

Activities of otolith collection and age estimation and analysis of the age data by Japan in 2008

2008年の日本による耳石収集および年齢査定活動 ならびに年齢データの分析

Tomoyuki ITOH¹, Osamu Sakai¹, Akio HIRAI² and Kenichiro OMOTE²

伊藤智幸¹・境磨¹・平井明夫²・表健一郎²

1: National Research Institute of Far Seas Fisheries 遠洋水産研究所

2: Marino-Research Corporation マリノリサーチ株式会社

要約

日本は2008年にミナミマグロ耳石を322個体から収集した。2004-2006年に漁獲されたミナミマグロ184個体の年齢を査定し、2009年にデータをCCSBT事務局へ提出した。

Summary

Japan collected otoliths from 322 SBT individuals in 2008. Ages were estimated from 184 SBT individuals which were caught between 2004 and 2006 and submitted to the CCSBT Secretariat in 2009.

1. Activities of otolith collection and age estimation

1) Otolith Collection:

In 2008, Japan collected otoliths from a total of 322 SBT individuals. 301 of them came from commercial longline vessels through the scientific observer program (Sakai et al. ESC/0909/24). 21 of them came from small fish presumably age 0-2 collected in the piston-line trolling survey (Itoh and Sakai ESC/0909/32).

2) Age estimation:

Ages of otoliths from 184 individuals were estimated according to the CCSBT manual, "A manual for age determination of southern bluefin tuna *Thunnus maccoyii*." Each of two staff members in Marino-Research Cooperation, who did the same work for years, estimated the age once respectively and independently. Then, one of the staff members determined the estimated age with referring to previous estimation of the two staff members.

The data of age estimated with capture information were sent to the CCSBT Secretariat in 2009. The number of individuals by year caught and CCSBT area in the 2009 data is shown in Table 1. Number of individuals by year caught and at fork length class in the 2009 data is shown in Table 2. The range of age estimated was from 2 to 26. One out of 184 individuals (0.5%) were not able to be estimated its age (readability was 1).

2. Analysis of age data

All age data which were submitted to the CCSBT by Japan from 2005 to 2009 were analyzed. The data includes 3095 individuals (Table 3). There are more than 200 individuals of age data in every year between 1998 and 2005. The age data for fish caught in after 2006 will be submitted in next years.

Statistical values of fork length and age estimated at 5 cm fork length class, as well as of age estimated, are shown in Table 4 and Table 5. Twenty four out of 3095 individuals (0.78%) were not able to be estimated its ages (readabilities are 0 or 1). No otolith was assigned to readability 5.

Relationships between fork length and age estimated are shown in Fig. 1 and Fig. 2. While there are a few outliers, majority of plots seems to be appropriate. Parameters of von Bertalanffy growth equation were estimated by the least square method as follows.

$$L_{inf} = 182.9 \text{ cm}, K = 0.166, t_0 = -1.463 \text{ (year)}$$

The length at age relationship used for OM in CCSBT is corresponded well with the von Bertalanffy growth curve by the otolith data (Fig. 3).

References

Anon. 2002. Report of the Direct Age Estimation Workshop. Victoria, Australia. 11-14 June 2002.

Itoh, T., and O. Sakai. 2009. Report on the piston-line trolling survey in 2008/2009. CCSBT-ESC/0909/32.

Sakai, O., T. Itoh, S. Tashiro, and T. Tanabe. 2009. Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2008/2009. CCSBT-ESC/0909/24.

Table 1 Number of otoliths, by year caught and CCSBT area, which were analyzed and submitted its data to CCSBT in 2009

Area	Year			Total
	2004	2005	2006	
2		19		19
4			6	6
8		19		19
9	22	50	68	140
Total	22	88	74	184

Table 2 Number of otoliths which were analyzed and submitted its data to CCSBT in 2009 by year caught and at fork length class

Year	2004	2005	2006	Total
80–89cm		1	1	2
90–99cm		1	3	4
100–109cm	4	2	6	12
110–119cm		4	5	9
120–129cm	1	10	4	15
130–139cm	2	3	3	8
140–149cm	2	8	8	18
150–159cm	4	16	19	39
160–169cm	4	22	8	34
170–179cm	2	17	12	31
180–189cm	2	3	4	9
190–199cm	1	1	1	3
200–209cm				
Total	22	88	74	184

Table 3 Total number of otoliths, by year of catch and CCSBT statistical area, which have been analyzed and submitted its data to CCSBT since 2005.

Year	Area1	Area2	Area4	Area7	Area8	Area9	Total
1997	14	10			33		57
1998			25		204	20	249
1999	1		73	144	334	36	588
2000		13	24	37	96	110	280
2001	13			71	57	208	349
2002	15		6	47	28	159	255
2003			60	42	78	302	482
2004	21	2	43	31	93	157	347
2005		29	46	5	83	251	414
2006			6			68	74
Total	64	54	283	377	1006	1311	3095

Table 4 Statistical values of fork length and age estimated at 5 cm fork length class in age estimated data by Japan.

Fork length Class	N	Age estimated (readability 1-5)						N	mean	media n	min	max	SD
		N_rea	N_rea	N_rea	N_rea	N_rea	N_rea						
		dabilit y0	dabilit y1	dabilit y2	dabilit y3	dabilit y4	dabilit y5						
25-	0												
30-	2			2			2	0.0	0.0	0	0	0.00	
35-	0												
40-	0												
45-	6				6		6	1.0	1.0	1	1	0.00	
50-	43			12	31		43	1.1	1.0	1	2	0.29	
55-	27	1		13	13		26	1.3	1.0	1	2	0.45	
60-	2			2			2	2.0	2.0	2	2	0.00	
65-	0												
70-	1			1			1	2.0	2.0	2	2		
75-	0												
80-	4	1		3			3	3.0	3.0	2	4	1.00	
85-	40			26	14		40	2.9	3.0	2	6	0.83	
90-	65		3	39	23		65	2.9	3.0	2	5	0.86	
95-	86	1		50	35		85	3.6	4.0	2	11	1.19	
100-	126	1	3	75	44	3	125	3.9	4.0	2	7	0.89	
105-	188	2	7	110	65	4	186	4.2	4.0	2	7	0.96	
110-	138		1	79	57	1	138	4.7	5.0	2	9	1.12	
115-	164		7	85	71	1	164	5.2	5.0	3	11	1.13	
120-	141		3	69	68	1	141	5.3	5.0	3	10	1.11	
125-	109		2	39	62	6	109	5.9	6.0	4	9	1.08	
130-	120		3	48	66	3	120	6.4	6.0	4	10	1.15	
135-	127		3	50	71	3	127	7.0	7.0	4	13	1.42	
140-	156	2	2	59	85	8	154	7.7	8.0	4	11	1.44	
145-	195	1	5	82	101	6	194	8.4	8.0	5	16	1.64	
150-	254	4	4	115	127	4	250	9.4	9.0	6	16	1.88	
155-	241		6	116	107	12	241	10.2	10.0	6	17	2.10	
160-	252	3	10	121	112	6	249	11.3	11.0	7	19	2.43	
165-	164	2	9	73	74	6	162	12.8	12.0	4	31	3.62	
170-	186	2	18	84	76	6	184	15.3	15.0	8	28	3.71	
175-	112	1	13	48	50		111	17.4	16.0	7	36	5.53	
180-	77	1	7	37	31	1	76	19.3	19.0	9	32	4.75	
185-	33		4	19	10		33	20.4	21.0	12	35	6.06	
190-	19	1	5	9	4		18						
195-	11		1	5	5		11	24.0	23.0	11	33	6.18	
200-	3			2	1		3	26.0	27.0	23	28	2.65	
205-	3			2	1		3	26.7	28.0	24	28	2.31	
210-	0												
Total	3095	23	116	1475	1410	71	0	3072					

Table 5 Statistical values of fork length at age in age estimated data by Japan.

Age Class	N	mean	media n	min	max	SD
0	2	32.6	32.6	32.2	33.0	0.57
1	64	53.1	53.0	48.0	57.0	2.48
2	71	86.8	91.0	51.0	112.0	16.00
3	190	101.3	102.0	82.0	123.0	8.68
4	294	108.3	108.0	84.0	165.0	10.41
5	353	117.7	117.0	92.0	149.0	10.54
6	259	127.3	127.0	88.0	169.0	12.49
7	264	139.2	139.0	103.0	175.0	12.08
8	249	147.3	147.0	117.0	176.0	9.62
9	259	152.4	153.0	112.0	180.0	9.27
10	204	155.7	155.5	123.0	182.0	8.94
11	159	159.7	161.0	96.0	195.0	10.27
12	141	162.2	162.0	145.0	188.0	8.13
13	94	166.6	167.5	138.0	188.0	8.36
14	90	166.2	166.5	146.0	185.0	8.40
15	69	170.2	171.0	151.0	187.0	7.60
16	65	172.2	173.0	148.0	190.0	9.06
17	34	171.6	173.0	159.0	184.0	6.57
18	34	175.4	174.5	163.0	195.0	8.71
19	33	176.5	176.0	163.0	191.0	6.67
20	18	176.2	175.5	168.0	190.0	5.96
21	33	180.2	180.0	168.0	196.0	7.10
22	17	181.0	180.0	170.0	195.0	8.19
23	15	180.2	175.0	168.0	200.0	11.12
24	11	183.0	180.0	174.0	207.0	9.13
25	4	182.5	186.0	167.0	191.0	10.72
26	11	179.9	180.0	170.0	197.0	7.35
27	5	186.2	183.0	176.0	203.0	10.76
28	9	187.9	182.0	172.0	205.0	13.48
29	3	186.7	190.0	175.0	195.0	10.41
30	5	184.0	182.0	178.0	196.0	6.96
31	3	178.3	185.0	165.0	185.0	11.55
32	2	187.5	187.5	184.0	191.0	4.95
33	1	197.0	197.0	197.0	197.0	
34	1	186.0	186.0	186.0	186.0	
35	3	185.0	188.0	176.0	191.0	7.94
36	1	177.0	177.0	177.0	177.0	
37						
38						
39						
40						
41						
42						
43						
44						
45	1	191.0	191.0	191.0	191.0	

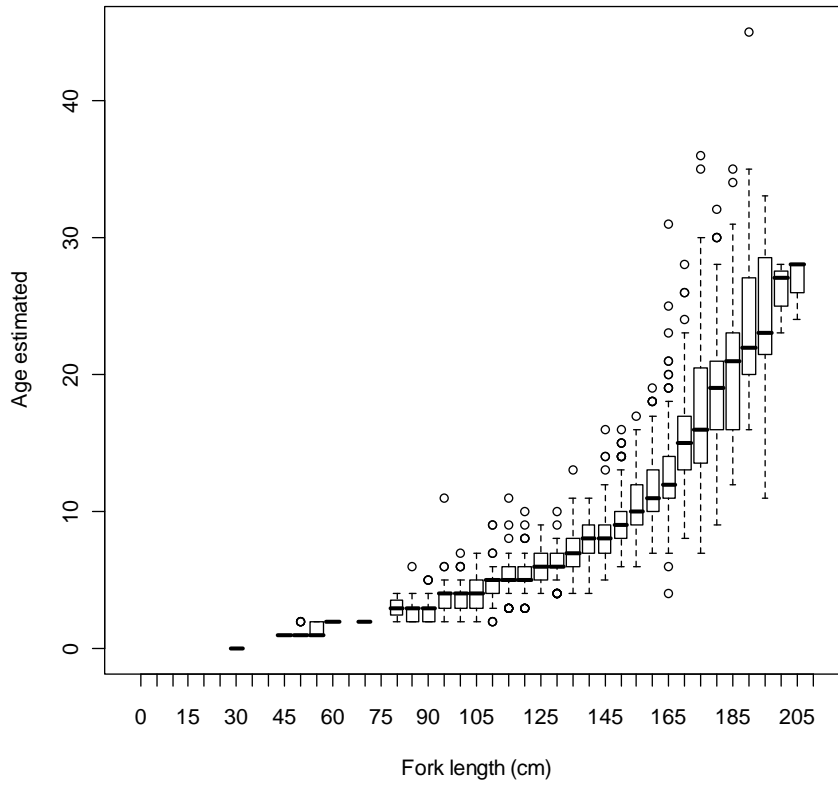


Fig. 1 Box plot of age estimated at fork length in 5 cm class in Japanese age estimated data

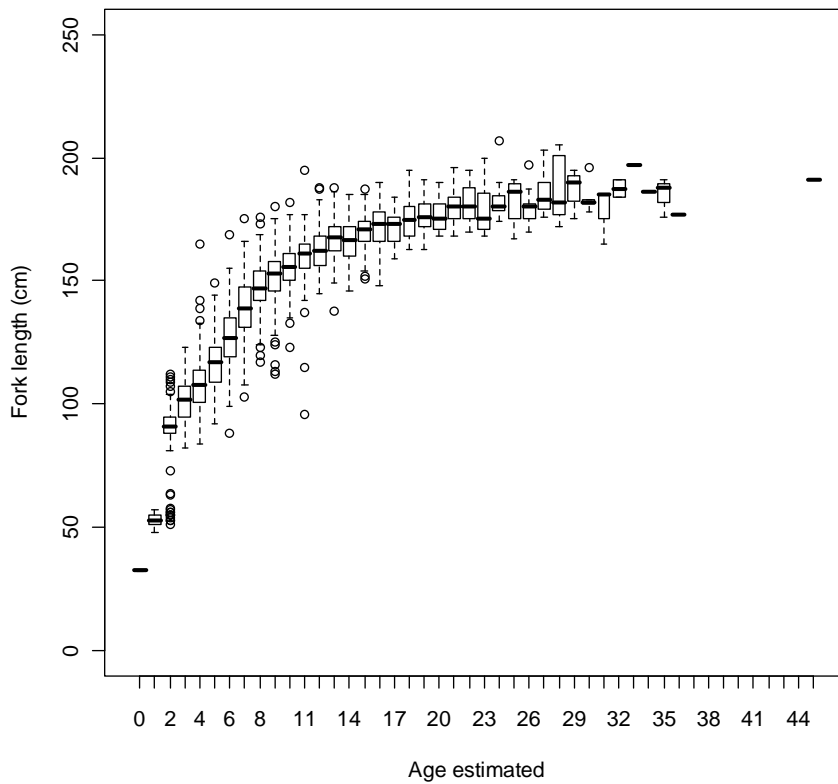


Fig. 2 Box plot of fork length at age estimated in Japanese age estimated data.

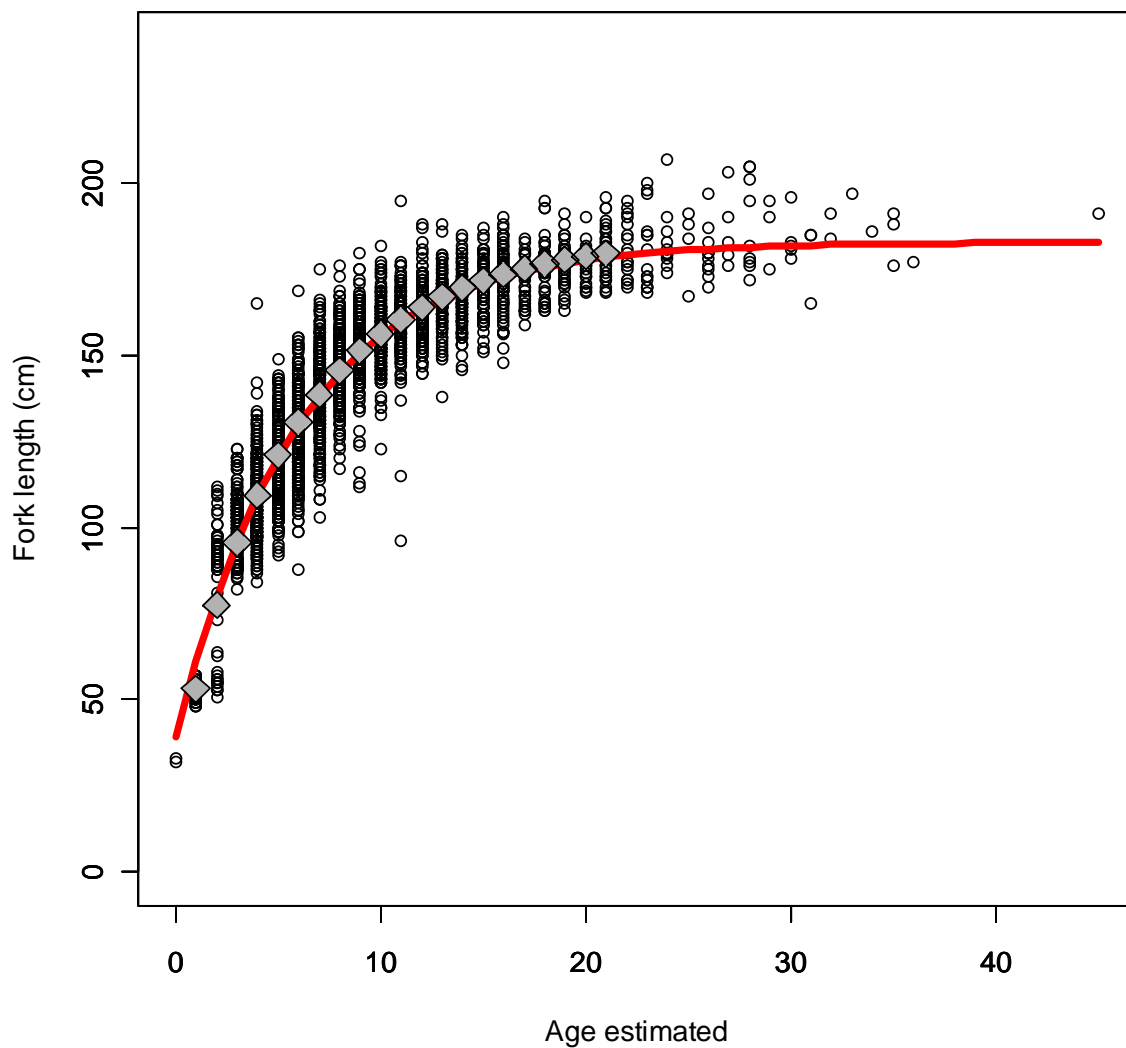


Fig. 3 von Bertalanffy curve and length plots for Japanese age estimated data. Diamonds are length-at-age used for MP in CCSBT.