

Activities of otolith collection and age estimation and analysis of the age data by Japan in 2006

2006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

ミナミマグロ耳石は2006年に511個体から収集した。2007年4月に、2001-2005年に漁獲されたミナミマグロ531個体の耳石年齢査定データを、CCSBT事務局へ提出した。

Summary

Otoliths were collected from 1340 SBT individuals in 2006. Age estimation data of otoliths from 531 SBT individuals which were caught between 2001 and 2005 were submitted to the CCSBT Secretariat in April 2007.

1. Activities of otolith collection and age estimation

1) Otolith Collection:

In 2006, Japan collected otoliths from a total of 511 SBT individuals. 433 were from commercial longline vessels through scientific observer program. 36 were from a survey for archival tagging which used a commercial longline vessel. 42 were from small fish presumably age 0-2 caught by the piston-line trolling survey.

2) Age estimation:

Ages of otoliths from 531 individuals were estimated up to April 2007 according to the CCSBT manual, "A manual for age determination of southern bluefin tuna *Thunnus maccoyii*." Two staff members in Marino-Research Cooperation, who did the same work last year, 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 April 2007. The number of individuals by year and CCSBT area in the 2007 data is shown in Table 1. Number of individuals by year and at fork length class in the 2007 data is shown in Table 2. The range of age estimated was 0 to 28 (Fig. 1). Six out of 531

individuals (1.1%) were not able to be estimated its ages (readabilities are 0).

2. Analysis of age data

All age data which were submitted to the CCSBT by Japan from 2005 to 2007 were analyzed. The data includes 2753 individuals (Table 3). There are more than 200 individuals age data in each year between 1998 and 2004. The number of age data from SBT which were caught in 2005 will be increased by analysis within this year.

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 two out of 2721 individuals (0.81%) were not able to be estimated its ages (readabilities are 0). No otolith was assigned to readability 5.

Box plots between fork length and age estimated are shown in Fig. 2 and Fig. 3. 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.

$L_{inf} = 182.9$ cm, $K = 0.1657$, $t_0 = -1.3945$ (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. 4).

References

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

Table 1 Number of otoliths, by year and CCSBT area, which were analyzed and submitted its data to CCSBT in 2007

Area	2001	2002	2003	2004	2005	Total
Area1		9				9
Area2				2	2	4
Area4				43	46	89
Area7	33			31	5	69
Area8				93	49	142
Area9	2		47	135	34	218
Total	35	9	47	304	136	531

Table 2 Number of otoliths which were analyzed and submitted its data to CCSBT in 2007 by year and at fork length class

Year	2001	2002	2003	2004	2005	Total
80-89cm				1	1	2
90-99cm				11	1	12
100-109cm	3			23	1	27
110-119cm	6		4	16	4	30
120-129cm	3		2	20	3	28
130-139cm	4		7	32	8	51
140-149cm	5		7	34	26	72
150-159cm	5	1	9	55	43	113
160-169cm	5	2	8	53	29	97
170-179cm	2	3	8	42	17	72
180-189cm	1	1	2	16	2	22
190-199cm		2		1	1	4
200-209cm	1					1
Total	35	9	47	304	136	531

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	1994	1995	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
Area1	4	10	14		1		13	15		21		78
Area2			10			13				2	2	27
Area4				25	73	24		6	60	43	46	277
Area7					145	37	71	47	42	31	5	378
Area8		1	33	203	334	99	57	28	78	93	49	975
Area9		3		20	36	111	218	159	302	135	34	1018
Area11-15				1								1
Total	4	14	57	248	589	284	359	255	482	325	136	2753

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_read ability	N_read ability	N_read ability	N_read ability	N_read ability	N_read ability						
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-	36			22	14		36	2.9	3.0	2	6	0.83	
90-	61		1	37	23		61	3.0	3.0	2	5	0.86	
95-	82	1		46	35		81	3.7	4.0	2	11	1.20	
100-	114	1	2	64	44	3	113	4.0	4.0	2	7	0.86	
105-	177	2	5	101	65	4	175	4.2	4.0	2	7	0.96	
110-	130		1	72	56	1	130	4.7	5.0	2	9	1.09	
115-	149		3	76	69	1	149	5.3	5.0	3	11	1.10	
120-	116		1	47	67	1	116	5.5	5.0	3	10	1.08	
125-	103		2	34	61	6	103	5.9	6.0	4	9	1.09	
130-	112		3	41	65	3	112	6.4	6.5	4	10	1.14	
135-	110		1	38	68	3	110	7.1	7.0	5	13	1.41	
140-	135	2		50	76	7	134	7.7	8.0	0	11	1.55	
145-	168	1	3	67	91	6	168	8.5	8.0	0	16	1.77	
150-	220	4	1	88	124	3	219	9.4	9.0	0	16	2.20	
155-	203		3	88	101	11	203	10.3	10.0	6	17	2.11	
160-	220	3	7	97	108	5	217	11.2	11.0	7	19	2.30	
165-	131	2	4	49	71	5	130	12.9	12.0	0	31	4.00	
170-	150	1	12	59	72	6	149	15.6	15.0	8	28	3.89	
175-	95	1	9	38	47		94	17.6	16.0	7	36	5.75	
180-	66	1	6	31	27	1	65	19.5	19.0	9	32	4.73	
185-	27		1	16	10		27	19.9	19.0	12	35	6.24	
190-	15	1	3	7	4		14	25.0	22.0	16	45	7.86	
195-	10		1	4	5		10	24.1	24.5	11	33	6.51	
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												

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	59	85.3	91.0	51.0	112.0	16.95
3	160	99.8	100.0	82.0	120.0	8.04
4	274	107.6	107.0	84.0	165.0	10.00
5	319	117.1	117.0	92.0	149.0	10.51
6	236	126.1	125.0	88.0	169.0	12.21
7	238	138.3	138.0	103.0	175.0	12.23
8	211	146.5	147.0	117.0	176.0	9.53
9	224	152.2	152.0	112.0	180.0	9.59
10	190	155.7	155.5	123.0	182.0	9.05
11	133	159.2	160.0	96.0	195.0	10.75
12	118	161.5	161.0	145.0	188.0	8.10
13	74	166.0	166.0	138.0	188.0	8.65
14	74	165.6	165.5	146.0	185.0	8.65
15	55	169.8	171.0	151.0	187.0	7.62
16	54	171.9	172.5	148.0	190.0	9.47
17	26	171.8	173.0	159.0	183.0	6.01
18	29	176.2	177.0	163.0	195.0	8.94
19	29	175.9	176.0	163.0	188.0	6.30
20	15	174.8	174.0	168.0	184.0	5.02
21	33	180.2	180.0	168.0	196.0	7.10
22	16	180.6	178.5	170.0	195.0	8.25
23	13	178.4	173.0	168.0	200.0	10.56
24	9	183.0	179.0	174.0	207.0	10.10
25	4	182.5	186.0	167.0	191.0	10.72
26	9	179.9	178.0	170.0	197.0	8.22
27	4	185.3	181.0	176.0	203.0	12.18
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	4	185.5	182.5	181.0	196.0	7.05
31	2	175.0	175.0	165.0	185.0	14.14
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	

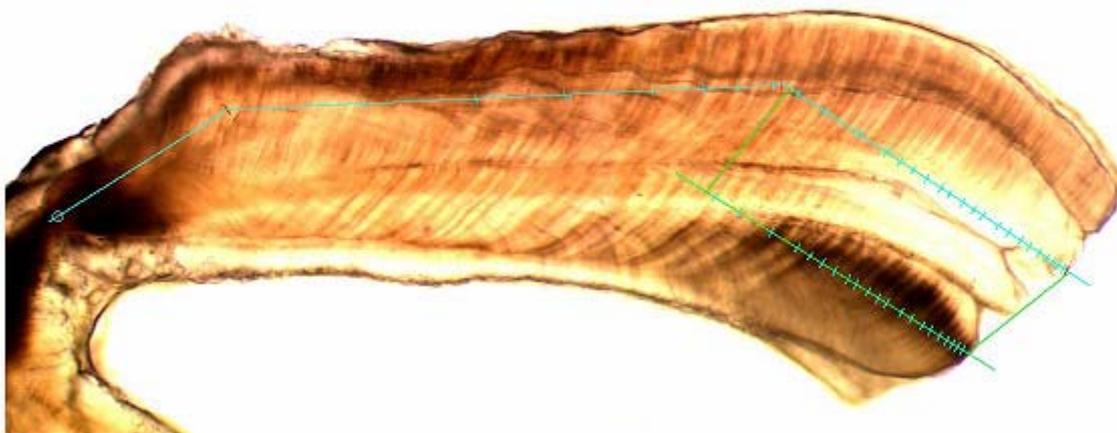


Fig.1 Photograph of otolith whose estimated age was the oldest (age 28) in the data submitted in 2007.

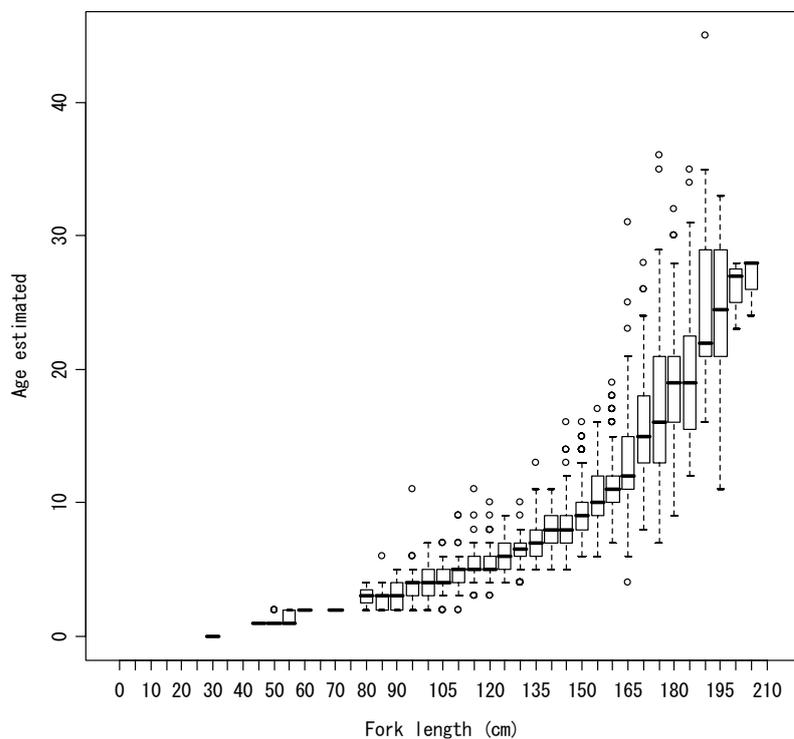


Fig. 2 Box plot of age estimated at fork length in 5 cm class in Japanese age estimated data

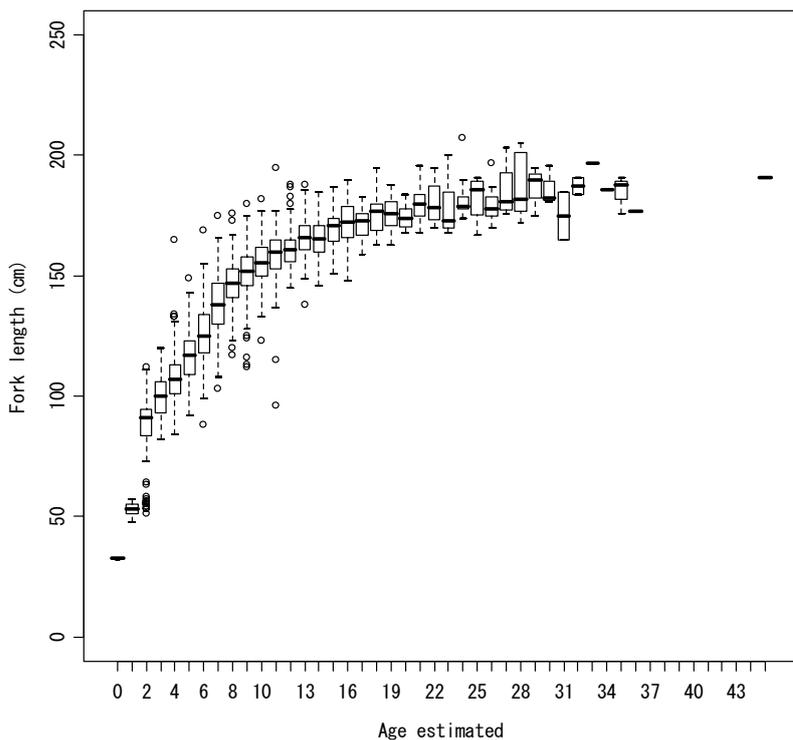


Fig. 3 Box plot of fork length at age estimated in Japanese age estimated data.

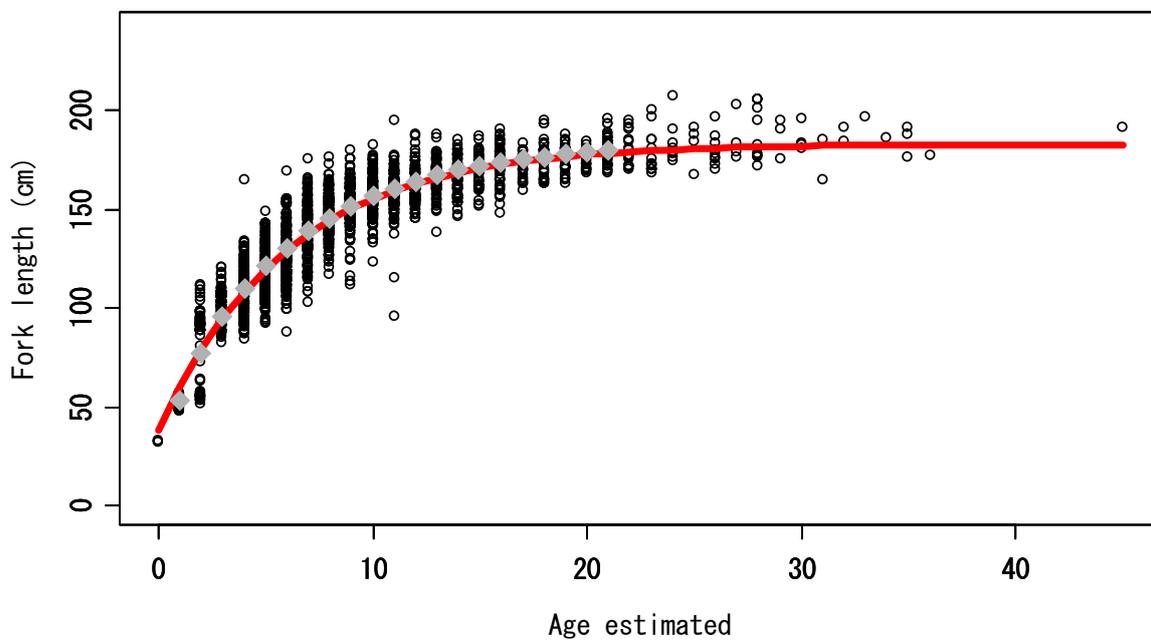


Fig. 4 von Bertalanffy curve and length plots for Japanese age estimated data. Diamonds are length-at-age used for MP in CCSBT.