant changes in lengths-at-age, and that these changes coincide with changes in length frequency distributions after 2007. These changes in lengths-at-age reflect changes in within-age size selectivity due to (a) changes in bag limits and in the behavior of

fishermen in recreational fisheries, and (b) increased availability of larger fish that are more capable of competing for bait.

2. The observed changes in size selectivity for red snappers among different years and strata suggested that (a) lengths-at-age for individual strata/years may need to be estimated directly from age-length data instead of being derived from one combined growth curve, and (b) size selectivity may need to be modeled to reflect the effect of changes in fishing regulations in stock assessment models.

References

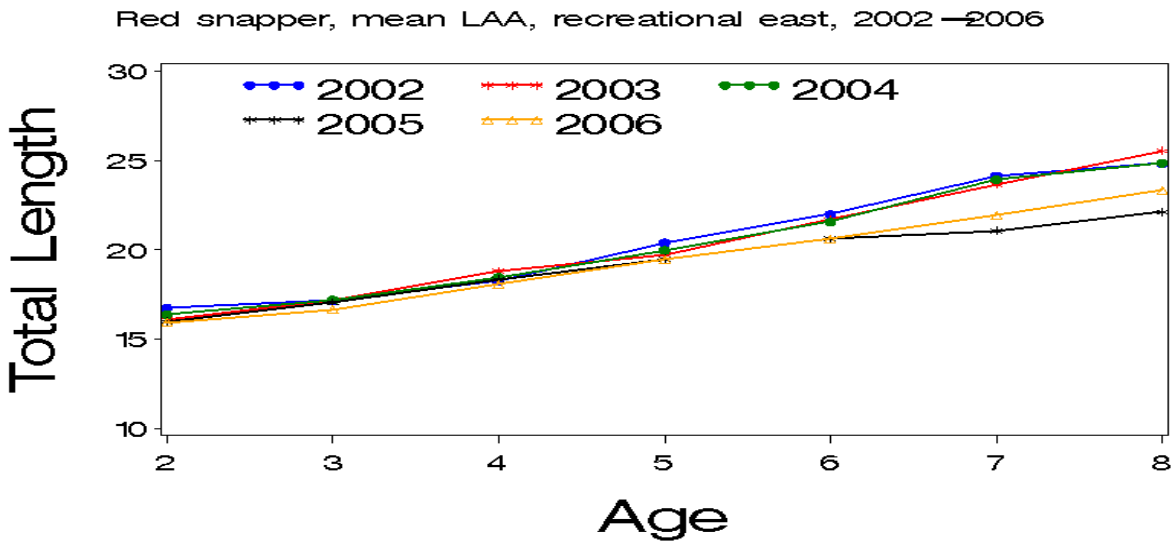
Chih, C.P. 2009, The effects of otolith sampling methods on the precision of growth curves, North American Journal of Fisheries Management, 29: 1519-1528.

Chih, C.P. 2012a, On the comparisons of regional differences in the growth of red snappers from the Gulf of Mexico. SEDAR31-DW18.

Chih, C.P. 2012b, Length frequency distribution for red snappers in the Gulf of Mexico from 1984-2011. SEDAR31-DW10.

Fig 1. Changes in mean lengths-at-age for red snapper samples collected from recreational east (RE) strata during (a) 2002-2006 and (b) 2006-2011.

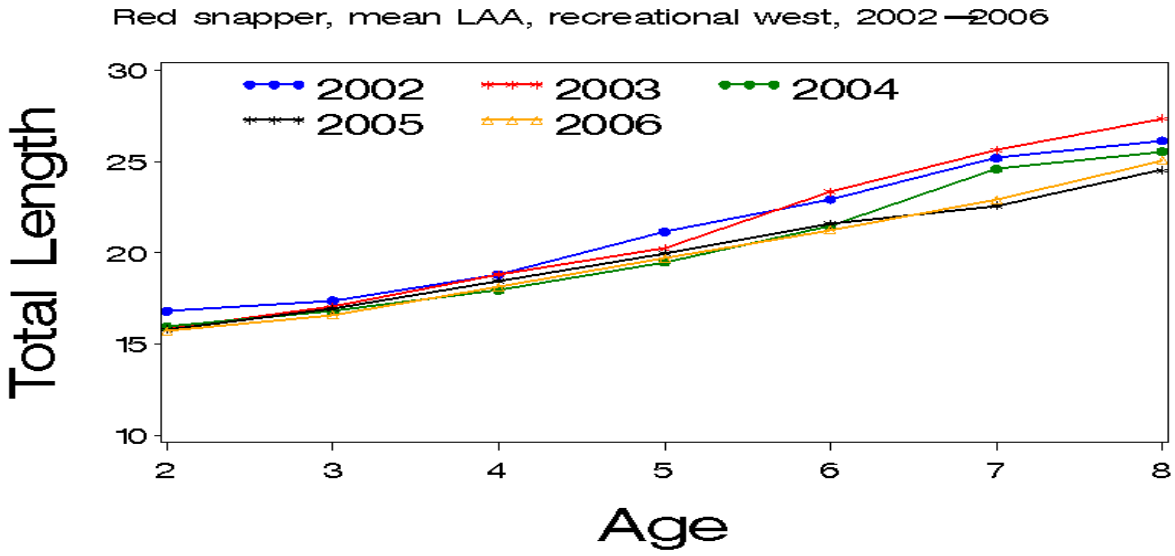
(a)



(b)

Fig 2. Changes in mean lengths-at-age for red snapper samples collected from recreational west (RW) strata during (a) 2002-2006 and (b) 2006-2011.

(a)



(b)

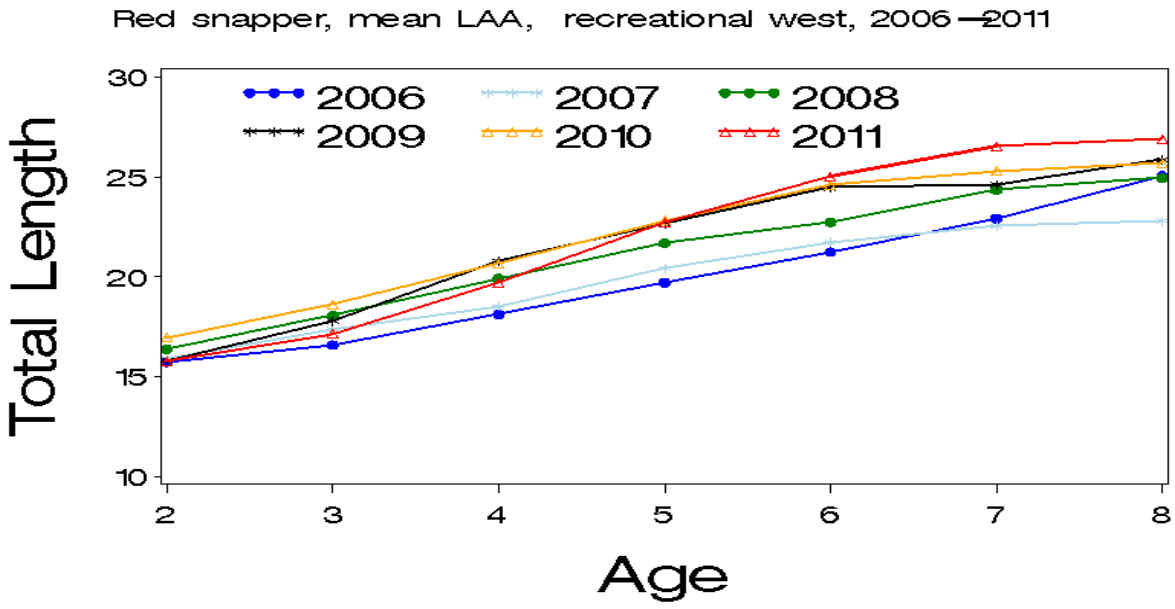
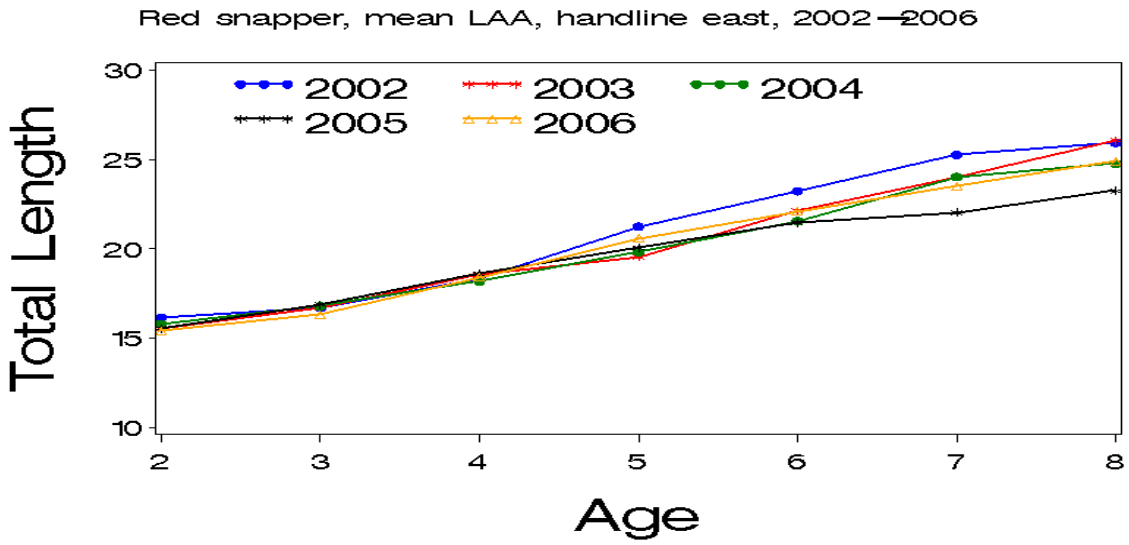


Fig 3. Changes in mean lengths-at-age for red snapper samples collected from handline east (HE) strata during (a) 2002-2006 and (b) 2006-2011.

(a)



(b)

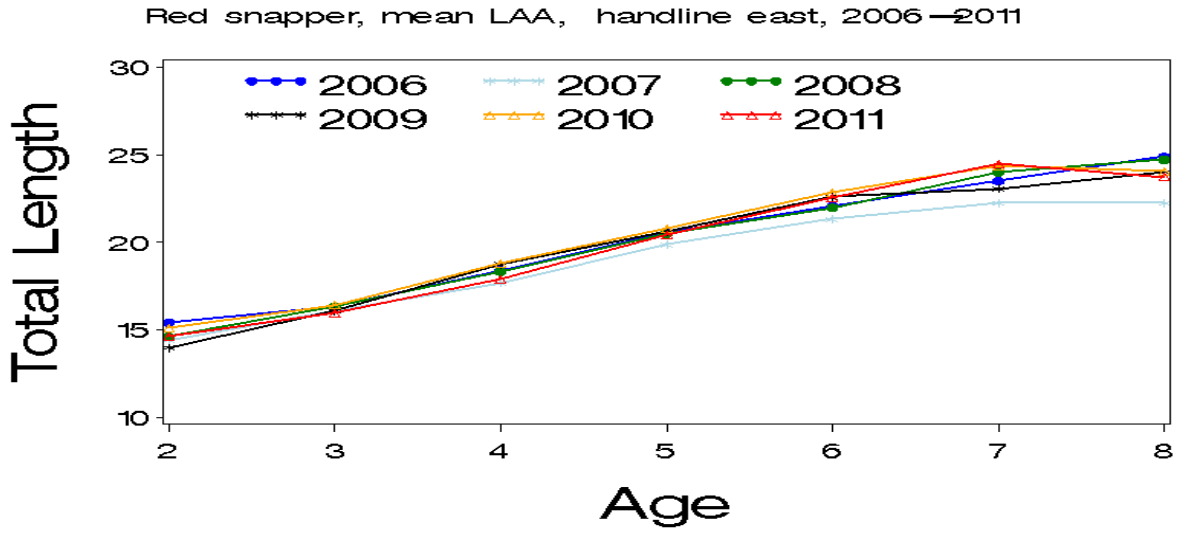
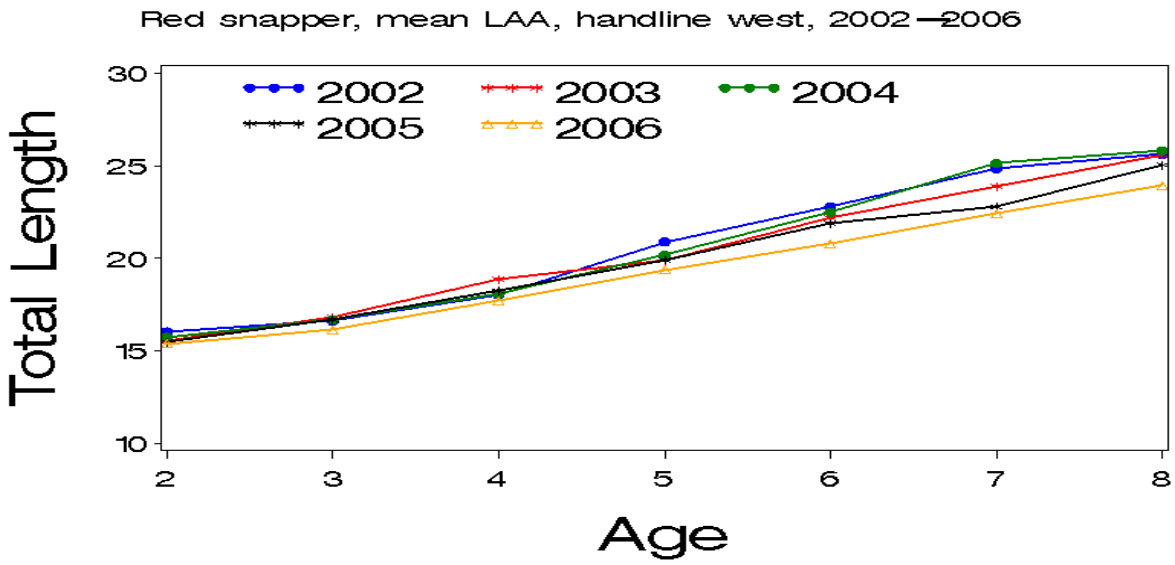


Fig 4. Changes in mean lengths-at-age for red snapper samples collected from handline (HW) strata during (a) 2002-2006 and (b) 2006-2011.

(a)



(b)

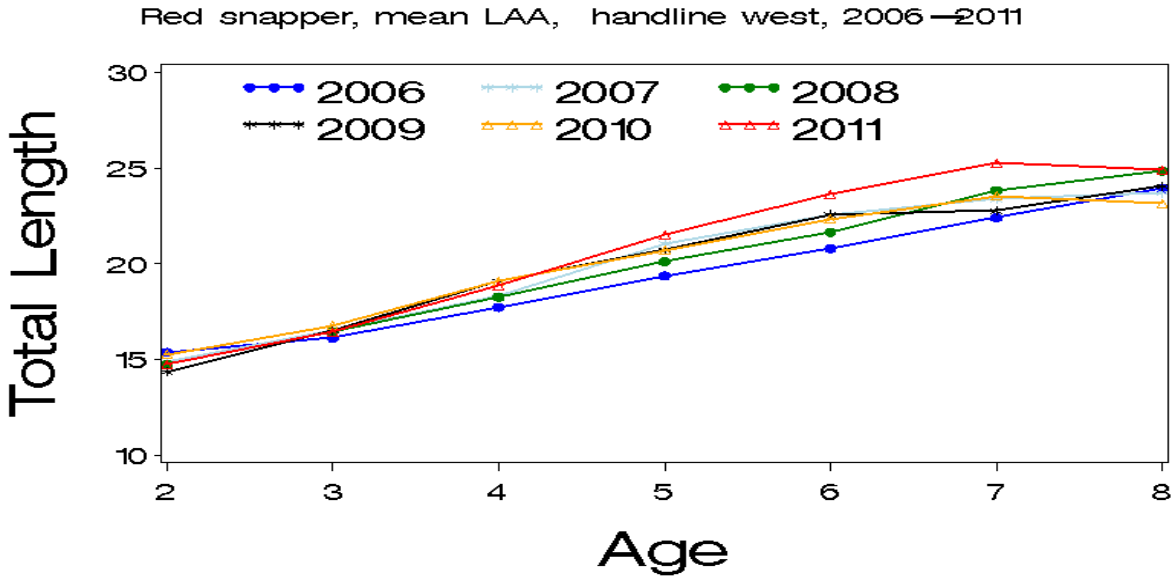


Fig 5. Changes in mean lengths-at-age for red snapper samples collected from different strata during (a) 2006 and (b) 2011.

(a)

(b)

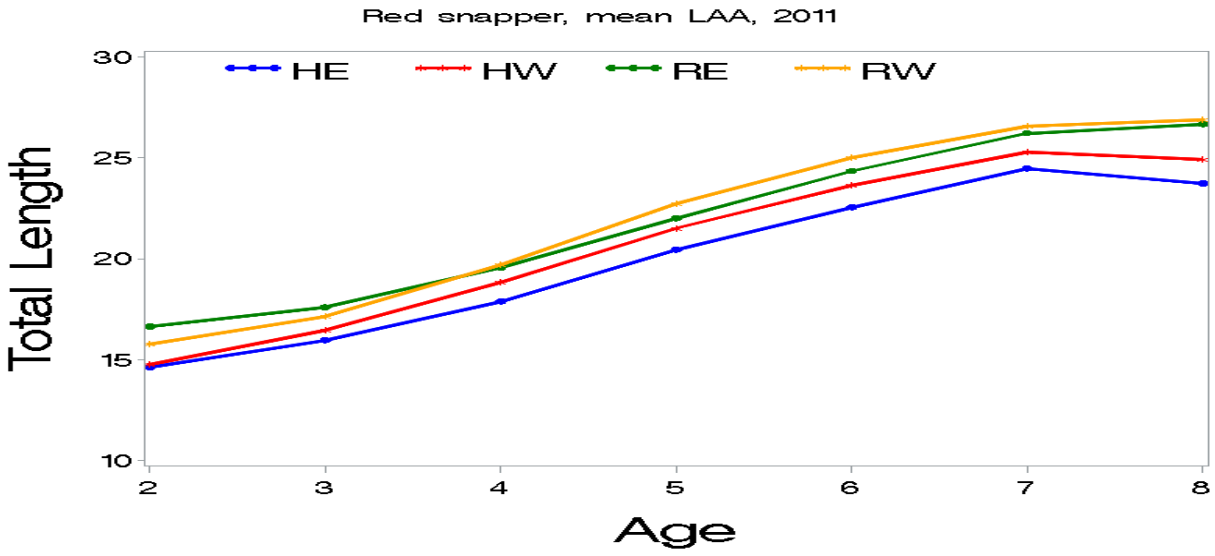


Table 1. Mean lengths-at-age, standard errors and weighted sample sizes for red snapper samples collected from recreational east (RE) strata during 2002 to 2011.

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
RE	2002	1	16.76	0.23	62
RE	2002	2	16.74	0.05	749
RE	2002	3	17.17	0.03	3752
RE	2002	4	18.24	0.06	1543
RE	2002	5	20.41	0.11	740
RE	2002	6	21.99	0.20	256
RE	2002	7	24.13	0.25	142
RE	2002	8	24.83	0.44	46
RE	2002	9	26.20	0.77	15
RE	2002	10	28.70	0.47	10
RE	2003	1	15.69	0.29	12
RE	2003	2	16.08	0.03	1389
RE	2003	3	17.18	0.02	4628
RE	2003	4	18.81	0.05	3105
RE	2003	5	19.72	0.12	759
RE	2003	6	21.69	0.22	334
RE	2003	7	23.66	0.29	164
RE	2003	8	25.55	0.35	85
RE	2003	9	25.65	0.61	34
RE	2003	10	26.48	0.74	19
RE	2004	1	16.88	0.25	29
RE	2004	2	16.37	0.04	1220
RE	2004	3	17.20	0.03	3473
RE	2004	4	18.47	0.05	2561
RE	2004	5	19.98	0.10	1057
RE	2004	6	21.56	0.21	261
RE	2004	7	23.93	0.26	146
RE	2004	8	24.86	0.32	80
RE	2004	9	25.76	0.47	40
RE	2004	10	26.78	0.46	31
RE	2005	1	15.44	0.22	8
RE	2005	2	15.99	0.02	1634
RE	2005	3	17.03	0.02	5233
RE	2005	4	18.34	0.06	2078
RE	2005	5	19.49	0.09	1228
RE	2005	6	20.63	0.15	513
RE	2005	7	21.06	0.29	171
RE	2005	8	22.12	0.43	85

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
RE	2005	9	24.13	0.58	38
RE	2005	10	24.92	0.79	23
RE	2006	1	13.45	0.82	24
RE	2006	2	15.92	0.03	1215
RE	2006	3	16.66	0.02	4976
RE	2006	4	18.08	0.05	2508
RE	2006	5	19.48	0.11	723
RE	2006	6	20.62	0.16	464
RE	2006	7	21.96	0.22	233
RE	2006	8	23.35	0.39	76
RE	2006	9	25.05	0.53	36
RE	2006	10	25.20	0.55	33
RE	2007	1	16.41	0.33	6
RE	2007	2	16.09	0.05	425
RE	2007	3	17.05	0.03	2816
RE	2007	4	17.98	0.06	1394
RE	2007	5	19.73	0.16	271
RE	2007	6	21.01	0.23	132
RE	2007	7	22.15	0.26	85
RE	2007	8	22.00	0.50	38
RE	2007	9	24.07	0.51	20
RE	2007	10	26.34	1.00	12
RE	2008	1	13.00	0.00	0
RE	2008	2	16.45	0.07	228
RE	2008	3	17.40	0.04	1571
RE	2008	4	18.71	0.06	1721
RE	2008	5	20.35	0.12	488
RE	2008	6	21.57	0.23	126
RE	2008	7	23.51	0.35	50
RE	2008	8	24.55	0.39	32
RE	2008	9	23.96	0.58	22
RE	2008	10	27.44	0.46	12
RE	2009	1	16.20	0.45	4
RE	2009	2	16.42	0.12	87
RE	2009	3	17.57	0.04	1809
RE	2009	4	19.99	0.05	2690
RE	2009	5	21.97	0.08	1594
RE	2009	6	24.09	0.14	587
RE	2009	7	24.01	0.37	114
RE	2009	8	25.43	0.52	53
RE	2009	9	26.66	0.33	67
RE	2009	10	26.98	0.51	38

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
RE	2010	1	16.91	0.46	4
RE	2010	2	16.86	0.08	203
RE	2010	3	18.32	0.05	1539
RE	2010	4	20.15	0.05	2733
RE	2010	5	22.09	0.08	1922
RE	2010	6	24.07	0.13	847
RE	2010	7	24.92	0.27	217
RE	2010	8	25.12	0.69	59
RE	2010	9	24.05	1.20	18
RE	2010	10	25.04	5.47	3
RE	2011	1	15.50	1.49	2
RE	2011	2	16.64	0.14	83
RE	2011	3	17.59	0.07	392
RE	2011	4	19.57	0.05	1986
RE	2011	5	22.00	0.06	2260
RE	2011	6	24.35	0.09	1197
RE	2011	7	26.23	0.16	455
RE	2011	8	26.68	0.41	137
RE	2011	9	28.28	0.56	44
RE	2011	10	20.75	1.47	6

Table 2. Mean lengths-at-age, standard errors and weighted sample sizes for red snapper samples collected from recreational west (RW) strata during 2002 to 2011.

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
RW	2002	1	16.59	0.32	64
RW	2002	2	16.81	0.07	657
RW	2002	3	17.38	0.03	3316
RW	2002	4	18.81	0.07	1558
RW	2002	5	21.16	0.11	926
RW	2002	6	22.93	0.19	358
RW	2002	7	25.19	0.24	230
RW	2002	8	26.14	0.42	80
RW	2002	9	27.64	0.69	27
RW	2002	10	28.16	0.93	23
RW	2003	1	15.20	0.28	18
RW	2003	2	15.86	0.03	1452
RW	2003	3	17.02	0.03	4336
RW	2003	4	18.82	0.05	2904
RW	2003	5	20.23	0.14	780
RW	2003	6	23.35	0.24	417
RW	2003	7	25.63	0.30	248
RW	2003	8	27.36	0.32	154
RW	2003	9	27.71	0.51	65
RW	2003	10	28.21	0.62	38
RW	2004	1	16.32	0.29	33
RW	2004	2	15.95	0.04	1466
RW	2004	3	16.78	0.03	3510
RW	2004	4	17.96	0.05	2374
RW	2004	5	19.49	0.10	934
RW	2004	6	21.47	0.23	220
RW	2004	7	24.59	0.29	132
RW	2004	8	25.55	0.35	75
RW	2004	9	26.67	0.48	40
RW	2004	10	27.47	0.46	32
RW	2005	1	15.15	0.26	9
RW	2005	2	15.80	0.03	1663
RW	2005	3	16.92	0.02	4905
RW	2005	4	18.45	0.06	2037
RW	2005	5	19.96	0.10	1262
RW	2005	6	21.59	0.17	574
RW	2005	7	22.58	0.33	205

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
RW	2005	8	24.53	0.48	119
RW	2005	9	26.50	0.56	64
RW	2005	10	28.19	0.71	50
RW	2006	1	14.56	0.69	23
RW	2006	2	15.73	0.03	1237
RW	2006	3	16.59	0.02	4800
RW	2006	4	18.12	0.05	2445
RW	2006	5	19.72	0.12	728
RW	2006	6	21.24	0.17	493
RW	2006	7	22.92	0.25	263
RW	2006	8	25.06	0.44	101
RW	2006	9	27.04	0.54	54
RW	2006	10	27.23	0.57	51
RW	2007	1	15.10	0.48	9
RW	2007	2	15.90	0.06	367
RW	2007	3	17.36	0.03	2592
RW	2007	4	18.53	0.06	1471
RW	2007	5	20.42	0.16	338
RW	2007	6	21.73	0.22	182
RW	2007	7	22.55	0.25	123
RW	2007	8	22.81	0.48	51
RW	2007	9	24.44	0.48	33
RW	2007	10	25.49	0.86	15
RW	2008	1	13.00	0.00	0
RW	2008	2	16.38	0.11	140
RW	2008	3	18.06	0.05	1123
RW	2008	4	19.92	0.06	1768
RW	2008	5	21.68	0.11	712
RW	2008	6	22.74	0.21	219
RW	2008	7	24.34	0.29	103
RW	2008	8	24.95	0.33	70
RW	2008	9	24.75	0.49	45
RW	2008	10	27.03	0.44	25
RW	2009	1	14.82	0.67	4
RW	2009	2	15.80	0.15	89
RW	2009	3	17.78	0.05	1268
RW	2009	4	20.79	0.05	2662
RW	2009	5	22.66	0.07	1868
RW	2009	6	24.47	0.13	725
RW	2009	7	24.61	0.33	138
RW	2009	8	25.87	0.47	67
RW	2009	9	26.85	0.36	91

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
RW	2009	10	27.67	0.53	53
RW	2010	1	15.96	0.90	4
RW	2010	2	16.95	0.08	154
RW	2010	3	18.60	0.06	1269
RW	2010	4	20.68	0.05	2599
RW	2010	5	22.82	0.07	2131
RW	2010	6	24.60	0.11	1023
RW	2010	7	25.31	0.25	261
RW	2010	8	25.70	0.64	65
RW	2010	9	24.84	1.11	20
RW	2010	10	24.67	5.50	2
RW	2011	1	15.36	0.64	2
RW	2011	2	15.79	0.10	111
RW	2011	3	17.14	0.08	342
RW	2011	4	19.72	0.06	1598
RW	2011	5	22.72	0.06	2229
RW	2011	6	25.03	0.09	1453
RW	2011	7	26.56	0.14	585
RW	2011	8	26.91	0.36	154
RW	2011	9	27.97	0.52	52
RW	2011	10	21.34	1.55	6

Table 3. Mean lengths-at-age, standard errors and weighted sample sizes for red snapper samples collected from handline east (HE) strata during 2002 to 2011.

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
HE	2002	1	15.97	0.24	76
HE	2002	2	16.15	0.06	800
HE	2002	3	16.71	0.03	3483
HE	2002	4	18.30	0.08	1444
HE	2002	5	21.25	0.12	817
HE	2002	6	23.24	0.20	332
HE	2002	7	25.26	0.22	217
HE	2002	8	25.95	0.39	71
HE	2002	9	27.36	0.59	24
HE	2002	10	28.77	0.43	17
HE	2003	1	14.85	0.24	32
HE	2003	2	15.52	0.03	1785
HE	2003	3	16.69	0.03	4382
HE	2003	4	18.54	0.05	2869
HE	2003	5	19.55	0.14	752
HE	2003	6	22.14	0.24	336
HE	2003	7	24.04	0.32	180
HE	2003	8	26.08	0.38	99
HE	2003	9	26.63	0.54	40
HE	2003	10	27.45	0.71	23
HE	2004	1	16.09	0.32	33
HE	2004	2	15.80	0.04	1456
HE	2004	3	16.78	0.03	3346
HE	2004	4	18.18	0.05	2488
HE	2004	5	19.83	0.10	1050
HE	2004	6	21.56	0.21	246
HE	2004	7	24.03	0.24	141
HE	2004	8	24.77	0.32	80
HE	2004	9	26.03	0.46	37
HE	2004	10	27.02	0.47	29
HE	2005	1	14.82	0.25	13
HE	2005	2	15.54	0.03	1748
HE	2005	3	16.88	0.03	4709
HE	2005	4	18.62	0.07	2157
HE	2005	5	20.07	0.10	1359
HE	2005	6	21.46	0.16	598

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
HE	2005	7	22.03	0.29	204
HE	2005	8	23.26	0.44	103
HE	2005	9	25.17	0.55	51
HE	2005	10	26.65	0.80	37
HE	2006	1	15.48	0.61	19
HE	2006	2	15.41	0.03	1338
HE	2006	3	16.32	0.02	4461
HE	2006	4	18.41	0.06	2394
HE	2006	5	20.58	0.13	808
HE	2006	6	22.09	0.17	581
HE	2006	7	23.50	0.22	328
HE	2006	8	24.89	0.36	128
HE	2006	9	26.54	0.45	66
HE	2006	10	26.50	0.48	60
HE	2007	1	13.43	0.24	47
HE	2007	2	14.38	0.05	1024
HE	2007	3	16.08	0.04	2644
HE	2007	4	17.67	0.07	1071
HE	2007	5	19.87	0.16	202
HE	2007	6	21.32	0.22	102
HE	2007	7	22.24	0.25	67
HE	2007	8	22.24	0.48	27
HE	2007	9	23.90	0.47	15
HE	2007	10	25.11	0.87	8
HE	2008	1	13.00	0.00	6
HE	2008	2	14.61	0.09	532
HE	2008	3	16.33	0.05	1645
HE	2008	4	18.33	0.07	1412
HE	2008	5	20.50	0.14	414
HE	2008	6	21.98	0.27	114
HE	2008	7	24.01	0.36	53
HE	2008	8	24.72	0.41	36
HE	2008	9	24.77	0.53	22
HE	2008	10	27.36	0.43	13
HE	2009	1	13.50	0.44	31
HE	2009	2	13.97	0.08	720
HE	2009	3	16.07	0.04	2784
HE	2009	4	18.75	0.05	2147
HE	2009	5	20.60	0.09	984
HE	2009	6	22.59	0.17	291
HE	2009	7	23.07	0.39	59
HE	2009	8	24.04	0.61	24

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
HE	2009	9	26.33	0.37	27
HE	2009	10	26.52	0.58	15
HE	2010	1	14.30	0.70	19
HE	2010	2	15.12	0.09	597
HE	2010	3	16.41	0.06	2345
HE	2010	4	18.78	0.06	2421
HE	2010	5	20.81	0.09	1422
HE	2010	6	22.87	0.15	561
HE	2010	7	24.37	0.29	132
HE	2010	8	24.08	0.75	39
HE	2010	9	22.58	1.36	13
HE	2010	10	23.56	5.42	2
HE	2011	1	14.28	0.54	14
HE	2011	2	14.63	0.08	631
HE	2011	3	15.96	0.07	1005
HE	2011	4	17.88	0.06	2426
HE	2011	5	20.45	0.07	1600
HE	2011	6	22.55	0.12	638
HE	2011	7	24.48	0.20	189
HE	2011	8	23.73	0.45	55
HE	2011	9	24.66	1.04	16
HE	2011	10	18.35	1.39	6

Table 4. Mean lengths-at-age, standard errors and weighted sample sizes for red snapper samples collected from handline west (HW) strata during 2002 to 2011.

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
HW	2002	1	15.64	0.25	88
HW	2002	2	16.04	0.06	846
HW	2002	3	16.61	0.03	3605
HW	2002	4	18.04	0.08	1439
HW	2002	5	20.89	0.12	756
HW	2002	6	22.81	0.20	291
HW	2002	7	24.84	0.23	177
HW	2002	8	25.62	0.42	60
HW	2002	9	27.10	0.66	19
HW	2002	10	27.51	0.99	15
HW	2003	1	14.84	0.25	30
HW	2003	2	15.55	0.03	1658
HW	2003	3	16.81	0.03	4287
HW	2003	4	18.86	0.05	3007
HW	2003	5	19.91	0.14	808
HW	2003	6	22.22	0.22	364
HW	2003	7	23.90	0.30	193
HW	2003	8	25.60	0.36	104
HW	2003	9	26.28	0.52	42
HW	2003	10	26.86	0.68	23
HW	2004	1	16.02	0.30	33
HW	2004	2	15.75	0.04	1472
HW	2004	3	16.68	0.03	3270
HW	2004	4	18.09	0.06	2347
HW	2004	5	20.18	0.12	1041
HW	2004	6	22.50	0.24	270
HW	2004	7	25.13	0.24	187
HW	2004	8	25.83	0.30	111
HW	2004	9	27.02	0.39	58
HW	2004	10	27.35	0.36	48
HW	2005	1	14.83	0.25	14
HW	2005	2	15.47	0.03	1906
HW	2005	3	16.67	0.03	4703
HW	2005	4	18.24	0.07	2000
HW	2005	5	19.92	0.11	1233
HW	2005	6	21.89	0.19	561
HW	2005	7	22.79	0.34	205
HW	2005	8	25.05	0.48	127

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
HW	2005	9	27.13	0.55	70
HW	2005	10	28.48	0.72	58
HW	2006	1	15.80	0.51	17
HW	2006	2	15.37	0.03	1582
HW	2006	3	16.13	0.02	4953
HW	2006	4	17.73	0.05	2270
HW	2006	5	19.38	0.13	644
HW	2006	6	20.80	0.17	428
HW	2006	7	22.41	0.24	221
HW	2006	8	23.93	0.42	78
HW	2006	9	26.28	0.51	39
HW	2006	10	26.26	0.52	37
HW	2007	1	13.88	0.30	24
HW	2007	2	14.85	0.06	729
HW	2007	3	16.49	0.04	2495
HW	2007	4	18.31	0.08	1205
HW	2007	5	21.07	0.18	304
HW	2007	6	22.58	0.22	181
HW	2007	7	23.38	0.24	130
HW	2007	8	23.71	0.44	55
HW	2007	9	25.07	0.44	38
HW	2007	10	26.49	0.78	18
HW	2008	1	13.00	0.00	4
HW	2008	2	14.75	0.09	493
HW	2008	3	16.46	0.05	1664
HW	2008	4	18.27	0.06	1457
HW	2008	5	20.11	0.13	402
HW	2008	6	21.66	0.27	106
HW	2008	7	23.83	0.39	47
HW	2008	8	24.85	0.46	32
HW	2008	9	25.27	0.62	22
HW	2008	10	28.31	0.48	13
HW	2009	1	14.03	0.50	17
HW	2009	2	14.35	0.09	451
HW	2009	3	16.51	0.04	2573
HW	2009	4	19.09	0.05	2416
HW	2009	5	20.73	0.08	1137
HW	2009	6	22.58	0.16	331
HW	2009	7	22.77	0.39	66
HW	2009	8	24.05	0.61	27
HW	2009	9	26.60	0.43	30
HW	2009	10	27.18	0.68	18

Strata	Year	Age	Mean Length	Standard Error	Weighted sample size
HW	2010	1	13.91	0.76	19
HW	2010	2	15.26	0.10	516
HW	2010	3	16.77	0.06	2233
HW	2010	4	19.08	0.06	2586
HW	2010	5	20.70	0.08	1495
HW	2010	6	22.33	0.14	533
HW	2010	7	23.54	0.28	123
HW	2010	8	23.17	0.74	35
HW	2010	9	21.28	1.19	12
HW	2010	10	21.90	4.85	1
HW	2011	1	14.20	0.62	8
HW	2011	2	14.77	0.10	337
HW	2011	3	16.45	0.08	638
HW	2011	4	18.85	0.06	2177
HW	2011	5	21.51	0.06	2041
HW	2011	6	23.63	0.10	946
HW	2011	7	25.27	0.17	306
HW	2011	8	24.92	0.42	83
HW	2011	9	26.76	0.83	26
HW	2011	10	19.94	1.54	6