Activities of otolith collection and age estimation and analysis of the age data by Japan in 2010

2010 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 2010 年にミナミマグロ耳石を 315 個体から収集した。2006-2009 年に漁獲されたミナミマグロ 369 個体の年齢を査定し、2011 年にデータを CCSBT 事務局へ提出した。

Summary

Japan collected otoliths from 315 SBT individuals in 2010.　Ages were estimated from 369 SBT individuals which were caught between 2006 and 2009 and submitted to the CCSBT Secretariat in 2011.

1. Activities of otolith collection and age estimation

1) Otolith Collection:

In 2010, Japan collected otoliths from a total of 315 SBT individuals. 93 of them came from commercial longline vessels through the scientific observer program (CCSBT-ESC/1107/23). 222 of them came from small fish presumably age 0-2 collected in the piston-line trolling survey (CCSBT-ESC/1107/29).

2) Age estimation:

Ages of otoliths from 369 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 2011. The number of individuals by year caught and CCSBT area in the 2011 data is shown in Table 1. Number of individuals by year caught and at fork length class in the 2011 data is shown in Table 2. Fork length of fish ranged from 78 to 200 cm. The range of age estimated was from 2 to 28.

2. Analysis of age data

All age data which were submitted to the CCSBT by Japan from 2005 to 2011 were analyzed. The data includes 3654 individuals (Table 3). There are more than 200 individuals of age data in every year between 1998 and 2005, and 2007.

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 3654 individuals (0.68%) 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 = 182.4 cm, K = 0.168, t0 = -1.506 (year)

The length at age relationship used in CCSBT (mean length at age for 2005 catch) 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.

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Table 1 Number of otoliths, by year caught and CCSBT area, which were analyzed and submitted its data to CCSBT in 2011

	Year				
Area	2006	2007	2008	2009	Total
2	1	1			2
4				5	5
8	7	116	67	111	301
9	9	43		9	61
Total	17	160	67	125	369

Table 2 Number of otoliths which were analyzed and submitted its data to CCSBT in 2011 by year caught and at fork length class

	Year				
Size	2006	2007	2008	2009	Total
70-79cm		1			1
80-89cm		14	4	1	19
90-99cm		29	4	2	35
100-109cm		24	6	10	40
110-119cm		10	3	4	17
120-129cm	1	6	1	12	20
130-139cm	1	11	3	15	30
140-149cm	2	9	5	18	34
150-159cm	4	22	15	20	61
160-169cm	3	21	18	17	59
170-179cm	2	11	5	16	34
180-189cm	3	2	3	9	17
190-199cm				1	1
200-209cm	1				1
Total	17	160	67	125	369

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		1	6		7	77	91
2007		1			172	46	219
2008			5	33	67	93	198
2009			5		111	9	125
Total	64	56	293	410	1363	1468	3654

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	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-	1			1				1	2.0	2.0	2	2	
80-	5	1		4				4	2.8	2.5	2	4	0.96
85-	58			44	14			58	2.7	3.0	2	6	0.77
90-	91		3	65	23			91	2.8	3.0	2	5	0.80
95-	96	1		60	35			95	3.6	4.0	2	11	1.15
100-	154	2	3	99	47	3		152	3.8	4.0	2	7	0.88
105-	208	2	7	129	66	4		206	4.1	4.0	2	7	0.95
110-	145		1	86	57	1		145	4.6	5.0	2	9	1.12
115-	180		9	98	72	1		180	5.1	5.0	3	11	1.15
120-	160		3	86	70	1		160	5.3	5.0	3	10	1.13
125-	123		2	50	65	6		123	5.9	6.0	4	9	1.10
130-	143		4	65	70	4		143	6.3	6.0	4	10	1.17
135-	156		4	76	73	3		156	7.0	7.0	4	13	1.34
140-	182	2	2	81	89	8		180	7.6	8.0	4	11	1.42
145-	225	1	6	107	105	6		224	8.4	8.0	4	16	1.65
150-	308	4	9	156	134	5		304	9.4	9.0	5	16	1.95
155-	288		7	158	111	12		288	10.1	10.0	6	17	2.03
160-	300	3	13	161	117	6		297	11.3	11.0	6	19	2.50
165-	221	2	13	120	80	6		219	12.8	12.0	4	31	3.45
170-	231	3	26	111	85	6		228	15.4	15.0	8	28	3.79
175-	127	1	15	60	51			126	17.3	16.0	7	36	5.23
180-	94	1	11	49	32	1		93	19.2	19.0	9	32	4.72
185-	39		7	22	10			39	20.1	19.0	12	35	5.92
190-	20	1	6	9	4			19					
195-	11		1	5	5			11	24.0	23.0	11	33	6.18
200-	4			3	1			4	26.3	27.0	23	28	2.22
205-	3			2	1			3	26.7	28.0	24	28	2.31
210-	0												
Total	3654	25	152	1937	1467	73	0	3629					

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	99	87.9	91.0	51.0	112.0	13.96
3	248	100.9	102.0	82.0	124.0	8.96
4	332	108.9	108.0	84.0	165.0	10.83
5	389	118.4	118.0	92.0	154.0	10.88
6	298	128.3	128.0	88.0	169.0	12.60
7	310	139.7	139.5	103.0	175.0	11.99
8	294	147.3	147.0	116.0	176.0	9.79
9	312	152.9	153.0	112.0	180.0	8.94
10	235	156.2	156.0	123.0	182.0	8.62
11	187	159.6	160.0	96.0	195.0	9.85
12	172	162.2	162.0	145.0	188.0	7.95
13	112	166.3	166.0	138.0	188.0	8.30
14	107	166.6	167.0	146.0	186.0	8.23
15	87	170.4	171.0	151.0	187.0	7.47
16	88	172.1	173.0	148.0	190.0	8.45
17	44	171.7	172.5	159.0	184.0	6.47
18	50	175.2	174.5	163.0	195.0	8.33
19	41	176.2	176.0	163.0	191.0	7.11
20	21	176.3	176.0	168.0	190.0	5.64
21	34	180.0	180.0	168.0	196.0	7.10
22	19	181.0	181.0	170.0	195.0	7.72
23	16	179.6	174.0	168.0	200.0	11.04
24	11	183.0	180.0	174.0	207.0	9.13
25	5	180.2	184.0	167.0	191.0	10.62
26	13	179.5	180.0	170.0	197.0	6.91
27	7	186.4	183.0	174.0	203.0	11.56
28	10	187.7	184.0	172.0	205.0	12.72
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	

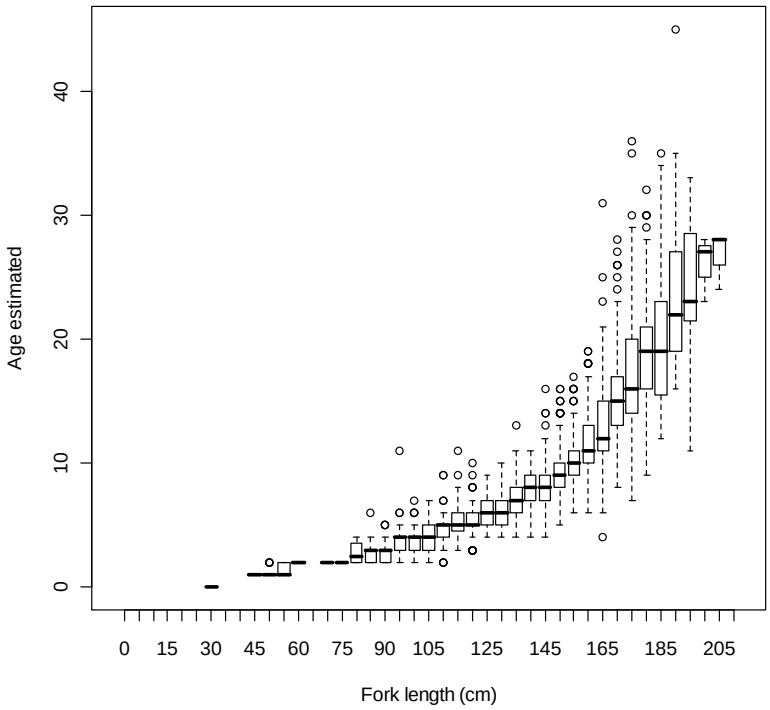

Fig. 1 Box plot of age estimated at fork length in 5 cm class in Japanese age estimated data

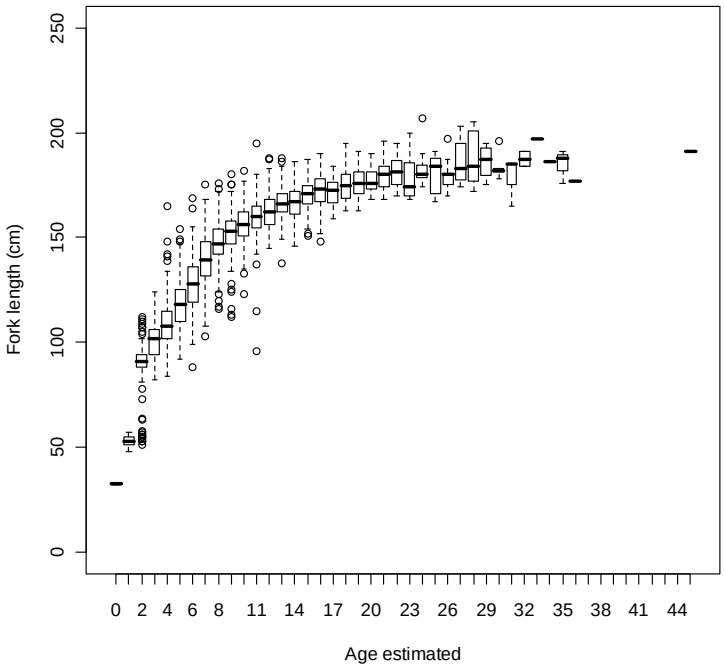

Fig. 2 Box plot of fork length at age estimated in Japanese age estimated data.

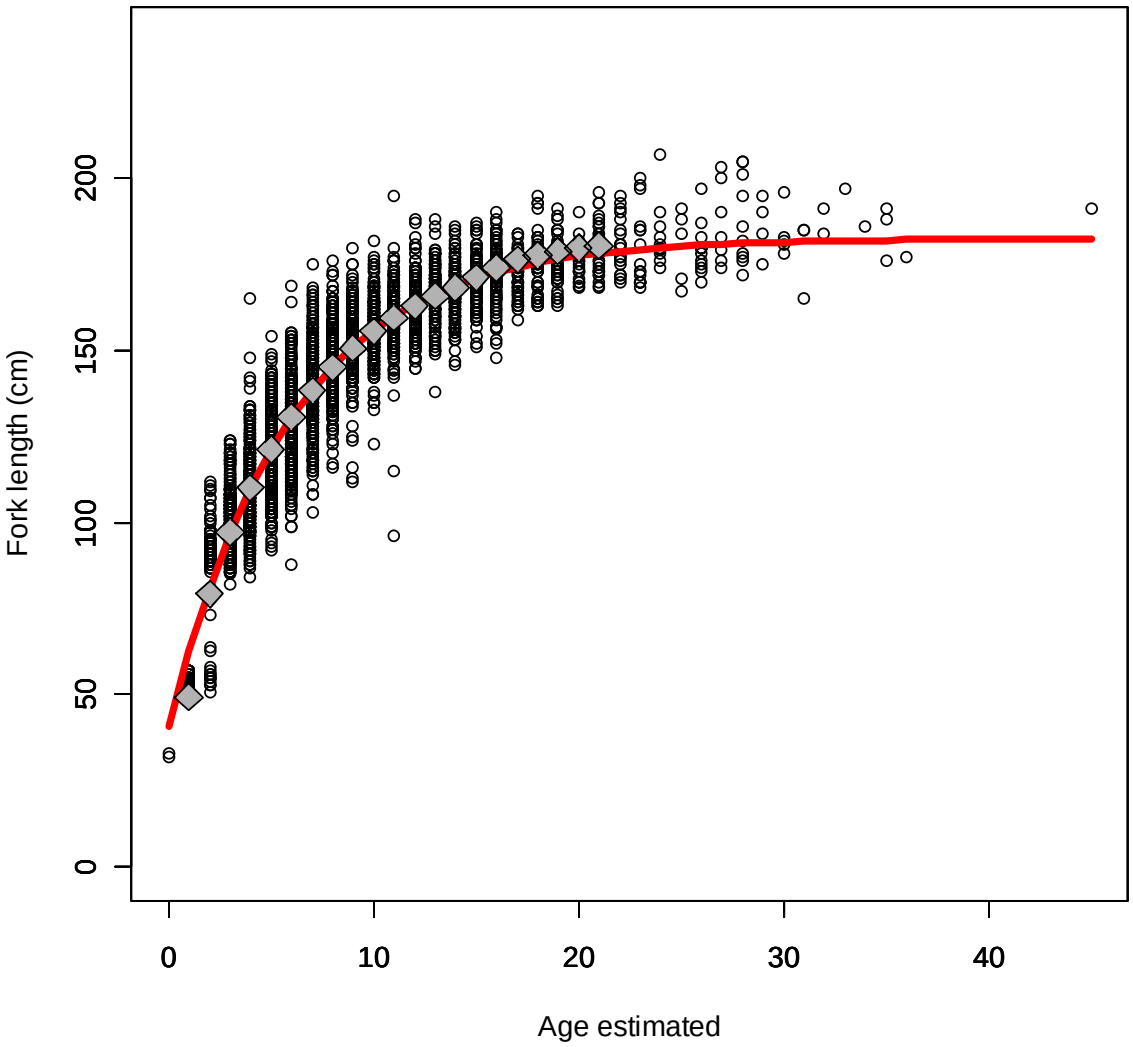

Fig. 3 von Bertalanffy curve and length plots for Japanese age estimated data. Diamonds are length-at-age used in CCSBT.