SEDAR 12 AW-8

Comparison of ALK and RAS methods for deriving age frequency distributions of red groupers caught by commercial fisheries in the Gulf of Mexico.

Ching-Ping Chih

October, 2006

Southeast Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
75 Virginia Beach Drive
Miami, FL 33149

Sustainable Fisheries Division Contribution No. SFD-2006-046

Introduction

This study compares the age length key (ALK) and random age sampling (RAS) methods for deriving age frequency distributions (AFDs) of commercial red grouper TIP samples collected from the Gulf of Mexico from 1991 to 2005. Each of these two methods has its drawbacks. The biggest problem with RAS is that the extra time required to take otoliths out of fish samples often limits the size of random otolith samples. Otolith sample sizes for more than 50% of red grouper TIP sampling trips from 1991 to 2005 were smaller than 5 (Chih, 06). These small sample sizes often resulted in non-random sampling by samplers (Chih, 06). Also, whether red grouper otolith samples collected before 2000 were taken randomly is unclear (Chih, 06). Moreover, it is difficult to obtain enough otolith samples for all strata. For example, no otolith samples were collected from trap fisheries in 2005. However, the ALK method also has problems, because it requires an equal number of samples from each length interval, and because it is difficult to get sufficient samples from either very young or very old fish. Also, the growth curve derived from analysis of otolith samples collected with the ALK method does not really reflect the growth curve of the catch. In general, AFDs obtained with the RAS method are considered more accurate than AFDs obtained with the ALK method since length frequency distributions (LFDs) have to be converted to AFDs in the ALK method. However, when otolith sample sizes are small, or the randomness of otolith samples is a concern, the ALK method may be better.

The analyses included in this report shows that, when red grouper otolith sample sizes are large, the AFDs estimated with ALK and RAS methods generally agree with each other. However, when otolith sample sizes are small, there can be significant differences in the AFDs determined with these two methods. **Overall, the ALK method appears to be a better way for determining AFDs for red groupers**. The results from this study also generally confirm the LFD results previously published (Chih, 06).

Methods

The age data used in all analyses were from the Panama City Laboratory (for details, see Lombardi, 06). Otolith samples from all sources were used to develop age length keys. Total lengths of fish from which otolith samples were taken were grouped into categories separated by two-inch intervals. The age composition for each length interval was calculated to build the age length key. Age length keys were generated for each year from 1991 to 2005. A combined ALK was also generated from all otolith samples collected from 1991 to 2005. If no otolith samples were collected for fish of a particular length interval in a given year, the age composition of the length interval of the combined ALK was used. For the ALK method, the AFDs for commercial TIP samples were estimated from LFDs by using the age length key. For the RAS method, the AFDs of commercial TIP samples were constructed directly by using the age and length data provided in the Panama City Laboratory red grouper age data set (Lombardi, 06).

Results & Discussion

I. Comparisons of AFDs (1991-2005) derived with the ALK and RAS methods

Table 1 shows the number of otolith samples for each 2-inch length interval for which ages were determined by the Panama City Laboratory from 1991 to 2005. The number of otolith samples increased significantly after 2001. The combined ALK obtained from otolith samples collected between 1991 and 2005 is showed in Table 2. Tables 3-17 show by year individual ALKs derived from otolith samples. The catch-at-age of commercial landings estimated with the ALK method from TIP length samples is shown in Table 19. Note that, from 1991 onward, the catches-at-age were estimated from the ALK for each year. For fish caught before 1991, catches at age were estimated from the combined ALK (Table 2) for 1991-2005 since no adequate ALKs were available for the years 1984-1989. The catch-at-age of commercial landings estimated with the RAS method from TIP otolith samples from the Panama City Laboratory age data sets is shown in Table 20.

The AFDs determined with both the ALK and RAS methods and covering the years 1991-2005 are shown in Fig 1. Note that, for AFDs determined with the ALK method, the commercial TIP length samples and individual ALK keys (Table 3-17) were used. For AFDs determined with the RAS method, only TIP commercial otolith samples were used. The differences between AFDs determined with the two methods before 2000 were quite significant, with the exceptions of 1993, 1995, and 1998. The differences between AFDs determined with these two methods coincided well with the differences in LFDs between length and otolith samples reported previously (Chih, 06). The differences between AFDs determined with these two methods were small after 2000, which also agreed with the observation that LFDs from commercial TIP length and otolith samples were similar between 2001 and 2005 (Chih, 06).

II. The effects of type of fishing gear on AFDs estimated with the ALK and RAS methods (2000-2005)

Although the differences between AFDs determined with the ALK and RAS methods were small from 2001 to 2005, the differences between AFDs for specific gear types, as determined with these two methods, were sometimes quite significant (Fig 2-7). In these figures, AFDs determined with the ALK method were estimated from TIP length samples for a specific gear type and from the age length key of a specific year. The age length keys for specific gear types were not constructed because otolith sample sizes were small in some gear categories.

Development of gear-specific ALKs is essential if the growth rates (or age-length relationships) of fish caught by different gear types were significantly different from each other. Fig 8(a)-(b) shows the mean fish length-at-age of commercial TIP otolith

samples taken from fish caught by handlines, longlines and traps from 2000 to 2005. The growth rates of fish sampled from handline and longline landings appear to be similar in these years. The small sizes of otolith samples taken from fish caught in traps (see legend of Fig 8) probably contribute to the apparent different growth rates in trap samples obtained from these years. Fig 9 shows the estimated mean length-at-age for red groupers caught by handline, longline or trap. The data for this figure include all available otolith samples in the Panama City Laboratory data set. Few differences were seen in growth rates between samples from different fisheries. Thus, gear-specific length samples and yearly ALKs are probably sufficient for generating gear-specific AFDs.

Figs. 2-7 show that the differences in AFDs between different gear types were much smaller if AFDs were determined with the ALK method rather than with the RAS method. The big differences in AFDs generated with the RAS method between different gear types seen in some years (e.g., the year 2000) were probably due to small otolith sample sizes rather than to real differences in age compositions among fish caught by different gear types. These results also coincide with the differences in LFDs obtained from commercial TIP length samples for fish caught with handlines, longlines or traps (see Chih, 06). Overall, these results show that when otolith sample sizes were sufficiently large, the ALK and RAS methods gave similar AFDs. When otolith sample sizes were small, AFDs obtained with these two methods were noticeably different. Thus, the ALK method is better than the RAS method for deriving AFDs for red groupers.

III. Comparisons of AFDs from 1984 to 1990 estimated with combined ALKs from the years 1978 to1989, and from the years 1991 to 2005.

The AFDs of commercial TIP samples from fish caught from 1984 to 1990 were estimated from combined ALKs coming from otolith samples obtained either from 1978 to 1989 or from 1991 to 2005. Both otolith data sets were provided by the Panama City Laboratory. Table 21 shows the number of otolith samples collected in each 2-inch length interval from 1978-1989. Table 22 shows the combined ALK for samples collected from1978-1989. For the years 1984-1990, the AFDs from commercial TIP samples estimated from the two combined ALKs differed greatly (Fig 10).

Conclusions

1. The analyses in this report show that the AFDs of commercial TIP samples estimated by the ALK method are very different from those estimated by the RAS method in most years from 1991 to 2000. These differences were most likely due to the small size of otolith samples. For 2001-2005, the AFDs estimated by the ALK and RAS methods were similar. These results coincide well with the LFDs for TIP length and otolith samples.

2. Although the AFDs from commercial TIP samples estimated with the ALK and RAS methods were similar from 2001 to 2005, there were significant differences in the AFDs of samples of fish caught with different gear types when estimated with the two methods. In most cases, as long as the sizes of otolith samples were large enough, the AFDs determined with the two methods were similar. Thus, **it appears that, for the red grouper, the ALK method is better for estimating age compositions**. Moreover, the ALK method is the only way to estimate AFDs when otolith samples are lacking or small. For example, there were no otolith samples collected from trap fisheries in 2005. Also, only a few otolith samples were collected before 1991.

3. This report suggests that the sampling activities for red groupers should be redesigned to strengthen the development of age length keys. While random age sampling is important in constructing growth curves for catches, extra non-random samples, which should be clearly recorded in the TIP database as non-random, of very small and very old fish should be taken routinely.

References

1. Ching-Ping Chih, 2006, Reevaluation of the trip interview program (SFD-2006-16).

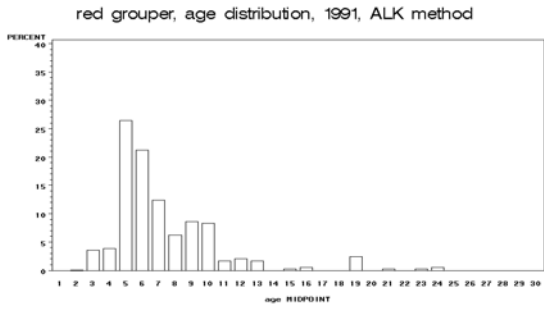
2. Ching-Ping Chih, 2006, Length frequency distribution for red groupers caught by commercial fisheries in the Gulf of Mexico from 1984 to 2005 (SFD-2006-27).

3.Ching-Ping Chih, 2006, Selected sampling issues regarding the length/age frequency distributions of red groupers caught by commercial fisheries in the Gulf of Mexico from 1984 to 2005 (SFD-2006-28).

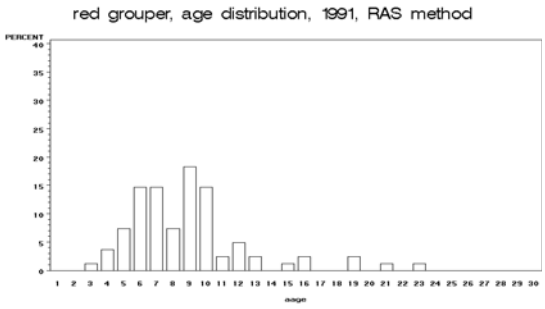
4. Linda Lombardi-Carlson, Chris Palmer, Chris Gardner and Bob Farsky, 2006, Temporal and spatial trends in red grouper (*Epinephelus morio*) age and growth from the northeastern Gulf of Mexico: 1979-2005 (SEDAR 12-DW-03).

Fig 1. Comparison of age frequency distributions derived with ALK and RAS methods. Data are from red grouper commercial TIP samples taken from 1991 to 2005.

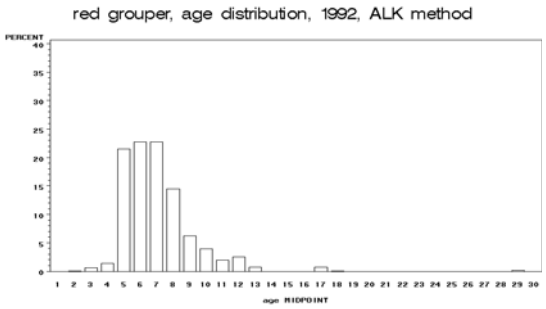
(1a). 1991, ALK, n=14855



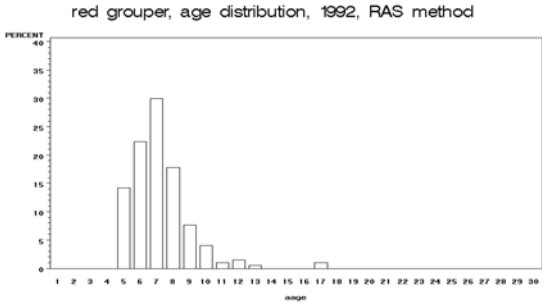
(1b). 1991, RAS, n=82



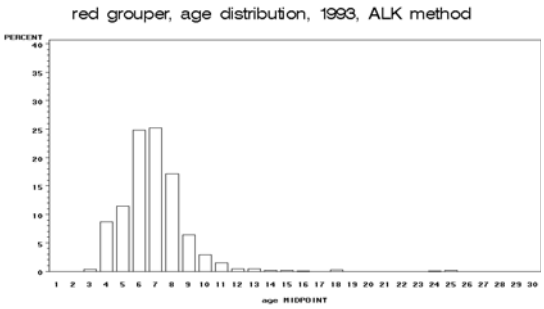
(2a). 1992, ALK, n=11692



(2b). 1992, RAS, n=197



(3a). 1993, ALK, n=12692



(3b). 1993, RAS, n=376

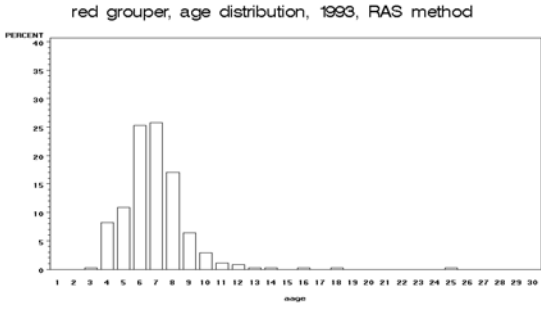
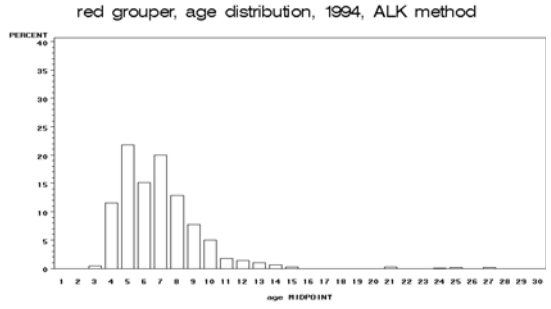
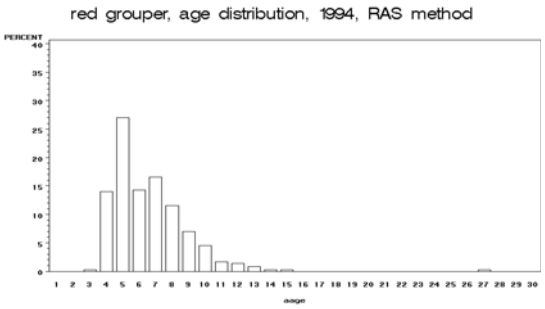


Fig 1. Continued.

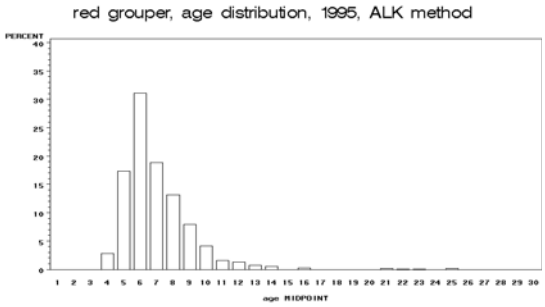
(4a). 1994, ALK, n=11682



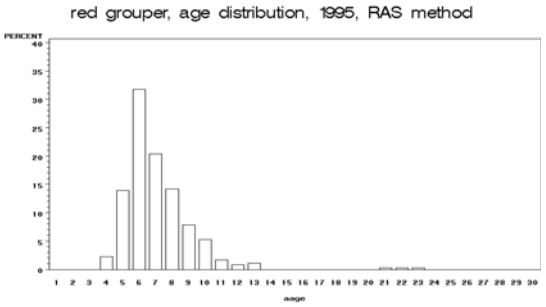
(4b). 1994, RAS, n=356



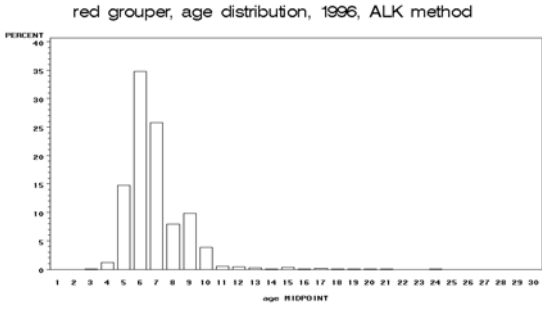
(5a). 1995, ALK, n=14737



(5b). 1995, RAS, n=359



(6a). 1996, ALK, n=13508



(6b). 1996, RAS, n=195

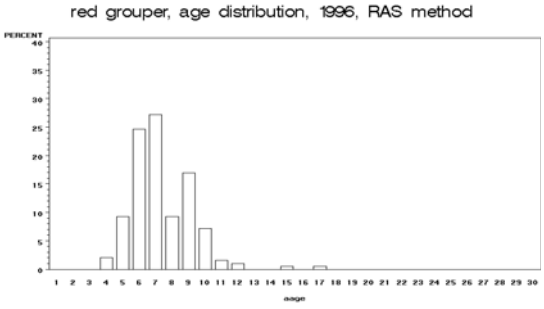
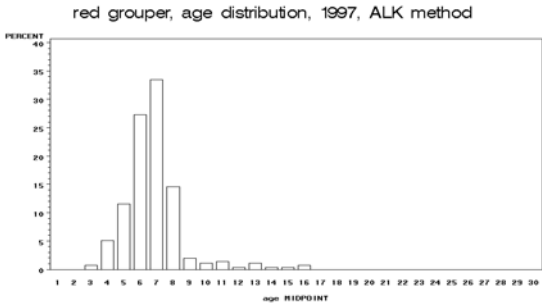
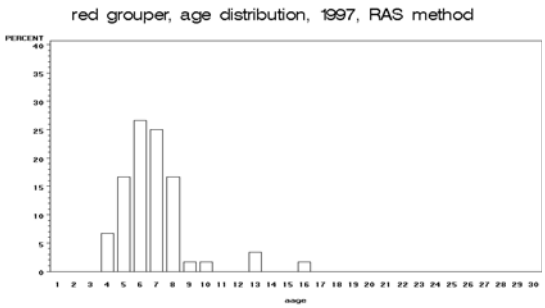


Fig 1. Continued.

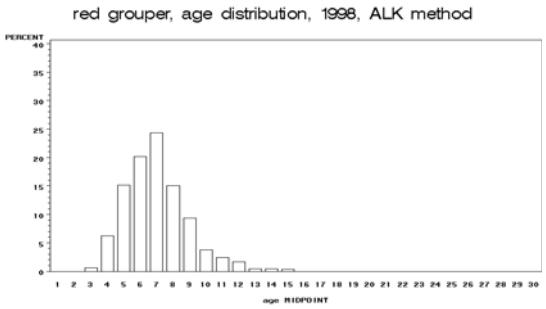
(7a). 1997, ALK, n=17642



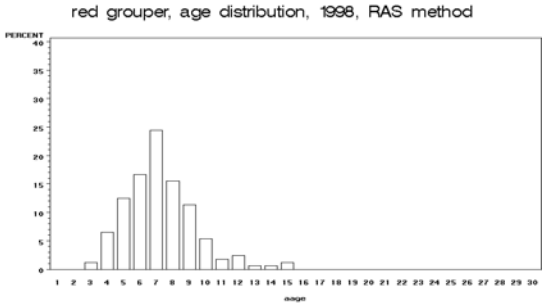
(7b). 1997, RAS, n=60



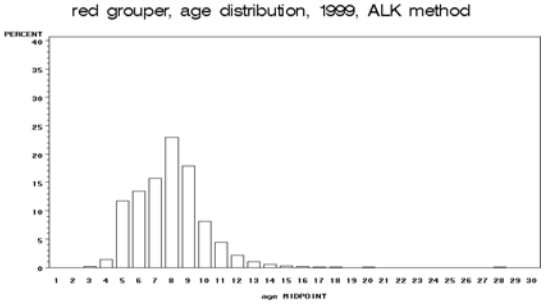
(8a). 1998, ALK, n=33508



(8b). 1998, RAS, n=168



(9a). 1999, ALK, n=52917



(9b). 1999, RAS, n=751

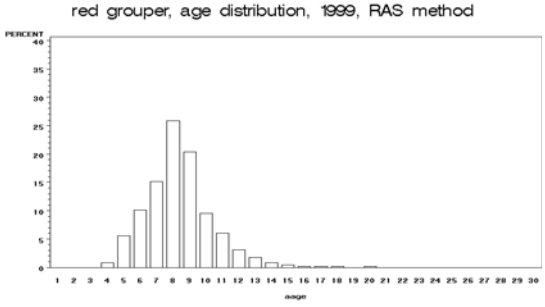
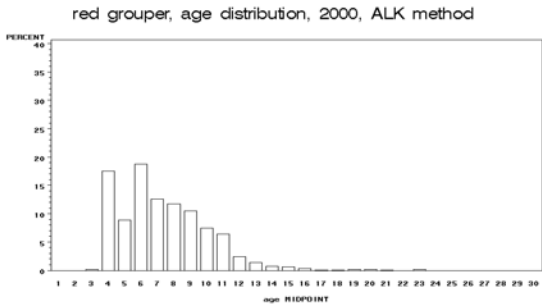
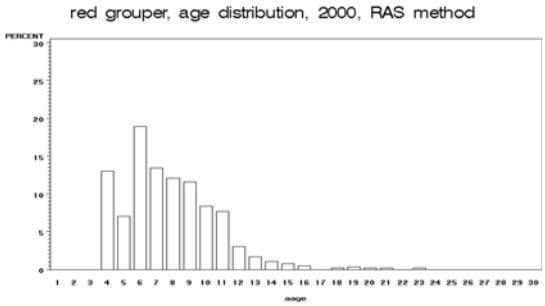


Fig1. Continued.

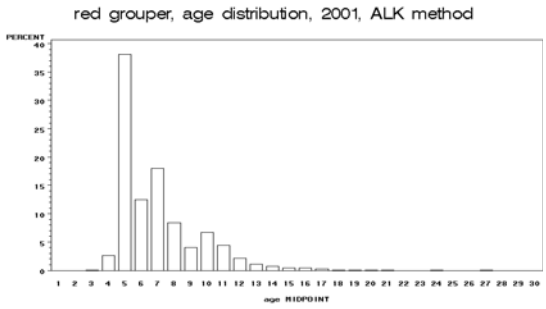
(10a). 2000, ALK, n=40789



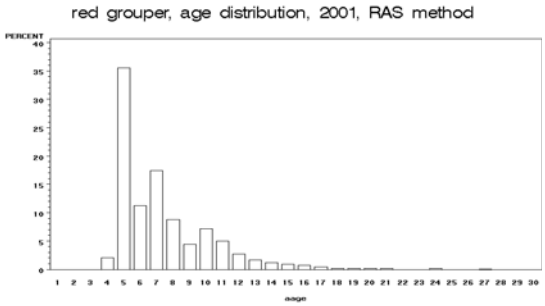
(10b). 2000, RAS, n=655



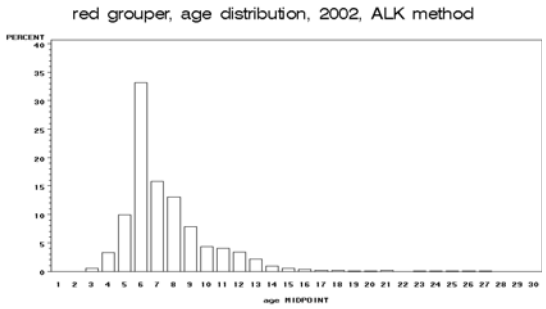
(11a). 2001, ALK, n=30933



(11b). 2001, RAS, n=1807



(12a). 2002, ALK, n=25803



(12b). 2002, RAS, n=1402

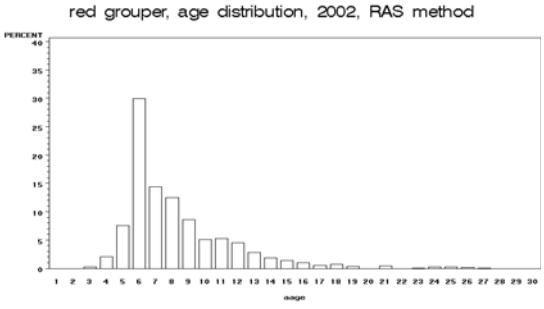
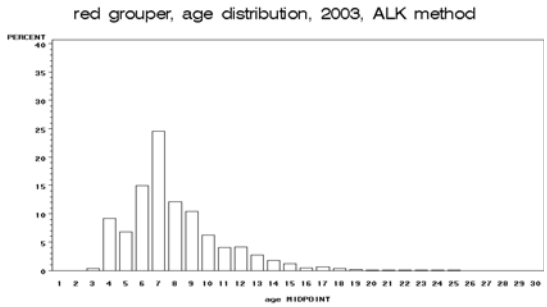
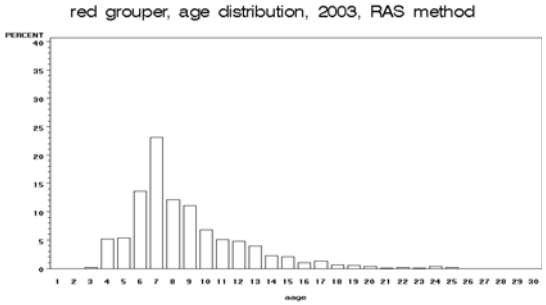


Fig 1. Continued.

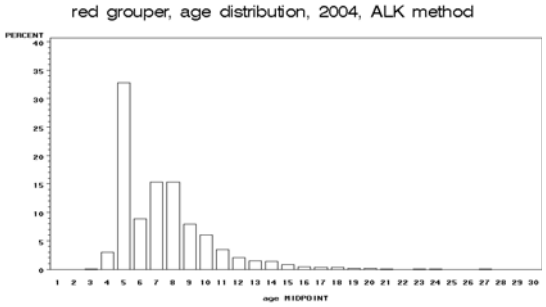
(13a). 2003, ALK, n=18055



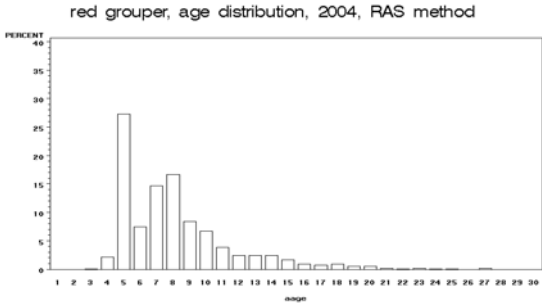
(13b). 2003, RAS, n=1657



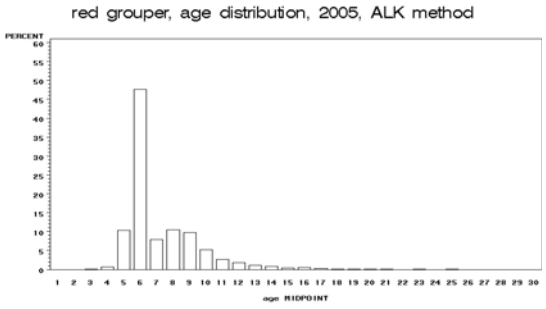
(14a). 2004, ALK, n=14297



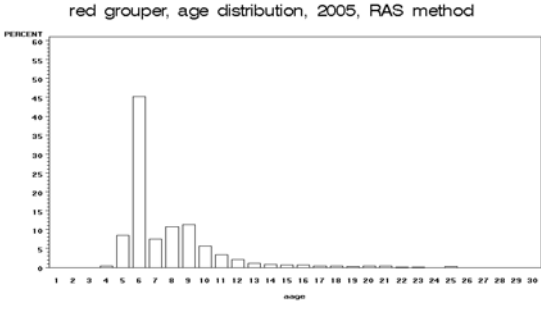
(14b). 2004, RAS, n= 1781



(15a). 2005, ALK, n=10140

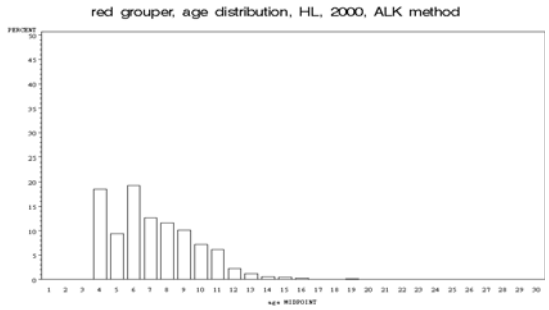


(15b). 2005, RAS, n=1634

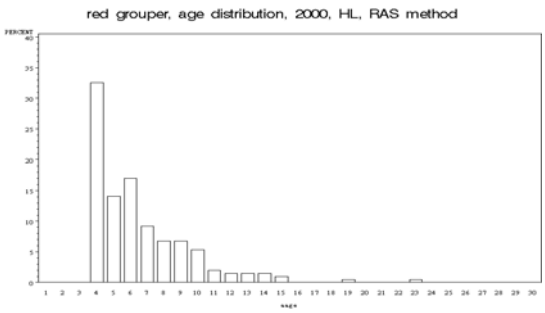


Figs 2. Comparison of age frequency distributions derived with ALK and RAS methods for different gear types. Data are from red grouper commercial TIP samples taken in 2000 (HL= handline; LL= longline; TR = trap).

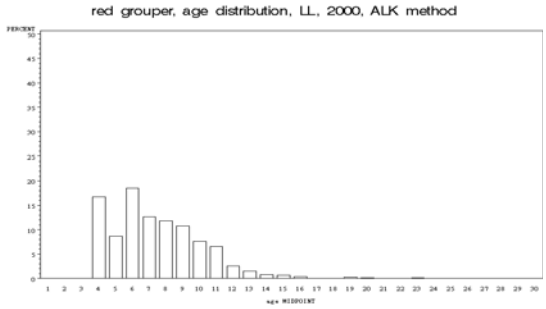
(n=7757)



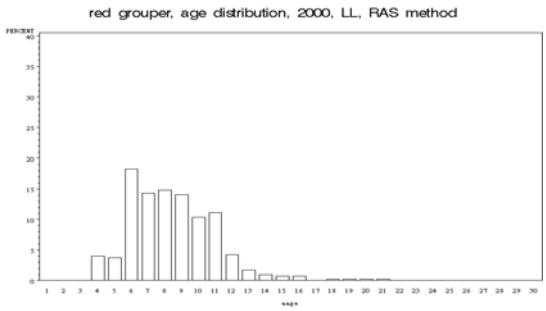
(n=206)



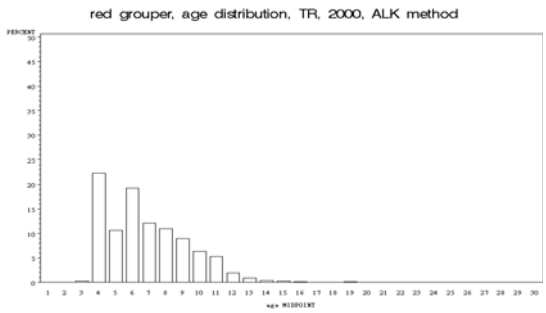
(n=30263)



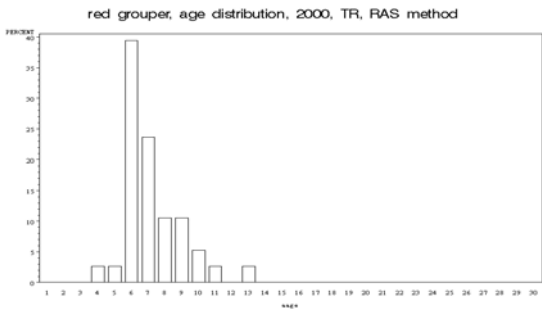
(n=405)



(n=2702)

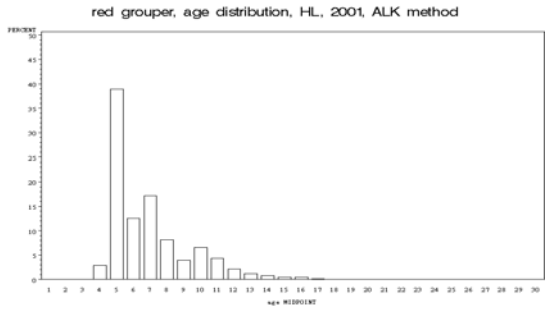


(n=38)

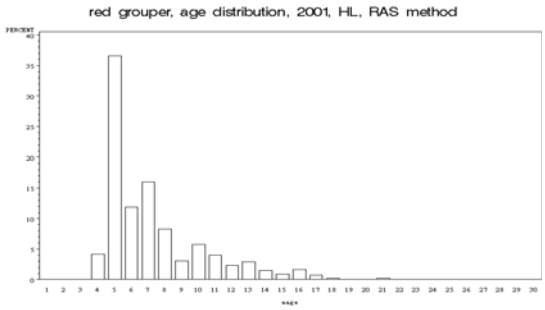


Figs 3. Comparison of age frequency distributions derived with ALK and RAS methods for different gear types. Data are from red grouper commercial TIP samples taken in 2001 (HL= handline; LL= longline; TR = trap).

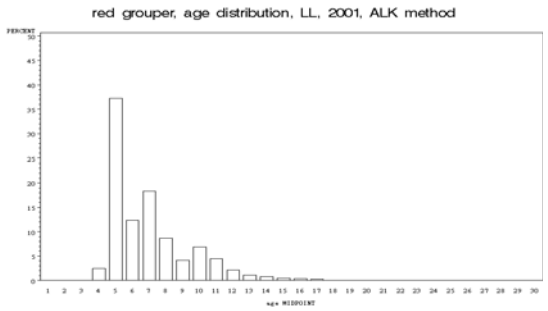
(n=6911)



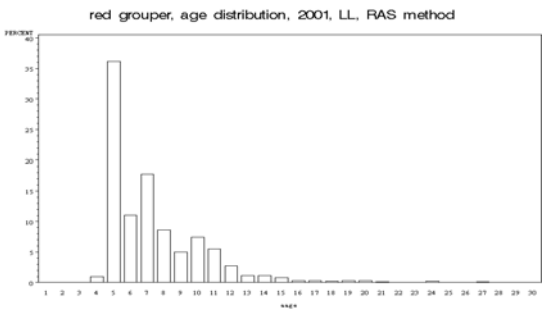
(n=555)



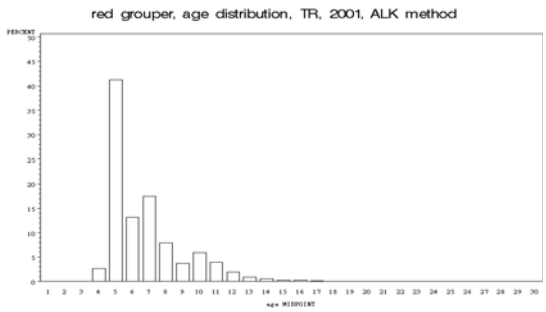
(n=20027)



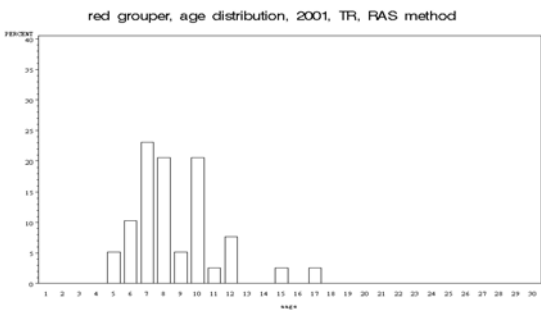
(n=1210)



(n=3965)

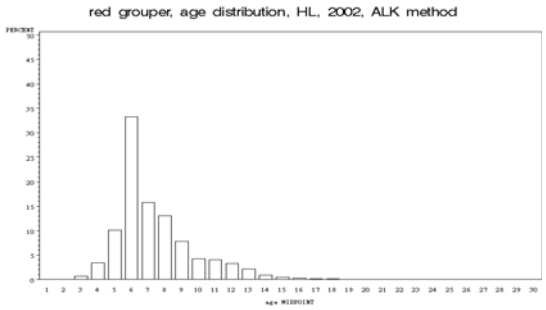


(n=39)

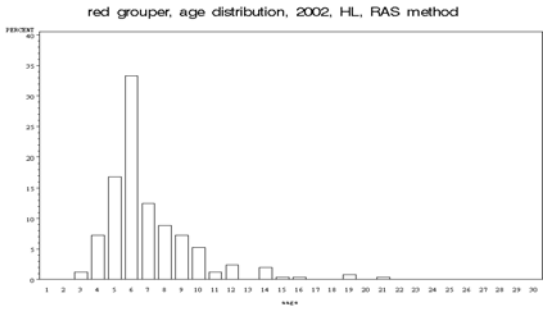


Figs 4. Comparison of age frequency distributions derived with ALK and RAS methods for different gear types. Data are from red grouper commercial TIP samples taken in 2002 (HL= handline; LL= longline; TR = trap).

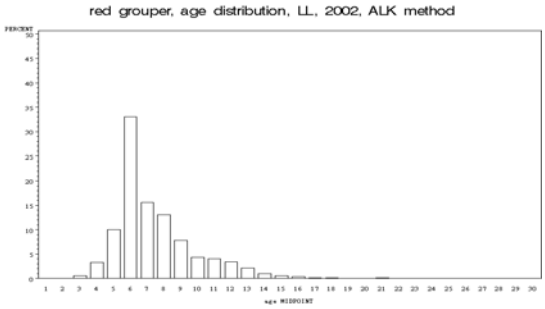
(n=5479)



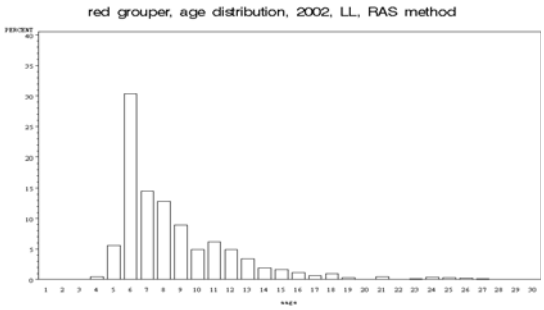
(n=249)



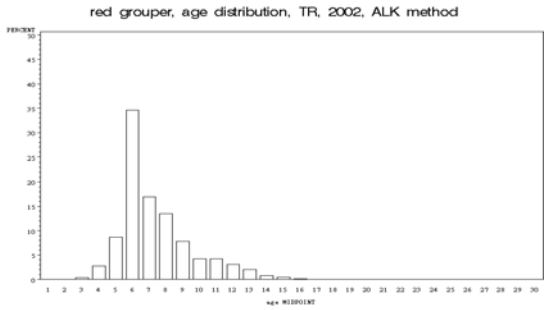
(n=18141)



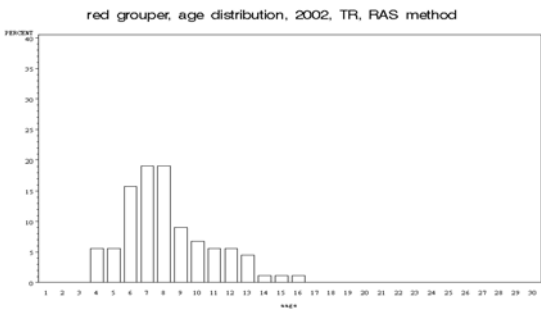
(n=1063)



(n=2178)

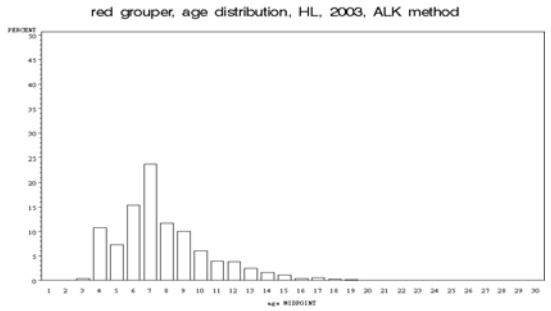


(n=89)

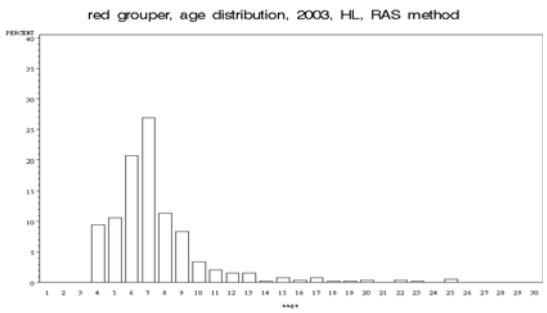


Figs 5. Comparison of age frequency distributions derived with ALK and RAS methods for different gear types. Data are from red grouper commercial TIP samples taken in 2003 (HL= handline; LL= longline; TR = trap).

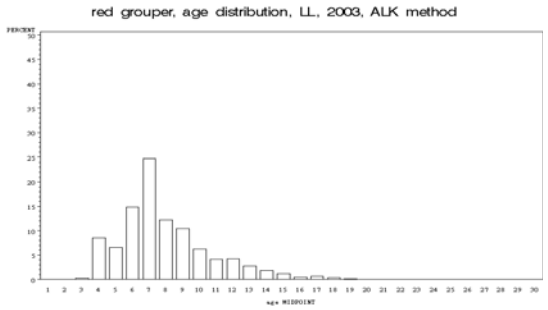
(n=2990)



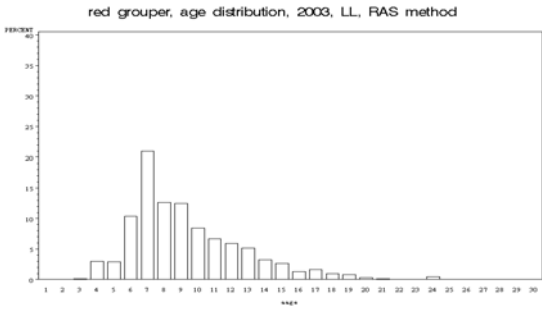
(n=527)



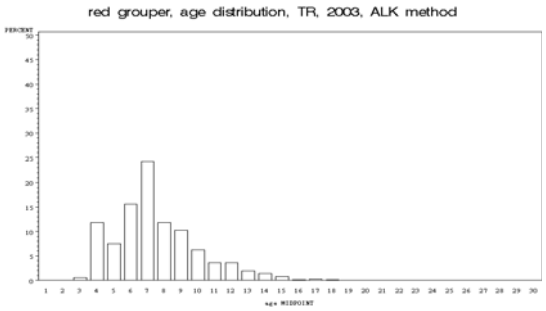
(n=13697)



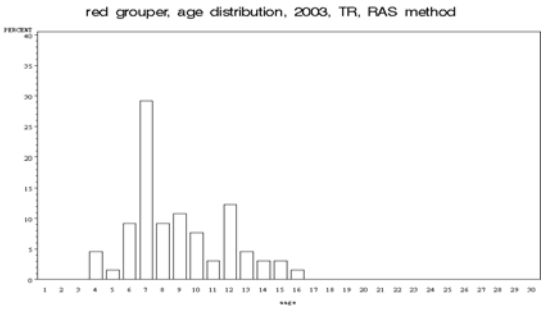
(n=1067)



(n=1344)

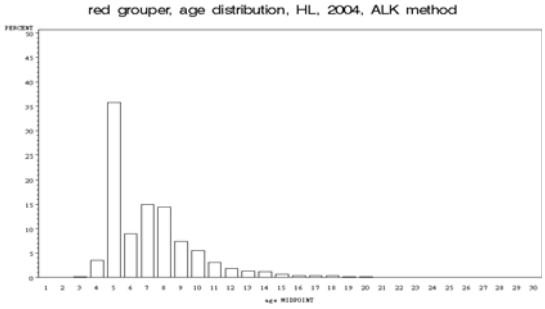


(n=65)

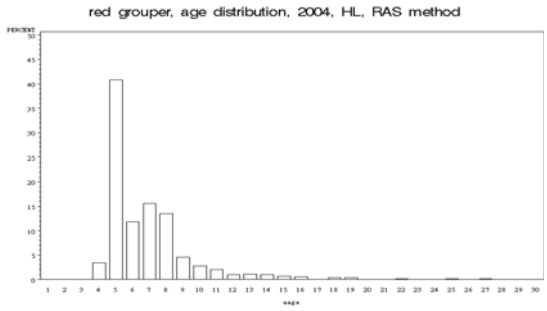


Figs 6. Comparison of age frequency distributions derived with ALK and RAS methods for different gear types. Data are from red grouper commercial TIP samples taken in 2004 (HL= handline; LL= longline; TR = trap).

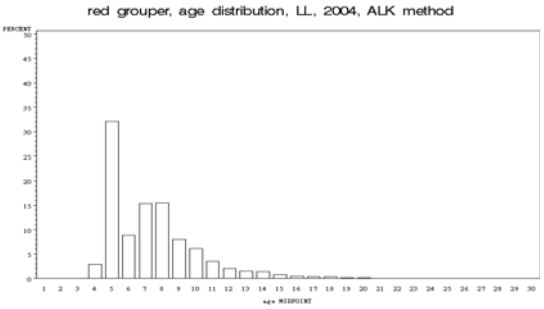
(n=2880)



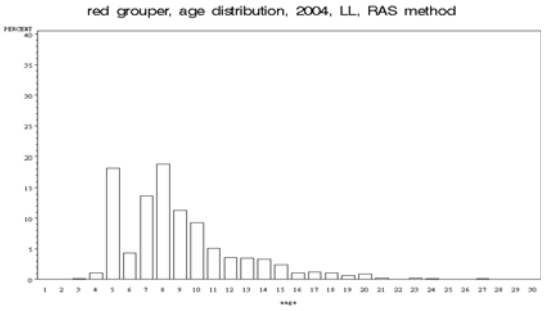
(n=726)



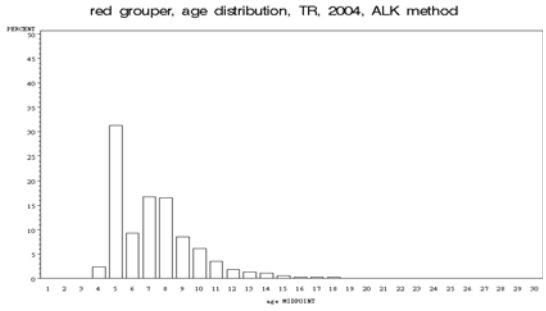
(n=11028)



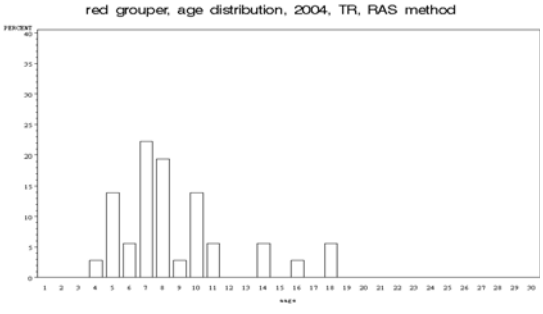
(n=1017)



(n=384)

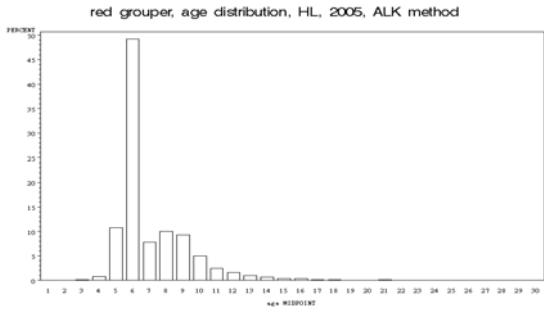


(n=36)

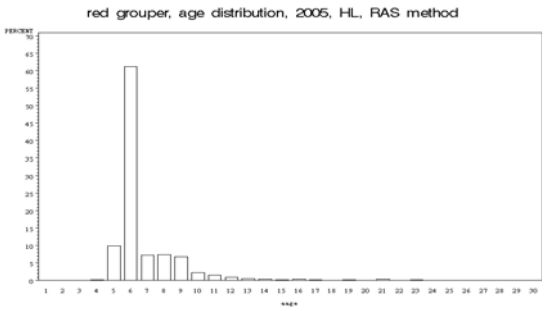


Figs 7. Comparison of age frequency distributions derived with ALK and RAS methods for different gear types. Data are from red grouper commercial TIP samples taken in 2005 (HL= handline; LL= longline; TR = trap).

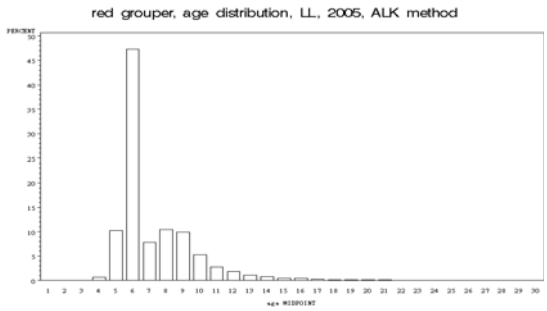
(n=1890)



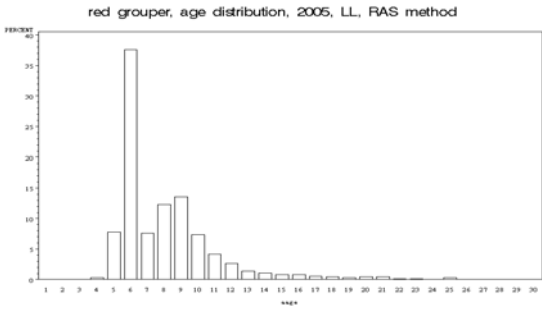
(n=526)



(n=7659)



(n=1104)



(n=524)

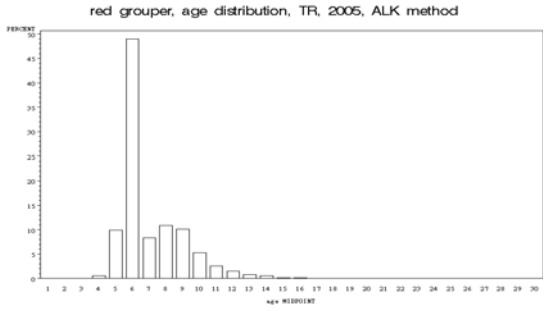
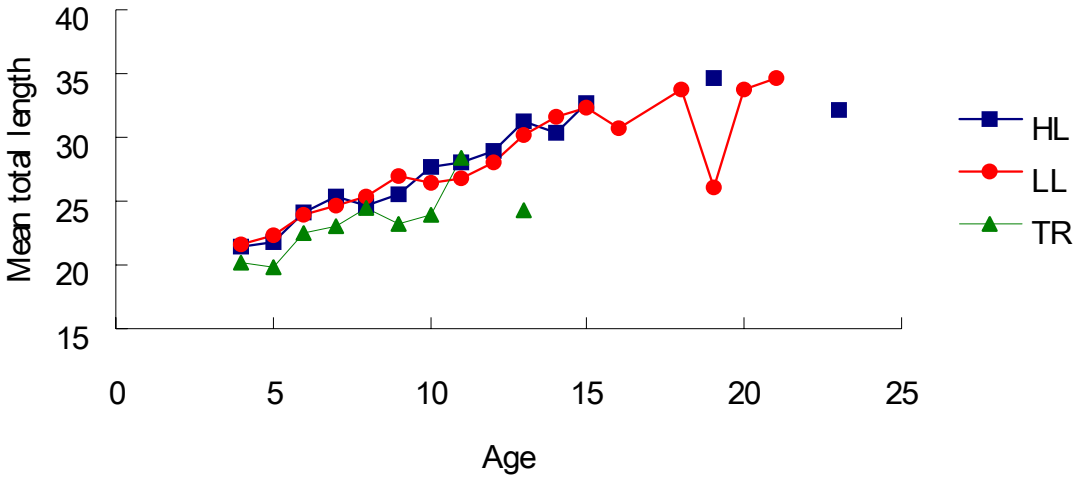
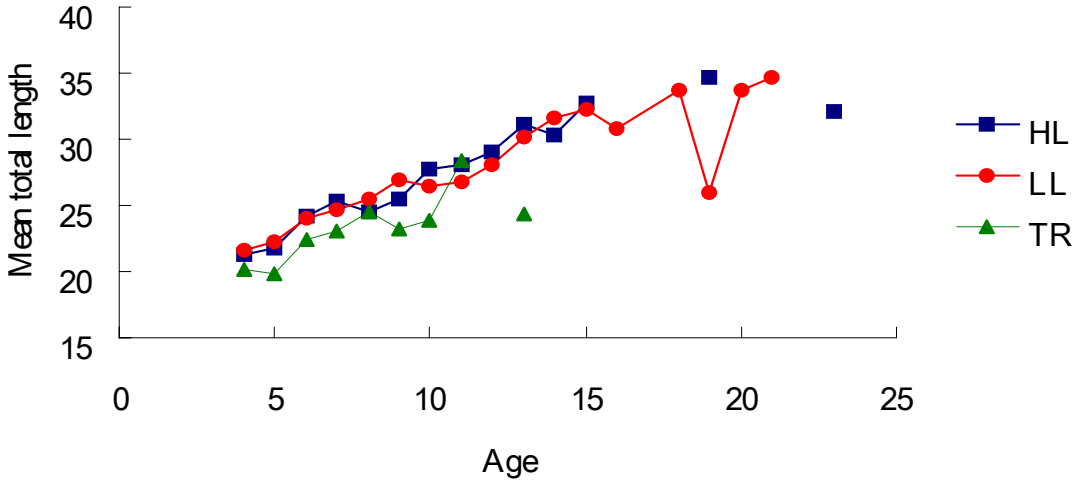


Fig 8. Mean length-at-age for red grouper commercial TIP otolith samples from landings caught with different types of gear from 2000 to 2005 (HL= handline; LL= longline; TR = trap).

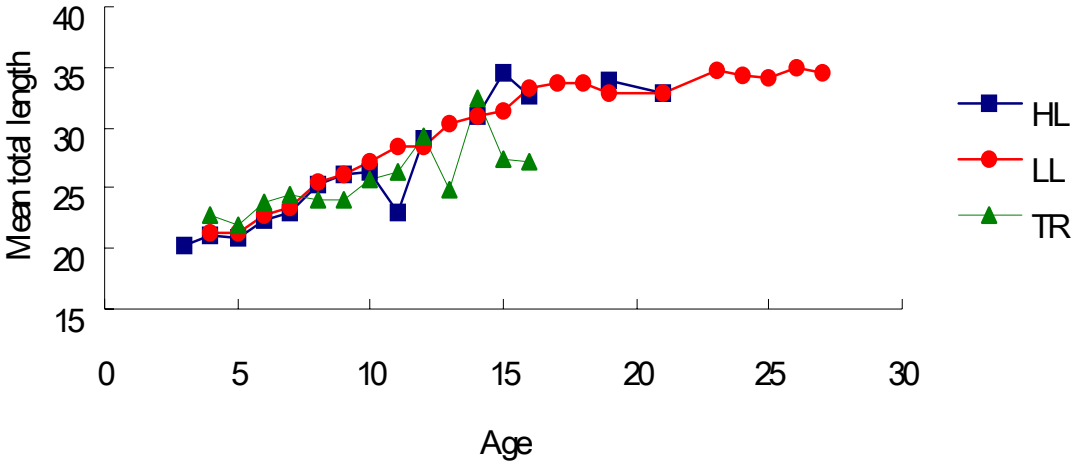
(A). 2000 (Sample size, HL-206, LL-405, TR-38)



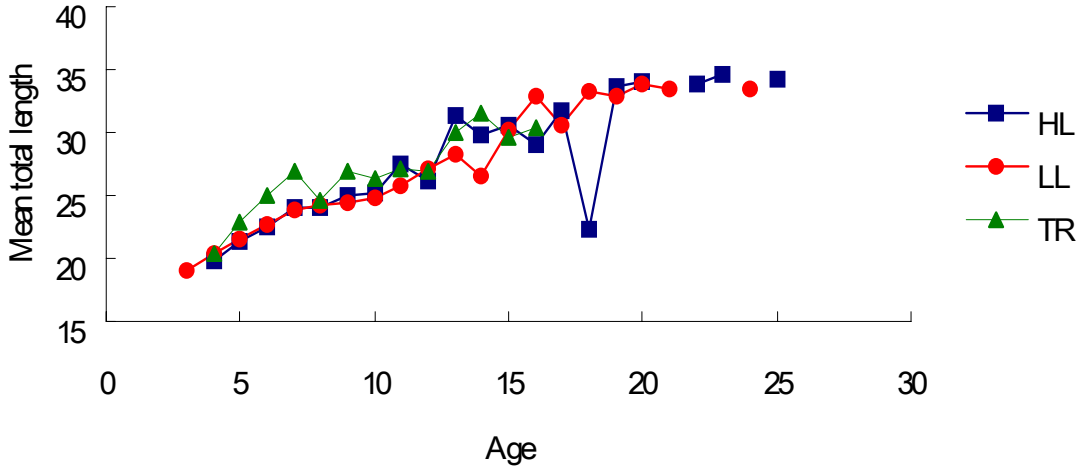
(B). 2001 (Sample size, HL-555, LL-1210, TR-39)



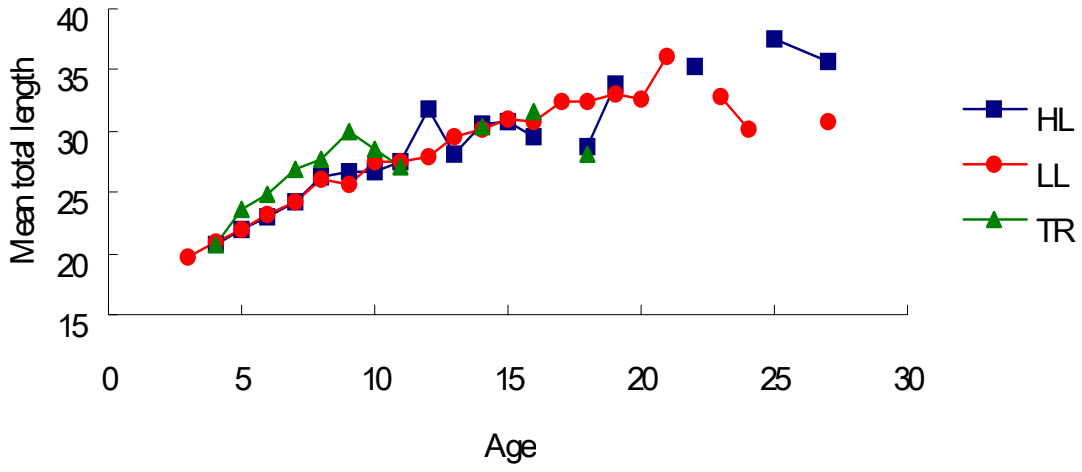
(C). 2002 (Sample size, HL-249, LL-1063, TR-89)



(D). 2003 (Sample size, HL-527, LL-1067, TR-65)



(E). 2004 (Sample size, HL-726, LL-1017, TR-36)



(F). 2005 (Sample size, HL-526, LL-1104)

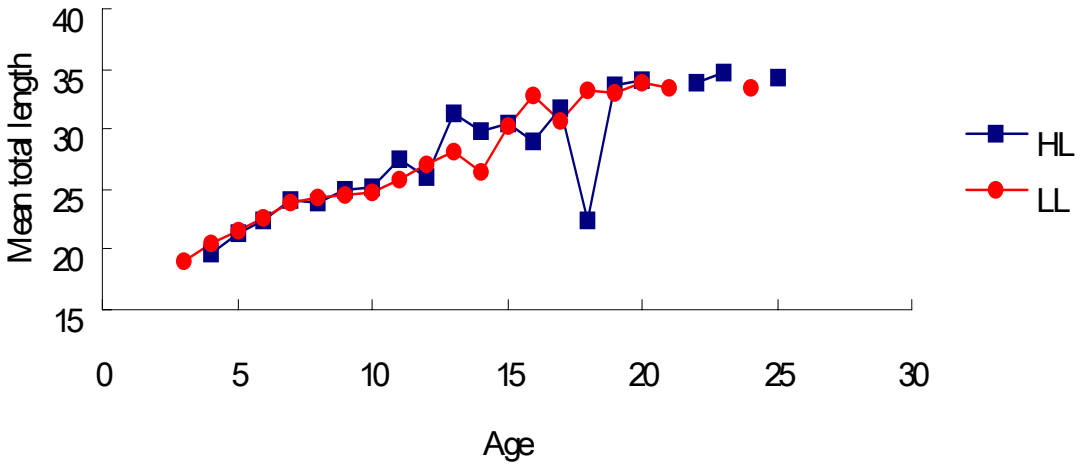


Fig 9. Mean length-at-age for red grouper otolith samples collected by the Panama City Laboratory from 1991 to 2005 (HL= handline; LL= longline; TR = trap, Sample size, HL-6907, LL-8197, TR-718).

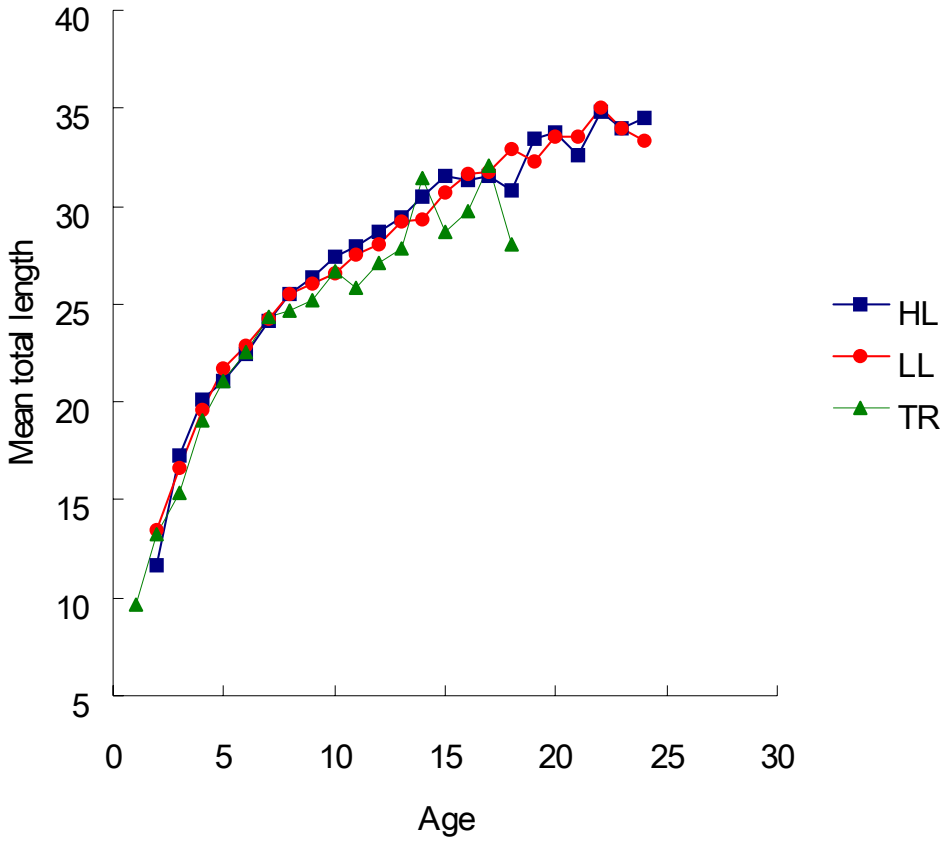
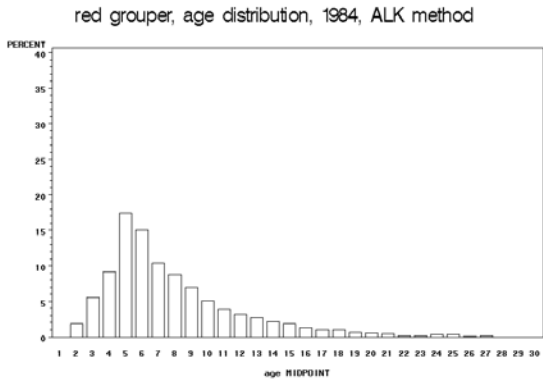
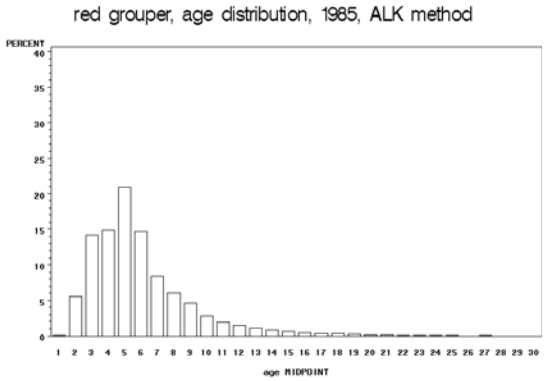
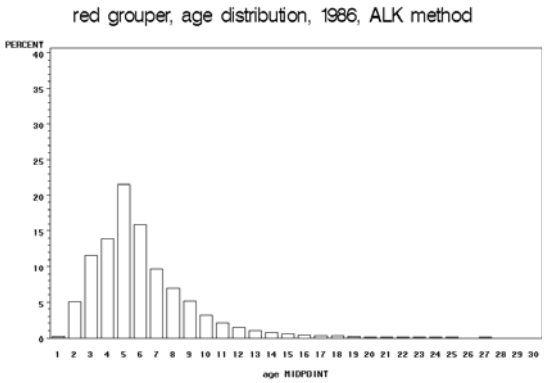


Fig 10. Comparisons of AFDs for commercial TIP samples from fish caught between 1984 and 1990. AFDs were estimated from combined ALKs coming from otolith samples obtained either (A) from 1978 to 1989 or (B) from 1991 to 2005.

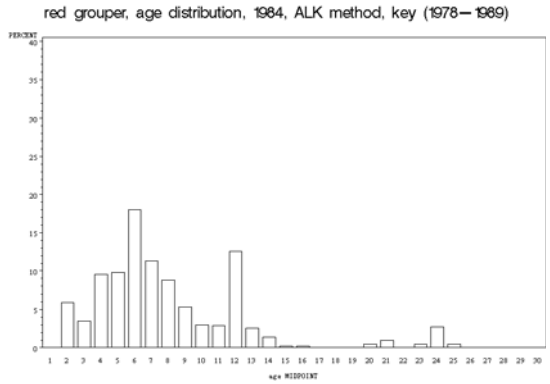
(A).

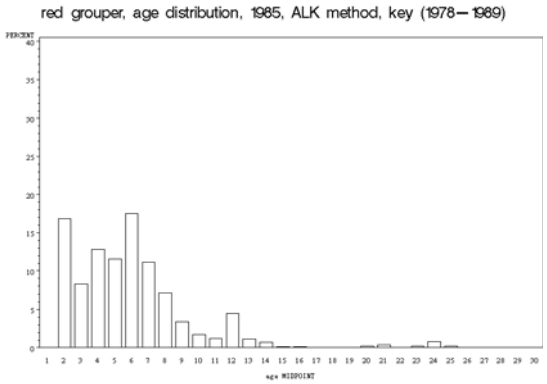






(B).





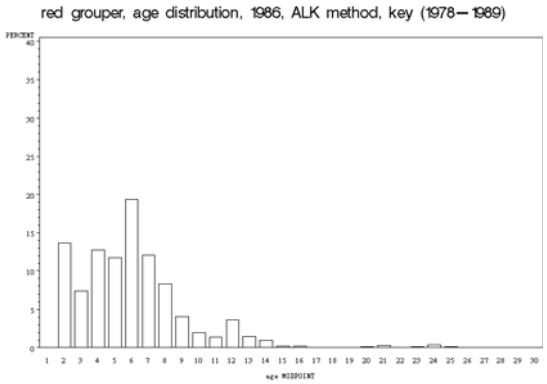
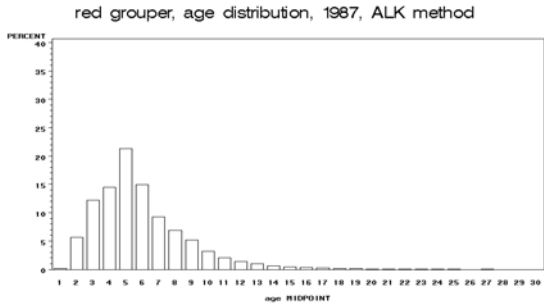
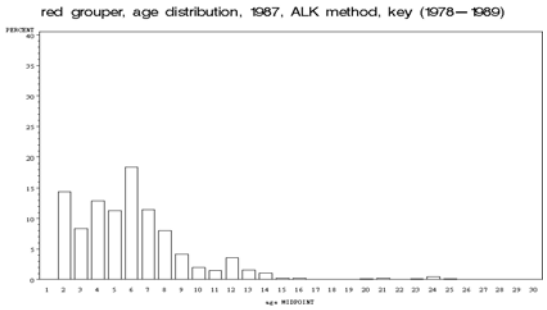
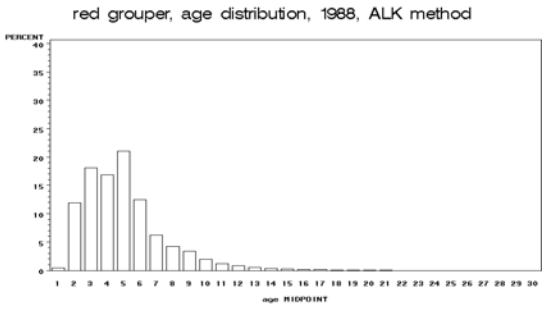
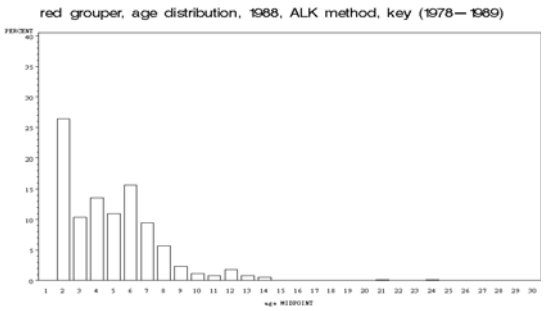


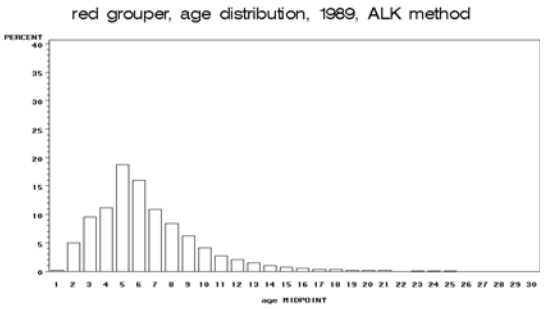
Fig 10. Continued.

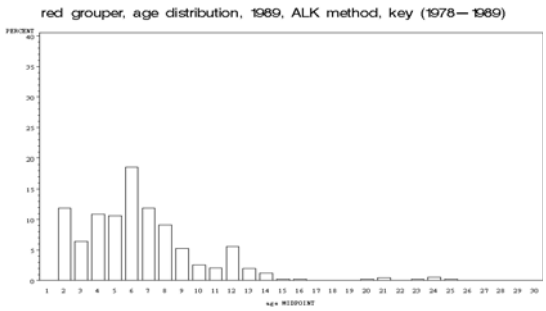


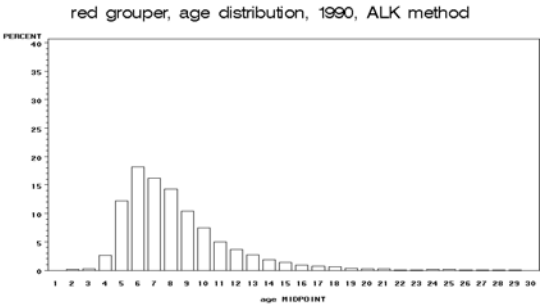












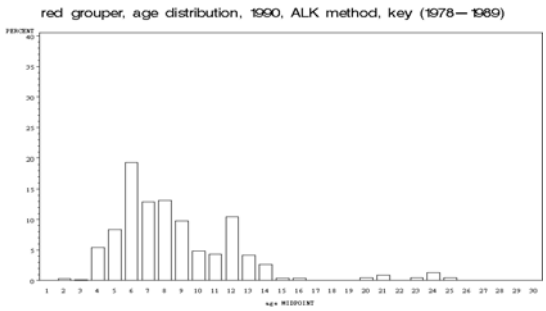


Table 1. Number of otolith samples used to construct age length keys for each length interval determined for data from 1991 to 2005. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	L6	L8	L10	L12	L14	L16	L18	L20	L22	L24	L26	L28	L30	L32	L34	L36	L38	L40	total
1991							2	1	15	9	8	16	21	19	18	8	2		119
1992							1	4	30	59	35	36	49	33	19	3	2	1	272
1993					2	1	2	6	63	81	97	81	77	46	24	9	3		492
1994						1	4	24	128	90	80	73	54	36	17	8	2	2	519
1995						2	8	14	97	103	101	81	46	43	25	5	3		528
1996						1	21	43	85	84	57	56	43	23	16		1	1	431
1997						1		6	35	41	25	13	19	9	8	2			159
1998								3	58	62	68	53	28	11	14	2			299
1999						1	1	4	129	186	153	157	141	70	29	14			885
2000						4	10	21	130	157	122	135	104	72	28	11			794
2001					2	8	20	54	398	457	360	243	248	126	68	33	9		2026
2002						1	10	25	443	479	320	282	237	163	116	48	10		1 2135
2003			4	2	8	8	11	53	456	378	307	258	215	160	91	54	11		2016
2004		1	9	22	23	29	72	133	510	650	410	293	275	243	122	56	26	2	2876
2005			1	3	1	26	41	56	443	614	458	310	224	123	60	32	10		2402

Table 2. Combined age length keys constructed from all otolith samples collected from 1991 to 2005. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25	age26	age27	age28	age29	age30
6	1		1.000																												
8	14	0.357	0.643																												
10	27	0.074	0.815	0.111																											
12	36	0.028	0.583	0.306	0.056		0.028																								
14	83		0.169	0.446	0.229	0.108	0.036			0.012																					
16	203		0.005	0.236	0.315	0.360	0.069	0.005		0.005	0.005																				
18	447			0.036	0.298	0.427	0.159	0.047	0.009	0.018	0.002	0.002	0.002																		
20	3020			0.008	0.126	0.341	0.272	0.110	0.064	0.037	0.018	0.011	0.006	0.005	0.001	0.001	0.001	0.001	0.000												
22	3450			0.001	0.054	0.268	0.292	0.166	0.094	0.056	0.031	0.015	0.011	0.005	0.004	0.001		0.000	0.001	0.000	0.000										
24	2601				0.017	0.171	0.299	0.211	0.123	0.079	0.043	0.026	0.014	0.008	0.005	0.003	0.001	0.000		0.000											
26	2087				0.001	0.052	0.234	0.264	0.188	0.104	0.069	0.043	0.023	0.010	0.005	0.003	0.002	0.000	0.001	0.000		0.000									
28	1781				0.001	0.007	0.062	0.199	0.264	0.188	0.126	0.061	0.041	0.021	0.015	0.007	0.003	0.004	0.001												
30	1177					0.003	0.012	0.071	0.188	0.202	0.161	0.122	0.091	0.061	0.033	0.020	0.013	0.010	0.006	0.002	0.001	0.001			0.003			0.001			
32	655					0.003		0.011	0.043	0.095	0.142	0.142	0.125	0.130	0.084	0.070	0.053	0.027	0.017	0.018	0.009	0.012	0.002	0.005	0.005	0.006		0.002			
34	285					0.004		0.007	0.011	0.021	0.014	0.056	0.084	0.112	0.112	0.130	0.102	0.074	0.077	0.049	0.049	0.039		0.014	0.014	0.014	0.004	0.011	0.004		
36	79					0.025	0.013					0.013	0.025	0.025	0.089	0.076	0.038	0.101	0.127	0.063	0.076	0.063	0.063	0.025	0.089	0.051	0.013	0.013		0.013	
38	6						0.167	0.167	0.333										0.167							0.167					
40	1																												1		

Table 3. Age length keys constructed from otolith samples collected in 1991. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24
1991	16	2				1.000																				
1991	18	1				1.000																				
1991	20	15			0.067	0.267	0.533	0.133																		
1991	22	9			0.111		0.444	0.222	0.222																	
1991	24	8					0.375	0.375		0.125											0.125					
1991	26	16					0.125	0.313	0.188	0.063	0.188	0.063			0.063											
1991	28	21					0.048	0.190	0.095	0.095	0.143	0.381	0.048													
1991	30	19							0.211	0.105	0.263	0.105	0.105	0.158	0.053											
1991	32	18					0.056		0.167	0.056	0.167	0.222		0.111				0.056			0.056		0.056			0.056
1991	34	8								0.250	0.250				0.125		0.125	0.125								0.125
1991	36	2						0.500																	0.500	

Table 4. Age length keys constructed from otolith samples collected in 1992. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25	age26	age27	age28	age29
1992	16	1						1.000																							
1992	18	4				0.750	0.250																								
1992	20	30			0.033	0.033	0.367	0.300	0.133	0.067	0.033			0.033																	
1992	22	59				0.017	0.237	0.356	0.254	0.102	0.034																				
1992	24	35					0.457	0.286	0.114	0.143																					
1992	26	36					0.139	0.250	0.389	0.139	0.083																				
1992	28	49						0.082	0.388	0.265	0.163	0.061	0.020	0.020																	
1992	30	33							0.182	0.303	0.121	0.182	0.061	0.091	0.061																
1992	32	19							0.053	0.105	0.105	0.368	0.158	0.105	0.053				0.053												
1992	34	3											0.333	0.333					0.333												
1992	36	2					0.500																								0.500
1992	38	1																		1.000											

Table 5. Age length keys constructed from otolith samples collected in 1993. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25
1993	12	2		0.5		0.5																					
1993	14	1			1																						
1993	16	2				1																					
1993	18	6			0.167	0.667				0.167																	
1993	20	63			0.016	0.365	0.254	0.238	0.063	0.048	0.016																
1993	22	81				0.074	0.148	0.333	0.296	0.111	0.025	0.012															
1993	24	97				0.082	0.124	0.34	0.258	0.165	0.021	0.01															
1993	26	81					0.111	0.284	0.37	0.173	0.037	0.025															
1993	28	77				0.013	0.026	0.156	0.39	0.26	0.117	0.026	0.013														
1993	30	46						0.087	0.152	0.391	0.13	0.13	0.087		0.022												
1993	32	24								0.167	0.375	0.125	0.125	0.083	0.042		0.042										0.042
1993	34	9					0.111			0.111	0.333			0.111	0.111	0.111				0.111							
1993	36	3																0.333		0.333					0.333		

Table 6. Age length keys constructed from otolith samples collected in 1994. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25	age26	age27
1994	14	1			1																								
1994	16	4			0.75	0.25																							
1994	18	24			0.042	0.542	0.375	0.042																					
1994	20	128			0.023	0.305	0.484	0.094	0.055	0.016	0.023																		
1994	22	90				0.222	0.389	0.1	0.156	0.089	0.022	0.011	0.011																
1994	24	80				0.038	0.2	0.325	0.325	0.025	0.038	0.05																	
1994	26	73				0.014	0.055	0.192	0.37	0.233	0.096	0.041																	
1994	28	54						0.167	0.222	0.296	0.148	0.056	0.037	0.056	0.019														
1994	30	36							0.083	0.306	0.25	0.167	0.056	0.028	0.028	0.056	0.028												
1994	32	17								0.059	0.176	0.294	0.176	0.118	0.059	0.059						0.059							
1994	34	8									0.125	0.125		0.125	0.375											0.125		0.125	
1994	36	2													0.5										0.5				
1994	38	2						0.5		0.5																			

Table 7. Age length keys constructed from otolith samples collected in 1995. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25
1995	14	2				0.5		0.5																			
1995	16	8				0.125	0.5	0.375																			
1995	18	14				0.143	0.429	0.143	0.286																		
1995	20	97				0.062	0.268	0.423	0.175	0.072																	
1995	22	103				0.049	0.243	0.447	0.175	0.049	0.019	0.01		0.01													
1995	24	101				0.01	0.208	0.416	0.257	0.089	0.01			0.01													
1995	26	81					0.099	0.247	0.296	0.247	0.099	0.012															
1995	28	46					0.022	0.065	0.13	0.326	0.304	0.13		0.022													
1995	30	43					0.023	0.023	0.047	0.163	0.279	0.256	0.163		0.023	0.023											
1995	32	25								0.08	0.12	0.16	0.16	0.16	0.2			0.08									0.04
1995	34	5												0.2		0.6							0.2				
1995	36	3																					0.333	0.333	0.333		

Table 8. Age length keys constructed from otolith samples collected in 1996. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24
1996	14	1			1																					
1996	16	21				0.19	0.667	0.143																		
1996	18	43					0.558	0.372	0.07																	
1996	20	85				0.012	0.365	0.471	0.153																	
1996	22	84				0.036	0.131	0.464	0.262	0.048	0.048	0.012														
1996	24	57					0.07	0.474	0.368	0.053	0.018	0.018														
1996	26	56					0.036	0.196	0.536	0.179	0.054															
1996	28	43						0.047	0.163	0.256	0.395	0.093		0.023			0.023									
1996	30	23								0.13	0.565	0.261	0.043													
1996	32	16								0.063	0.25	0.375	0.125	0.063	0.063				0.063							
1996	36	1																								1
1996	38	1							1																	

Table 9. Age length keys constructed from otolith samples collected in 1997. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16
1997	14	1				1												
1997	18	6					0.167	0.333	0.333	0.167								
1997	20	35			0.029	0.086	0.114	0.4	0.343	0.029								
1997	22	41				0.122	0.244	0.317	0.268	0.049								
1997	24	25					0.12	0.28	0.36	0.2	0.04							
1997	26	13						0.231	0.462	0.308								
1997	28	19					0.053	0.105	0.474	0.211	0.053		0.105					
1997	30	9						0.111	0.222	0.444	0.111	0.111						
1997	32	8										0.125	0.125	0.125	0.375	0.125	0.125	
1997	34	2																1

Table 10. Age length keys constructed from otolith samples collected in 1998. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15
1998	18	3				0.333	0.333		0.333								
1998	20	58			0.034	0.155	0.276	0.19	0.19	0.121	0.017		0.017				
1998	22	62				0.097	0.226	0.242	0.177	0.145	0.065	0.032	0.016				
1998	24	68				0.059	0.162	0.279	0.309	0.088	0.044	0.029	0.015	0.015			
1998	26	53					0.075	0.226	0.377	0.17	0.113	0.019	0.019				
1998	28	28					0.036	0.107	0.179	0.357	0.25	0.036			0.036		
1998	30	11						0.091	0.182		0.182	0.273	0.091	0.182			
1998	32	14					0.071		0.143	0.071	0.143	0.071	0.143	0.143		0.071	0.143
1998	34	2											0.5			0.5	

Table 11. Age length keys constructed from otolith samples collected in 1999. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25	age26	age27	age28
1999	14	1			1																									
1999	16	1			1																									
1999	18	4				0.5		0.25			0.25																			
1999	20	129		0.008	0.016	0.256	0.24	0.209	0.132	0.101	0.008	0.031																		
1999	22	186			0.027	0.199	0.167	0.199	0.172	0.129	0.07	0.016	0.016	0.005																
1999	24	153			0.007	0.098	0.137	0.124	0.268	0.209	0.085	0.046	0.013	0.007		0.007														
1999	26	157				0.006	0.108	0.178	0.331	0.248	0.083	0.025	0.006	0.006	0.006															
1999	28	141					0.021	0.121	0.397	0.248	0.149	0.028	0.021		0.007	0.007														
1999	30	70						0.029	0.171	0.257	0.214	0.171	0.086	0.057	0.014															
1999	32	29							0.034	0.103	0.103	0.276	0.241	0.069	0.069	0.034	0.034	0.034												
1999	34	14										0.286	0.071	0.286	0.071		0.071		0.071		0.071									0.071

Table 12. Age length keys constructed from otolith samples collected in 2000. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23
2000	14	4			0.5	0.25	0.25																		
2000	16	10			0.4	0.5	0.1																		
2000	18	21			0.095	0.762	0.095	0.048																	
2000	20	130				0.454	0.208	0.162	0.069	0.062	0.015	0.008	0.008	0.008	0.008										
2000	22	157				0.293	0.14	0.185	0.134	0.083	0.076	0.045	0.038	0.006											
2000	24	122				0.115	0.082	0.311	0.164	0.131	0.09	0.041	0.057		0.008										
2000	26	135				0.007	0.03	0.259	0.148	0.148	0.126	0.133	0.096	0.044							0.007				
2000	28	104						0.144	0.183	0.212	0.183	0.154	0.096	0.019	0.01										
2000	30	72							0.083	0.153	0.278	0.139	0.111	0.111	0.042	0.042		0.042							
2000	32	28									0.107	0.071	0.179	0.107	0.214	0.107	0.179								0.036
2000	34	11											0.182		0.091	0.091	0.091		0.091	0.091	0.091	0.182	0.091		

Table 13. Age length keys constructed from otolith samples collected in 2001. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25	age26	age27
2001	12	2		1																									
2001	14	8		0.5		0.5																							
2001	16	20		0.05	0.15	0.5	0.25	0.05																					
2001	18	54			0.056	0.241	0.556	0.074	0.037	0.019	0.019																		
2001	20	398				0.08	0.606	0.191	0.068	0.018	0.015	0.005	0.01	0.005	0.003														
2001	22	457				0.022	0.6	0.144	0.133	0.053	0.02	0.011	0.009	0.007	0.002														
2001	24	360				0.006	0.431	0.158	0.228	0.078	0.025	0.039	0.019	0.011	0.003	0.003													
2001	26	243					0.111	0.119	0.374	0.132	0.045	0.111	0.078	0.025	0.004														
2001	28	248					0.012	0.012	0.262	0.226	0.105	0.21	0.101	0.02	0.024	0.012	0.008	0.008											
2001	30	126					0.016		0.087	0.119	0.135	0.246	0.159	0.127	0.04	0.024	0.016	0.016	0.016										
2001	32	68								0.015	0.029	0.044	0.162	0.162	0.162	0.191	0.074	0.088	0.015	0.015		0.015	0.015			0.015			
2001	34	33											0.03	0.091	0.152	0.121	0.182	0.091	0.152	0.03	0.03	0.03	0.03			0.03			0.03
2001	36	9					0.111						0.111				0.111		0.111	0.111	0.222	0.222							

Table 14. Age length keys constructed from otolith samples collected in 2002. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25	age26	age27
2002	14	1			1																								
2002	16	10			0.9						0.1																		
2002	18	25			0.16	0.2	0.2	0.24	0.12		0.04	0.04																	
2002	20	443			0.016	0.077	0.23	0.377	0.144	0.081	0.041	0.014	0.007	0.007	0.005		0.002												
2002	22	479			0.004	0.046	0.132	0.461	0.169	0.09	0.05	0.015	0.008	0.017	0.004	0.004													
2002	24	320				0.019	0.069	0.356	0.225	0.128	0.088	0.044	0.044	0.013	0.013	0.003													
2002	26	282				0.004	0.018	0.376	0.191	0.195	0.067	0.05	0.05	0.028	0.021														
2002	28	237						0.105	0.105	0.278	0.173	0.118	0.072	0.076	0.038	0.021	0.004	0.004	0.004										
2002	30	163							0.037	0.104	0.178	0.104	0.178	0.178	0.11	0.055	0.037	0.006				0.006			0.006				
2002	32	116								0.026	0.069	0.086	0.164	0.129	0.155	0.086	0.078	0.06	0.034	0.034	0.026	0.009	0.026				0.009		0.009
2002	34	48							0.021				0.021	0.042	0.042	0.104	0.188	0.188	0.063	0.125	0.042	0.021	0.063		0.021		0.021	0.021	0.021
2002	36	10														0.1			0.2	0.2						0.3	0.1	0.1	
2002	40	1																											

Table 15. Age length keys constructed from otolith samples collected in 2003. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25
2003	8	4	1																								
2003	10	2		1																							
2003	12	8	0.125	0.875																							
2003	14	8			0.875	0.125																					
2003	16	11				1																					
2003	18	53			0.038	0.66	0.151	0.019	0.057		0.057		0.019														
2003	20	456			0.011	0.261	0.116	0.173	0.154	0.083	0.086	0.059	0.026	0.015	0.007	0.007	0.002										
2003	22	378				0.095	0.116	0.185	0.243	0.14	0.085	0.037	0.034	0.021	0.016	0.016	0.005		0.003	0.003							
2003	24	307				0.01	0.052	0.228	0.316	0.124	0.098	0.062	0.033	0.033	0.016	0.02	0.007		0.003								
2003	26	258					0.012	0.136	0.357	0.136	0.109	0.074	0.043	0.07	0.027	0.012	0.016	0.004	0.004	0.004							
2003	28	215					0.009	0.042	0.316	0.167	0.172	0.093	0.047	0.065	0.037	0.028	0.014		0.009								
2003	30	160					0.006	0.031	0.088	0.125	0.15	0.088	0.119	0.106	0.125	0.044	0.031	0.025	0.031	0.019	0.006					0.006	
2003	32	91							0.011	0.011	0.066	0.088	0.099	0.11	0.165	0.077	0.11	0.088	0.055	0.022	0.055	0.011	0.011	0.011		0.011	
2003	34	54							0.019				0.037	0.093	0.093	0.037	0.167	0.111	0.13	0.074	0.056	0.074	0.019		0.019	0.037	0.037
2003	36	11															0.091	0.182	0.091	0.273	0.091			0.091		0.091	0.091

Table 16. Age length keys constructed from otolith samples collected in 2004. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25	age26	age27
2004	6	1		1																									
2004	8	9	0.111	0.889																									
2004	10	22	0.091	0.773	0.136																								
2004	12	23	0.043	0.739	0.174	0.043																							
2004	14	29		0.345	0.034	0.345	0.241				0.034																		
2004	16	72			0.014	0.333	0.597	0.042	0.014																				
2004	18	133			0.008	0.248	0.647	0.053	0.023		0.015			0.008															
2004	20	510			0.002	0.082	0.604	0.088	0.086	0.076	0.031	0.02	0.006		0.002				0.002										
2004	22	650			0.002	0.023	0.431	0.105	0.175	0.111	0.063	0.043	0.017	0.014	0.006	0.005	0.003			0.002		0.002							
2004	24	410				0.007	0.278	0.11	0.202	0.163	0.1	0.041	0.032	0.024	0.017	0.015	0.005	0.005											
2004	26	293					0.089	0.143	0.232	0.208	0.119	0.089	0.061	0.014	0.014	0.014	0.007	0.007		0.003									
2004	28	275				0.004	0.007	0.029	0.189	0.32	0.124	0.116	0.076	0.047	0.018	0.029	0.015	0.004	0.015	0.007									
2004	30	243						0.004	0.07	0.3	0.152	0.165	0.086	0.058	0.045	0.041	0.025	0.008	0.012	0.016	0.004	0.004				0.004			0.004
2004	32	122								0.057	0.09	0.205	0.107	0.098	0.131	0.082	0.074	0.057	0.025	0.025	0.025	0.008	0.008		0.008				
2004	34	56										0.036	0.054	0.089	0.125	0.196	0.143	0.071	0.054	0.089	0.071	0.054			0.018				
2004	36	26												0.077	0.038	0.192	0.115		0.115	0.077	0.077	0.115	0.077	0.077					0.038
2004	38	2								0.5																	0.5		

Table 17. Age length keys constructed from otolith samples collected in 2005. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25
2005	8	1		1																							
2005	10	3		1																							
2005	12	1						1																			
2005	14	26			0.846	0.038	0.038	0.077																			
2005	16	41			0.659	0.098	0.146	0.073				0.024															
2005	18	56			0.036	0.089	0.321	0.536		0.018																	
2005	20	443				0.016	0.208	0.58	0.05	0.061	0.029	0.016	0.009	0.007	0.014	0.002		0.005	0.002	0.002							
2005	22	614				0.008	0.129	0.572	0.081	0.073	0.059	0.042	0.013	0.01	0.005	0.005	0.002				0.002						
2005	24	458					0.057	0.579	0.096	0.094	0.094	0.046	0.02	0.009	0.002		0.004										
2005	26	310					0.029	0.413	0.139	0.187	0.116	0.058	0.032	0.013		0.006		0.003					0.003				
2005	28	224						0.036	0.08	0.246	0.339	0.125	0.063	0.054	0.027	0.018	0.004	0.009									
2005	30	123						0.008	0.008	0.146	0.333	0.179	0.13	0.065	0.041	0.024	0.024	0.024	0.016								
2005	32	60								0.05	0.05	0.183	0.167	0.133	0.083	0.117	0.05	0.05	0.033	0.017		0.033			0.017		0.017
2005	34	32										0.031	0.031	0.125	0.094	0.094	0.094	0.094	0.031	0.094	0.094	0.063	0.125		0.031		
2005	36	10														0.1	0.1		0.1	0.1		0.1	0.2	0.1			0.2

Table 18. The catch-at-age of commercial landings, as estimated with the ALK method from TIP length samples.

year	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25	age26	age27	age28	age29	age30
1984	2711	0.000	0.018	0.055	0.091	0.173	0.150	0.104	0.087	0.070	0.050	0.039	0.032	0.027	0.021	0.019	0.013	0.011	0.010	0.006	0.006	0.005	0.002	0.002	0.003	0.003	0.001	0.001	0.000	0.000	
1985	5310	0.001	0.056	0.142	0.148	0.208	0.146	0.084	0.060	0.046	0.029	0.019	0.015	0.011	0.008	0.007	0.005	0.004	0.003	0.002	0.002	0.002	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	
1986	7531	0.001	0.050	0.115	0.139	0.214	0.158	0.097	0.070	0.052	0.032	0.021	0.015	0.010	0.007	0.005	0.003	0.003	0.002	0.001	0.001	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	
1987	4638	0.002	0.057	0.122	0.144	0.213	0.150	0.092	0.069	0.051	0.032	0.020	0.014	0.010	0.007	0.005	0.003	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	
1988	2560	0.004	0.119	0.180	0.168	0.209	0.124	0.062	0.042	0.034	0.019	0.012	0.008	0.006	0.004	0.003	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
1989	2810	0.001	0.050	0.095	0.111	0.187	0.160	0.108	0.083	0.062	0.041	0.028	0.020	0.015	0.010	0.008	0.005	0.004	0.003	0.002	0.002	0.001	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	
1990	12200	0.000	0.001	0.003	0.027	0.122	0.181	0.162	0.142	0.104	0.074	0.050	0.037	0.027	0.019	0.014	0.009	0.007	0.006	0.004	0.003	0.003	0.001	0.001	0.002	0.002	0.000	0.001	0.000	0.000	
1991	14855	0.000	0.001	0.036	0.039	0.264	0.212	0.124	0.062	0.085	0.083	0.017	0.020	0.017		0.002	0.005		0.000	0.025		0.003		0.002	0.005	0.000			0.000		
1992	11692	0.000	0.000	0.006	0.014	0.215	0.228	0.228	0.145	0.062	0.040	0.020	0.025	0.007				0.007	0.001												0.002
1993	12692			0.003	0.086	0.114	0.248	0.252	0.171	0.064	0.029	0.015	0.005	0.005	0.001	0.002	0.001		0.002						0.001	0.002					
1994	11682			0.005	0.115	0.218	0.152	0.200	0.128	0.077	0.050	0.017	0.014	0.010	0.006	0.002						0.002			0.001	0.001		0.001			
1995	14737	0.000	0.000	0.000	0.028	0.173	0.311	0.189	0.131	0.079	0.041	0.016	0.013	0.008	0.006		0.002		0.000			0.002	0.000	0.000		0.001					
1996	13508			0.000	0.012	0.148	0.348	0.257	0.080	0.098	0.038	0.006	0.004	0.002	0.001	0.003	0.001	0.002	0.000	0.000	0.000	0.000		0.000	0.001	0.000	0.000	0.000	0.000		
1997	17642		0.000	0.007	0.051	0.115	0.273	0.334	0.146	0.019	0.011	0.014	0.004	0.011	0.004	0.004	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
1998	33508	0.000	0.000	0.006	0.062	0.152	0.201	0.244	0.150	0.093	0.038	0.024	0.017	0.005	0.004	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	
1999	52917			0.002	0.014	0.117	0.134	0.157	0.229	0.179	0.081	0.044	0.021	0.010	0.005	0.003	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
2000	40789	0.000	0.000	0.001	0.175	0.089	0.187	0.126	0.117	0.105	0.074	0.064	0.024	0.014	0.007	0.006	0.003	0.001	0.001	0.002	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	
2001	30933	0.000	0.000	0.000	0.026	0.381	0.125	0.180	0.084	0.040	0.067	0.044	0.022	0.011	0.007	0.004	0.004	0.002	0.001	0.000	0.001	0.000			0.000	0.000		0.000			
2002	25803			0.005	0.033	0.099	0.332	0.158	0.131	0.078	0.043	0.041	0.034	0.022	0.009	0.006	0.003	0.002	0.001	0.001	0.000	0.001		0.000	0.001	0.000	0.000	0.000			
2003	18055		0.000	0.003	0.091	0.068	0.150	0.245	0.121	0.103	0.062	0.040	0.041	0.027	0.018	0.012	0.005	0.006	0.003	0.002	0.001	0.000	0.000	0.000	0.001	0.000			0.000		
2004	14297			0.001	0.030	0.327	0.089	0.153	0.153	0.079	0.060	0.034	0.020	0.015	0.014	0.008	0.004	0.004	0.004	0.001	0.001	0.000	0.000	0.000	0.000			0.000			
2005	10140			0.001	0.007	0.103	0.476	0.079	0.104	0.098	0.053	0.027	0.018	0.011	0.008	0.004	0.005	0.002	0.002	0.001	0.001	0.001	0.000	0.000		0.001					

Table 19. The catch-at-age of commercial landings, as estimated with the RAS method from TIP otolith sample data taken from the Panama City Laboratory age data sets.

Year	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25	age26	age27
1991	82			0.012	0.037	0.073	0.146	0.146	0.073	0.183	0.146	0.024	0.049	0.024		0.012	0.024			0.024		0.012		0.012				
1992	197					0.142	0.223	0.299	0.178	0.076	0.041	0.010	0.015	0.005				0.010										
1993	376			0.003	0.082	0.109	0.253	0.258	0.170	0.064	0.029	0.011	0.008	0.003	0.003		0.003		0.003							0.003		
1994	356			0.003	0.140	0.270	0.143	0.166	0.115	0.070	0.045	0.017	0.014	0.008	0.003	0.003												0.003
1995	359				0.022	0.139	0.318	0.203	0.142	0.078	0.053	0.017	0.008	0.011								0.003	0.003	0.003				
1996	195				0.021	0.092	0.246	0.272	0.092	0.169	0.072	0.015	0.010			0.005		0.005										
1997	60				0.067	0.167	0.267	0.250	0.167	0.017	0.017			0.033			0.017											
1998	168			0.012	0.065	0.125	0.167	0.244	0.155	0.113	0.054	0.018	0.024	0.006	0.006	0.012												
1999	751				0.008	0.056	0.101	0.152	0.258	0.204	0.096	0.060	0.031	0.017	0.008	0.004	0.001	0.001	0.001		0.001							
2000	655				0.130	0.070	0.189	0.134	0.121	0.116	0.084	0.076	0.031	0.017	0.011	0.008	0.005		0.002	0.003	0.002	0.002		0.002				
2001	1807				0.020	0.356	0.113	0.174	0.087	0.044	0.072	0.050	0.027	0.017	0.012	0.009	0.007	0.004	0.002	0.002	0.002	0.001			0.001			0.001
2002	1402			0.002	0.021	0.076	0.300	0.144	0.125	0.086	0.051	0.053	0.045	0.029	0.019	0.014	0.010	0.005	0.007	0.004		0.004		0.001	0.003	0.002	0.001	0.001
2003	1657			0.001	0.052	0.054	0.136	0.231	0.121	0.110	0.068	0.051	0.048	0.040	0.022	0.021	0.010	0.013	0.007	0.005	0.003	0.001	0.001	0.001	0.003	0.002		
2004	1781			0.001	0.021	0.273	0.074	0.147	0.167	0.084	0.067	0.039	0.024	0.024	0.024	0.016	0.009	0.007	0.009	0.005	0.005	0.001	0.001	0.001	0.001	0.001		0.001
2005	1634				0.004	0.085	0.452	0.075	0.107	0.114	0.057	0.033	0.021	0.011	0.009	0.006	0.007	0.004	0.003	0.002	0.003	0.004	0.001	0.001		0.002		

Table 20. Numbers of otolith samples used for constructing age length keys in each 2 inch length interval from 1978-1989. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

year	L6	L8	L10	L12	L14	L16	L18	L20	L22	L24	L26	L28	L30	L32	L34	L36	L38	L40	total
1978								1											1
1979							1		3	7	6	10	14	16	13	1			71
1980												2	3	1	1		1		8
1981			4	6	44	43	23	34	35	44	24	28	10	1					296
1982																			0
1983																			0
1984																			0
1985							1												1
1986					3	2	1			2									8
1987						4	4		1		1				1				11
1988							1	1		1	4	1	1	1					10
1989					2	3	1	2				2			1				11

Table 21. Combined age length keys constructed from all samples collected from1978 to 1989. (Note: Lengths are reported in 2-inch intervals. For example. L20 means that total lengths of fish were between 19 and 20.99 inches. Total= total number of observations)

length	total	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	age16	age17	age18	age19	age20	age21	age22	age23	age24	age25
8	4	1																								
10	6	0.333	0.667																							
12	49		0.878	0.102	0.02																					
14	52		0.635	0.135	0.115	0.096		0.019																		
16	32			0.375	0.25	0.125	0.125	0.094	0.031																	
18	38		0.026	0.026	0.263	0.184	0.316	0.105	0.079																	
20	39				0.154	0.179	0.359	0.256	0.051																	
22	54				0.13	0.185	0.315	0.148	0.148	0.037	0.037															
24	35				0.086	0.143	0.314	0.257	0.143	0.029	0.029															
26	43					0.047	0.186	0.14	0.209	0.233	0.023	0.023	0.047	0.023	0.023	0.023	0.023									
28	28						0.107	0.071	0.179	0.143	0.107	0.071	0.071	0.143	0.107											
30	19								0.053	0.211	0.105	0.211	0.263	0.105	0.053											
32	16								0.063		0.063	0.063	0.375	0.063						0.063	0.125		0.063	0.063	0.063	
34	1												1													
36	1																								1	