Activities of otolith collection and age estimation and analysis of the age data by Japan in 2009

2009 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

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要約

日本は 2009 年にミナミマグロ耳石を 327 個体から収集した。2007-2008 年に漁獲されたミナミマグロ 190 個体の年齢を査定し、2010 年にデータを CCSBT 事務局へ提出した。

Summary

Japan collected otoliths from 327 SBT individuals in 2009.　Ages were estimated from 190 SBT individuals which were caught between 2007 and 2008 and submitted to the CCSBT Secretariat in 2010.

1. Activities of otolith collection and age estimation

1) Otolith Collection:

In 2009, Japan collected otoliths from a total of 327 SBT individuals. 279 of them came from commercial longline vessels through the scientific observer program (Sakai et al. ESC/1009/18). 48 of them came from small fish presumably age 0-2 collected in the piston-line trolling survey (Itoh and Sakai ESC/1009/25).

2) Age estimation:

Ages of otoliths from 190 individuals were estimated following 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 2010. The number of individuals by year caught and CCSBT area in the 2010 data is shown in Table 1. Number of individuals by year caught and at fork length class in the 2010 data is shown in Table 2. Fork length ranged from 97 to 189 cm. The range of age estimated was from 2 to 29. Two out of 190 individuals (0.1%) were not able to be estimated its age.

2. Analysis of age data

All age data which were submitted to the CCSBT by Japan from 2005 to 2010 were analyzed. The data includes 3285 individuals (Table 3). There are more than 200 individuals of age data in every year between 1998 and 2005.

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 five out of 3095 individuals (0.77%) were not able to be estimated its ages (readabilities are 0 or 1). No otolith was assigned to readability 5 (no doubt).

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.

Linf = 182.3 cm, K = 0.167, t0 = -1.468 (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. 2010. Report of the piston-line trolling survey in 2009/2010. CCSBT-ESC/1009/25.

Sakai, O., T. Itoh, Y. Akatsuka, and T. Tanabe. 2009. Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2009/2010. CCSBT-ESC/1009/18.

Table 1 Number of otoliths, by year caught and CCSBT area, which were analyzed and submitted its data to CCSBT in 2010

	Year		
Area	2007	2008	Total
4		5	5
7		33	33
8	56		56
9	3	93	96
Total	59	131	190

Table 2 Number of otoliths which were analyzed and submitted its data to CCSBT in 2010 by year caught and at fork length class

Year	2007	2008	Total
80-89cm			
90-99cm		1	1
100-109cm		8	8
110-119cm		6	6
120-129cm		13	13
130-139cm	6	16	22
140-149cm	7	15	22
150-159cm	14	26	40
160-169cm	14	32	46
170-179cm	14	12	26
180-189cm	4	2	6
190-199cm			
200-209cm			
Total	59	131	190

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
2007					56	3	59
2008			5	33		93	131
Total	64	54	288	410	1062	1407	3285

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

Fork length		N_readability						Age estimated (readability 1-5)					
Class	N	0	1	2	3	4	5	N	mean	media n	min	max	SD
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-	87	1		51	35			86	3.6	4.0	2	11	1.19
100-	132	2	3	78	46	3		130	3.8	4.0	2	7	0.91
105-	190	2	7	112	65	4		188	4.1	4.0	2	7	0.97
110-	140		1	81	57	1		140	4.6	5.0	2	9	1.12
115-	168		7	88	72	1		168	5.1	5.0	3	11	1.16
120-	147		3	73	70	1		147	5.2	5.0	3	10	1.14
125-	116		2	43	65	6		116	5.8	6.0	4	9	1.08
130-	131		3	55	69	4		131	6.2	6.0	4	10	1.19
135-	138		3	59	73	3		138	6.9	7.0	4	13	1.38
140-	167	2	2	67	88	8		165	7.6	8.0	4	11	1.47
145-	206	1	5	92	102	6		205	8.4	8.0	4	16	1.67
150-	276	4	4	132	131	5		272	9.4	9.0	5	16	1.92
155-	259		6	132	109	12		259	10.2	10.0	6	17	2.09
160-	276	3	12	138	117	6		273	11.3	11.0	6	19	2.48
165-	186	2	11	89	78	6		184	12.7	12.0	4	31	3.53
170-	209	3	20	98	82	6		206	15.3	15.0	8	28	3.72
175-	115	1	13	50	51			114	17.4	16.0	7	36	5.46
180-	82	1	8	40	32	1		81	19.4	19.0	9	32	4.83
185-	34		4	20	10			34	20.4	20.0	12	35	5.97
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	3285	25	123	1614	1450	73	0	3260					

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

Age Class	N	mean	median	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	74	87.5	91.0	51.0	112.0	16.00
3	200	102.0	103.0	82.0	124.0	9.09
4	306	109.0	108.0	84.0	165.0	11.09
5	368	118.3	118.0	92.0	154.0	11.03
6	273	127.9	128.0	88.0	169.0	12.69
7	284	139.6	139.5	103.0	175.0	12.03
8	264	147.8	148.0	117.0	176.0	9.79
9	274	152.6	153.0	112.0	180.0	9.13
10	216	155.9	156.0	123.0	182.0	8.84
11	171	159.9	161.0	96.0	195.0	10.13
12	160	162.2	162.0	145.0	188.0	7.93
13	102	166.3	166.0	138.0	188.0	8.30
14	94	166.2	166.5	146.0	185.0	8.28
15	73	170.1	171.0	151.0	187.0	7.48
16	72	172.0	173.0	148.0	190.0	8.71
17	38	171.7	173.0	159.0	184.0	6.28
18	39	174.7	174.0	163.0	195.0	8.59
19	38	176.4	176.0	163.0	191.0	6.95
20	19	176.5	176.0	168.0	190.0	5.89
21	33	180.2	180.0	168.0	196.0	7.10
22	18	181.0	180.5	170.0	195.0	7.94
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	12	179.4	179.0	170.0	197.0	7.22
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	4	186.0	187.0	175.0	195.0	8.60
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	

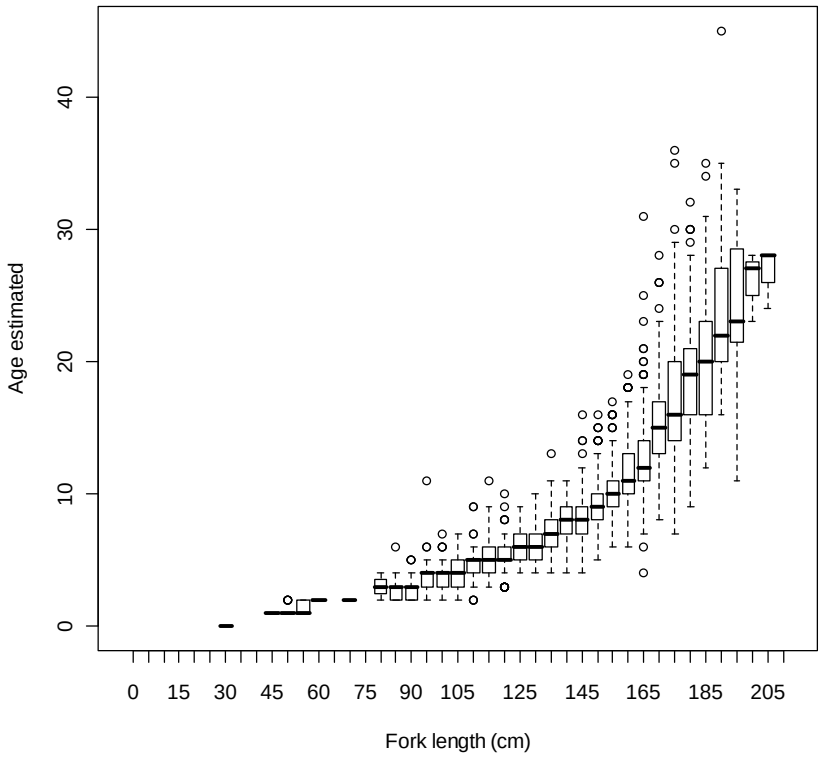

Fig. 1 Box plot of age estimated at fork length in 5 cm class in Japanese age estimated data

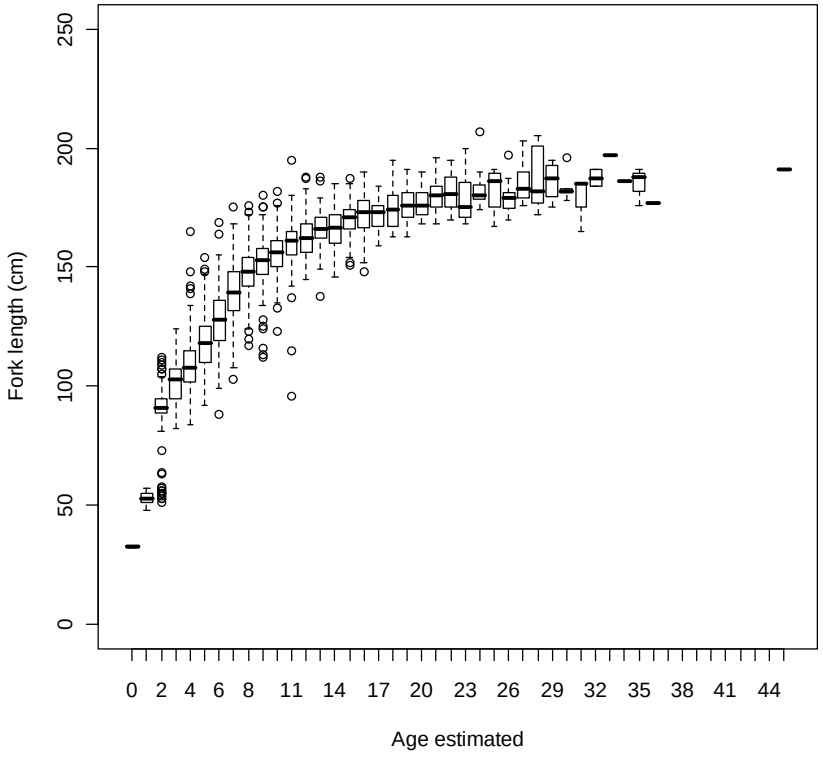

Fig. 2 Box plot of fork length at age estimated in Japanese age estimated data.

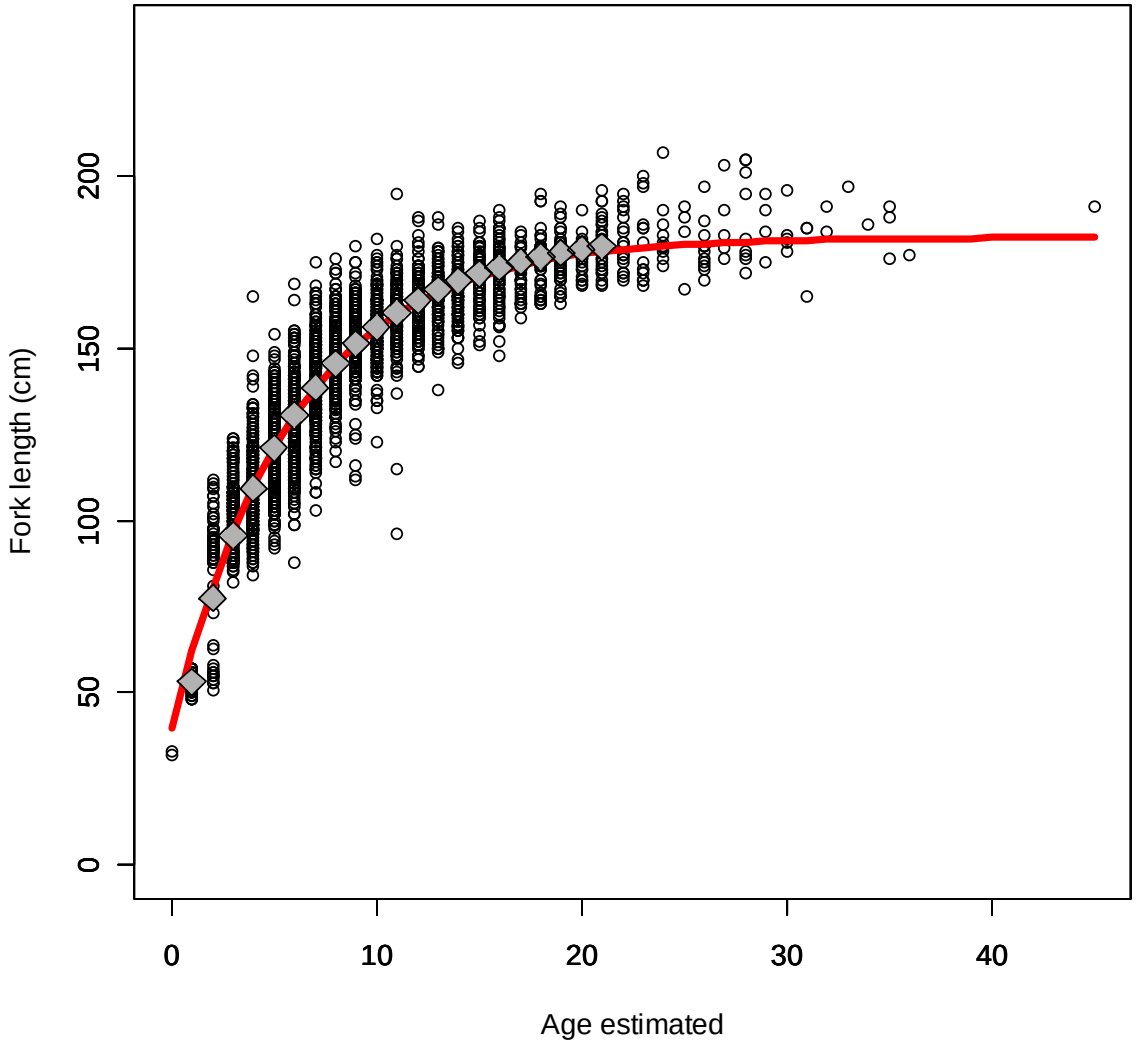

Fig. 3 von Bertalanffy curve and length plots for Japanese age estimated data. Diamonds are length-at-age used for MP in CCSBT.