

## Activities of otolith collection and age estimation and analysis of the age data by Japan in 2007

### 2007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2007年に636個体から収集した。2008年に、2005年に漁獲されたミナミマグロ190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 636 SBT individuals in 2007. Age estimation data of otoliths from 190 SBT individuals which were caught in 2005 were submitted to the CCSBT Secretariat in 2008.

#### 1. Activities of otolith collection and age estimation

##### 1) Otolith Collection:

In 2007, Japan collected otoliths from a total of 636 SBT individuals. 422 were from commercial longline vessels through the scientific observer program (Sakai et al. ESC/0809/32). 198 were from a survey for archival tagging which used a commercial longline vessel (Sakai and Itoh ESC/0809/34). 16 were from small fish presumably age 0-2 caught by the piston-line trolling survey (Itoh and Sakai ESC/0809/41).

##### 2) Age estimation:

Ages of otoliths from 190 individuals were estimated 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 2008. The number of individuals by year caught and CCSBT area in the 2008 data is

shown in Table 1. Number of individuals by year caught and at fork length class in the 2008 data is shown in Table 2. The range of age estimated was 2 to 31. One out of 190 individuals (0.5%) 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 2008 were analyzed. The data includes 2911 individuals (Table 3). There are more than 200 individuals age data in each year between 1998 and 2005. The data for fish caught in 2006 will be submitted next 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 three out of 2911 individuals (0.79%) were not able to be estimated its ages (readabilities are 0). 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.

$L_{inf} = 182.8 \text{ cm}$ ,  $K = 0.166$ ,  $t_0 = -1.437 \text{ (year)}$

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. 2008. Report on the piston-line trolling survey in 2007/2008. CCSBT-ESC/0809/41.
- Sakai, O., T. Itoh, S. Fukui, and T. Tanabe. 2008. Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2007/2008. CCSBT-ESC/0809/32.
- Sakai, O., and T. Itoh. 2008. Report of activities for conventional and archival tagging and recapture of southern bluefin tuna by Japan in 2007/2008. CCSBT-ESC/0809/34.

Table 1 Number of otoliths, by year caught and CCSBT area, which were analyzed and submitted its data to CCSBT in 2008

Area	2005
Area2	8
Area8	15
Area9	167
Total	190

Table 2 Number of otoliths which were analyzed and submitted its data to CCSBT in 2008 by year caught and at fork length class

Year	2005
80-89cm	2
90-99cm	4
100-109cm	11
110-119cm	14
120-129cm	16
130-139cm	17
140-149cm	30
150-159cm	33
160-169cm	31
170-179cm	22
180-189cm	8
190-199cm	2
200-209cm	
Total	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	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
Area1	14		1		13	15		21		64
Area2	10			13				2	10	35
Area4		25	73	24		6	60	43	46	277
Area7			144	37	71	47	42	31	5	377
Area8	33	204	334	96	57	28	78	93	64	987
Area9		20	36	110	208	159	302	135	201	1171
Total	57	249	588	280	349	255	482	325	326	2911

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 ability0	N_read ability1	N_read ability2	N_read ability3	N_read ability4	N_read ability5						
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–	38			24	14		38	2.9	3.0	2	6	0.83	
90–	64		3	38	23		64	3.0	3.0	2	5	0.86	
95–	83	1		47	35		82	3.6	4.0	2	11	1.21	
100–	119	1	3	68	44	3	118	3.9	4.0	2	7	0.88	
105–	183	2	7	105	65	4	181	4.2	4.0	2	7	0.95	
110–	134		1	75	57	1	134	4.7	5.0	2	9	1.10	
115–	159		7	80	71	1	159	5.2	5.0	3	11	1.11	
120–	130		3	59	67	1	130	5.3	5.0	3	10	1.14	
125–	105		2	36	61	6	105	5.9	6.0	4	9	1.09	
130–	117		3	46	65	3	117	6.4	7.0	4	10	1.16	
135–	122		2	46	71	3	122	7.0	7.0	4	13	1.41	
140–	148	2		55	84	7	146	7.7	8.0	5	11	1.41	
145–	185	1	3	75	100	6	184	8.5	8.0	5	16	1.65	
150–	240	4	2	104	127	3	236	9.4	9.0	6	16	1.88	
155–	216		6	96	103	11	216	10.2	10.0	6	17	2.09	
160–	233	3	10	105	109	6	230	11.3	11.0	7	19	2.35	
165–	149	2	7	61	74	5	147	12.9	12.0	4	31	3.74	
170–	165	2	16	67	74	6	163	15.4	15.0	8	28	3.82	
175–	102	1	9	42	50		101	17.6	16.0	7	36	5.74	
180–	70	1	6	32	30	1	69	19.4	19.0	9	32	4.75	
185–	31		3	18	10		31	20.2	19.0	12	35	6.20	
190–	16	1	4	7	4		15	25.1	22.0	16	45	7.60	
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	2911	23	98	1328	1395	67	0	2888					

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	66	86.1	91.0	51.0	112.0	16.22
3	174	100.8	102.0	82.0	123.0	8.70
4	288	108.1	107.5	84.0	165.0	10.19
5	337	117.5	117.0	92.0	149.0	10.60
6	250	127.0	126.0	88.0	169.0	12.54
7	253	138.7	138.0	103.0	175.0	12.10
8	232	146.9	147.0	117.0	176.0	9.62
9	245	152.2	152.0	112.0	180.0	9.37
10	195	155.7	155.0	123.0	182.0	8.99
11	145	159.5	161.0	96.0	195.0	10.52
12	127	161.8	161.0	145.0	188.0	8.09
13	83	166.6	167.0	138.0	188.0	8.52
14	78	165.6	165.5	146.0	185.0	8.49
15	64	170.3	171.0	151.0	187.0	7.56
16	58	172.1	172.5	148.0	190.0	9.38
17	29	171.3	173.0	159.0	183.0	6.21
18	31	175.8	177.0	163.0	195.0	8.87
19	31	176.1	176.0	163.0	188.0	6.32
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	17	181.0	180.0	170.0	195.0	8.19
23	14	179.8	174.0	168.0	200.0	11.42
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	10	179.9	179.0	170.0	197.0	7.75
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	

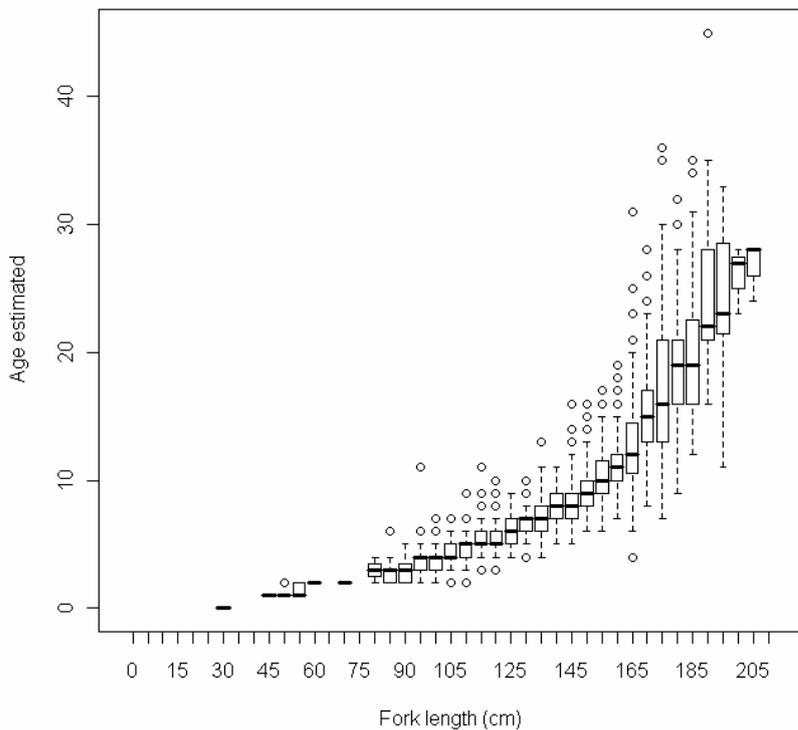


Fig. 1 Box plot of age estimated at fork length in 5 cm class in Japanese age estimated data

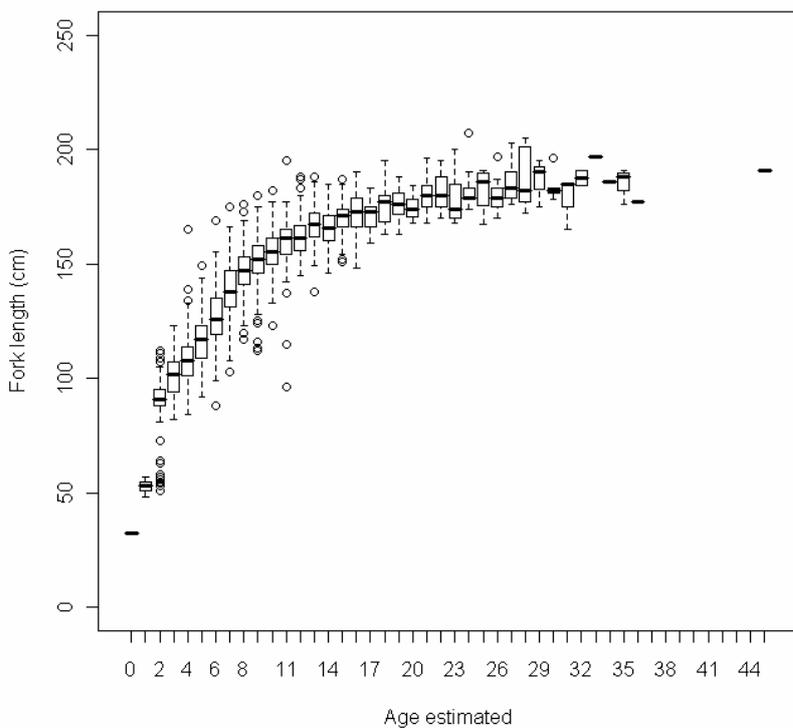


Fig. 2 Box plot of fork length at age estimated in Japanese age estimated data.

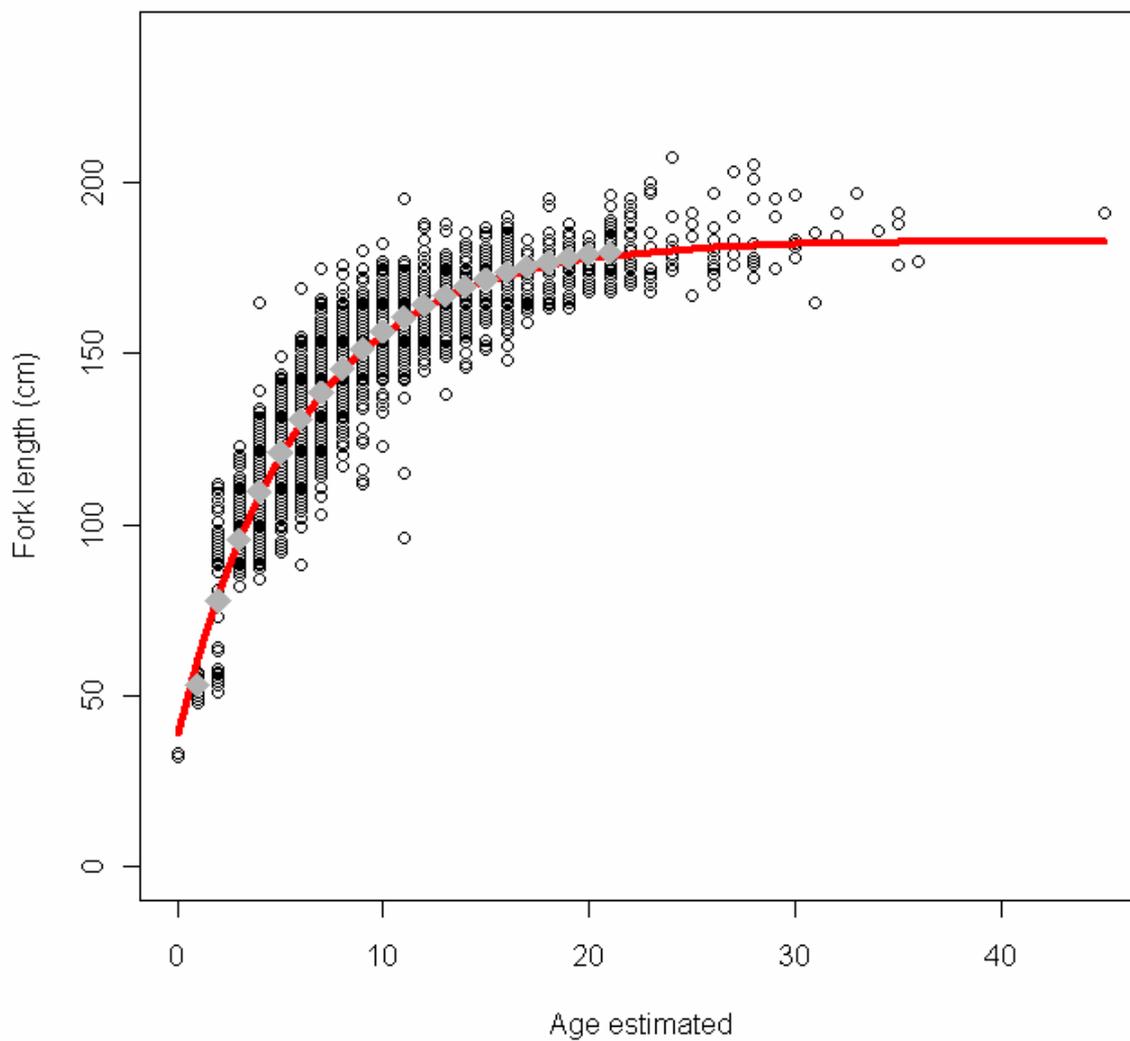


Fig. 3 von Bertalanffy curve and length plots for Japanese age estimated data. Diamonds are length-at-age used for MP in CCSBT.