CCSBT-ESC/1708/21
(ESC Agenda item 7)

Activities of southern bluefin tuna otolith collection and age estimation and analysis of the age data by Japan in 2016

2016 年の日本によるミナミマグロ耳石収集と年齢査定活動並びに年齢データの分析

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要約

日本は 2016 年にミナミマグロ耳石を 551 個体から収集した。2015 年に漁獲されたミナミマグロ 197 個体の年齢を査定し、2017 年にデータを CCSBT 事務局へ提出した。日本は合計 4726 個体の年齢データを分析し、尾叉長と年齢との関係を示した。

Summary

Japan collected otoliths from 551 southern bluefin tuna *Thunnus maccoyii* (SBT) individuals in 2016. Ages were estimated from 197 SBT in individuals which were caught in 2015. The data were submitted to the CCSBT Secretariat in 2017. Age data in total of 4726 SBT individuals by Japan were analyzed to show relationships between fork length and age estimated.

1. Activities of otolith collection

In 2016, Japan collected otoliths from a total of 551 southern bluefin tuna *Thunnus Maccoyii* (SBT) individuals. 484 out of 551 otoliths came from commercial longline vessels through the scientific observer program (Itoh et al., CCSBT-ESC/1708/19). These fish were caught from March to September 2015, and fork length of them were 92 to 179 cm. In addition, 67 out of 551 otoliths were collected from the trolling survey in 2017 (Tsuda and Itoh, CCSBT-ESC/1708/22).

2. Age estimation of 2015 data

Ages of 197 individuals were estimated using otoliths following to the CCSBT manual (Anon. 2002), "A manual for age determination of southern bluefin tuna *Thunnus maccoyii*." Each of two staff members in Marino-Research Corporation, who did the same work for years, estimated the age once respectively and independently. Then, one of them determined the final estimated age with referring to their previous estimation.

The data of age estimated with capture information were sent to the CCSBT Secretariat in 2017. The number of individuals by year caught and CCSBT area in the 2015 data is shown in Table 1. Number of individuals by year caught and at fork length class in the 2015 data is shown in Table 2. The range of age estimated was from 3 to 24.

3. Analysis of accumulated age dataset

The age data for 197 individuals which estimated in 2016 were added into accumulated age dataset since 1997 to apply the analysis. The total number of age data reached 4726 individuals by 2015 (Table 3). Table 4 shows frequency of reliability of age estimation by fork length class, seventy otoliths out of 4726 individuals (0.36%) were not able to be estimated its ages (readability is 0). No otolith was assigned to readability 5 (no doubt). These age data have been submitted to CCSBT from 2005.

Statistical values of 4709 individuals that analyzed are shown for age estimated by 5 cm fork length class (Table 4) and fork length by age estimated (Table 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.

Linf = 181.6 cm, K = 0.166, t0 = -1.609 (year)

References

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

Itoh, T., Tsuda, Y., Inoue, Y. and Semba, Y. (2017) Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2016. CCSBT- ESC/1708/19.

Tsuda, Y., and Itoh, T. (2017) Report of the piston-line trolling monitoring survey for the age-1 southern bluefin tuna recruitment index in 2016/2017. CCSBT-ESC/1708/22.

Table 1 Number of otoliths, by year caught and CCSBT area, which were analyzed and submitted its data to CCSBT in 2017. The otolith samples had been analyzed in 2016 were taken from the fish which had been caught in 2015.

	Year
Area	2015
4	32
5	1
8	41
9	123
Total	197

Table 2 Number of otoliths which were analyzed and submitted its data to CCSBT in 2017 by year caught and at fork length class.

	Year
Size	2015
90-99cm	9
100-109cm	7
110-119cm	5
120-129cm	24
130-139cm	27
140-149cm	44
150-159cm	59
160-169cm	16
170-179cm	6
180-190cm	0
Total	197

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	Area5	Area7	Area8	Area9	Other	Total
1997	14	10				32			56
1998			25			203	20	1	249
1999	1		73		144	332	36		586
2000		13	24		37	94	110		278
2001	13				70	56	206		345
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			17	84		108
2007		1				194	104		299
2008			5		33	106	93		237
2009			7			141	77		225
2010		5	12			57		6	80
2011		10	5	18		26	39	3	101
2012			2		5	46	55		108
2014		2	1		222	37	97		359
2015			32	1		41	123		197
Total	64	73	347	19	636	1664	1913	10	4726

Table 4 Statistical value 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	median	min	max	SD
30-	2			2				2	0.0	0	0	0	0.00
35-	0												
40-	0												
45-	6				6			6	1.0	1	1	1	0.00
50-	42			12	30			42	1.1	1	1	2	0.30
55-	28	1		13	14			27	1.3	1	1	2	0.45
60-	2			2				2	2.0	2	2	2	0.00
65-	0												
70-	1			1				1	2.0	2	2	2	
75-	1			1				1	2.0	2	2	2	
80-	8			8				8	2.8	3	2	4	0.71
85-	69		1	53	15			69	2.7	3	2	6	0.74
90-	98		4	71	23			98	2.8	3	2	5	0.77
95-	110			73	37			110	3.6	4	2	11	1.12
100-	170	1	3	116	47	3		169	3.8	4	1	7	0.93
105-	223		7	144	68	4		223	4.2	4	2	7	0.97
110-	180		1	120	58	1		180	4.7	5	2	9	1.09
115-	213		10	129	73	1		213	5.2	5	2	11	1.16
120-	212		6	134	71	1		212	5.5	5	3	12	1.31
125-	198		4	120	68	6		198	6.1	6	4	10	1.25
130-	213		4	130	75	4		213	6.4	6	4	11	1.16
135-	226		6	137	80	3		226	7.1	7	4	13	1.51
140-	277	1	5	167	96	8		276	7.8	8	4	13	1.49
145-	336	1	8	207	114	6		335	8.6	9	4	19	1.77
150-	442	3	18	277	139	5		439	9.5	9	5	17	1.95
155-	382		11	246	113	12		382	10.2	10	6	19	2.00
160-	373	3	15	229	120	6		370	11.5	11	6	24	2.66
165-	277	2	18	170	81	6		275	13.0	12	4	31	3.62
170-	285	4	30	158	87	6		281	15.5	15	6	29	3.90
175-	160	1	20	86	53			159	17.0	16	7	36	5.22
180-	107		15	58	33	1		107	19.2	19	9	32	4.63
185-	46		7	29	10			46	19.6	19	8	35	6.09
190-	20		6	10	4			20					
195-	11		1	5	5			11	24.0	23	11	33	6.18
200-	5		1	3	1			5	25.0	27	20	28	3.39
205-	3			2	1			3	26.7	28	24	28	2.31
Total	4726	17	201	2913	1522	73		4709					

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	32.5	32.5	32	33	0.71
1	65	53.8	53.0	48	103	6.66
2	110	88.2	90.0	51	118	13.64
3	277	100.5	101.0	80	124	9.05
4	372	109.3	108.0	84	165	10.98
5	457	118.6	118.0	92	154	10.87
6	422	128.4	128.0	88	171	12.60
7	450	138.9	139.0	103	176	11.81
8	432	146.0	146.0	116	185	10.57
9	430	151.9	152.0	112	185	9.02
10	341	155.4	155.0	121	182	9.18
11	265	158.4	159.0	96	195	9.49
12	226	161.0	161.0	124	188	9.14
13	150	164.9	165.0	138	188	8.65
14	129	166.4	167.0	146	187	8.36
15	105	169.4	170.0	149	187	7.95
16	109	171.7	172.0	148	190	7.93
17	60	171.5	172.0	152	184	6.63
18	61	175.2	175.0	163	195	8.22
19	53	174.4	175.0	145	191	8.35
20	30	176.4	175.0	164	201	7.22
21	38	179.4	179.5	167	196	7.26
22	22	179.9	178.5	170	195	7.70
23	21	179.4	175.0	168	200	10.56
24	18	180.7	180.0	162	207	9.36
25	7	179.9	184.0	167	191	9.15
26	15	178.3	178.0	165	197	7.43
27	9	184.8	181.0	174	203	10.58
28	10	187.7	184.0	172	205	12.72
29	5	183.2	184.0	172	195	9.73
30	5	184.0	182.0	178	196	6.96
31	3	178.3	185.0	165	185	11.55
32	2	187.5	187.5	184	191	4.95
33	1	197.0	197.0	197	197	
34	1	186.0	186.0	186	186	
35	3	185.0	188.0	176	191	7.94
36	1	177.0	177.0	177	177	
37						
38						
39						
40						
41						
42						
43						
44						
45	1	191.0	191.0	191	191	

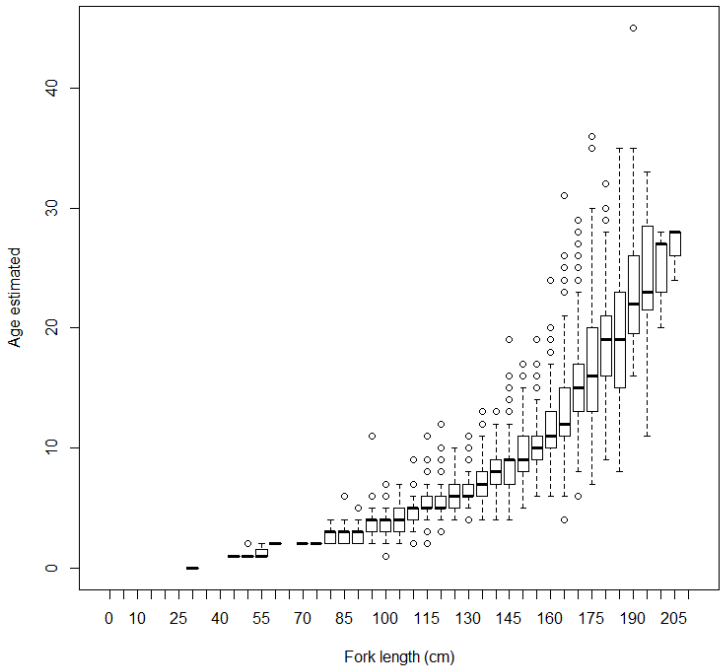

Fig. 1 Boxplot of age estimated at fork length in 5 cm class in Japanese age estimated data.

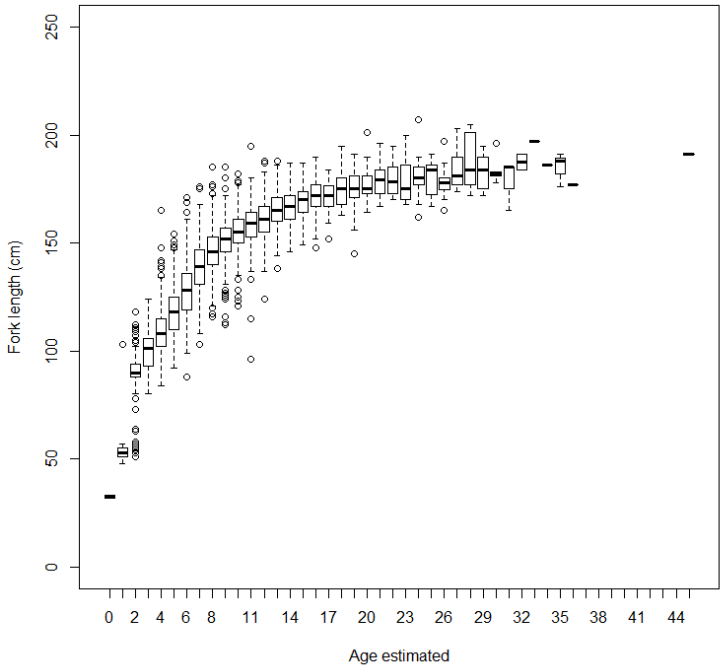

Fig. 2 Boxplot of fork length at age estimated in Japanese age estimated data.

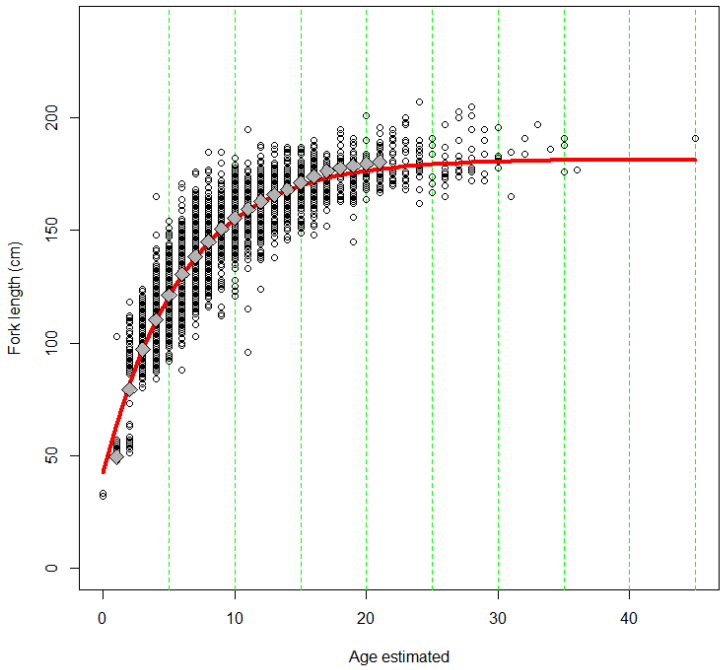

Fig. 3 von Bertalanffy curve and length plots for Japanese age estimated data. Diamonds are length-at age used in CCSBT.