# Suggestion of alternative estimation of albacore catch by Japanese coastal longline fishery to apply to stock synthesis model<sup>1</sup>

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<sup>&</sup>lt;sup>1</sup>This working paper was submitted to the ISC Albacore Working Group Intercessional Workshop, 19-26 March 2013, held at the College of Marine Sciences, Shanghai Ocean University, Shanghai, China. Document not to be cited without author's permission.

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by

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#### Summary

This paper summarizes the processes of creating catch data for Japanese coastal longline fishery based on alternative method for applying SS3 analyses as well as estimated catch and brief review of the fishery. There are three categories in Japanese coastal longline fishery, for which operation area and availability of logbook data differ. The vessels which don't submit logbooks are regarded as operating in Japan EEZ area, and seasonal proportion of the catch was regarded as the same as that of nominal quarterly CPUE for the vessels which submit logbooks. Catch before 1994, in which logbooks are not available, was estimated based on landing statistics and seasonal and spatial proportion of the catch for 1994-1997. Slight difference was observed between catch data used for the last assessment and that estimated by the method in the present study.

#### 1. Introduction

Japanese coastal (small) longliners are defined as longline fishery operated by small (0-20 GRT) vessels, and are operating mainly in the nearshore area of Japan (**Fig. 1**). Main component of the catch is albacore, which is mainly caught between late autumn and early spring (**Fig. 2**). Annual albacore catch in recent years is between 13,000 and 18,000 mt, which accounts for about 30% of total albacore catch by Japanese fisheries (Satoh et al., 2012). Fishing effort of coastal longline shows increasing trend and at least in recent years exceeds that for offshore or distant water longline (**Fig. 3**).

Last stock assessment of north Pacific albacore was conducted at ISC albacore working group (ALBWG) meeting in June 2011 using SS3 (Stock Synthesis 3) (ISC, 2011). Japanese longline fishery in the SS3 model was divided into two: one is offshore and distant water longline, and the other is coastal longline. Each fishery was further divided into two based on fish size caught (Table 1, **Fig. 4**). Offshore longliners are 20-120 GRT and the area of operation in the north Pacific is limited to the waters west of 150°W. Distant water longliners are over 120 GRT and basically can fish at all oceans. At that assessment, the catch for coastal longliners was estimated based on logbook data and raising factor obtained from landing statistics assuming that raising factor is constant for each area and season. In this paper, alternative estimation of the catch by coastal longliners is suggested based on actual situation of the operations.

#### 2. Overview of Japanese coastal longline and its logbooks

There are several categories of coastal longliners based on permission. Table 2 shows summary of each category of Japanese coastal longline vessels. There are three categories, that is, "permitted A", "permitted B" and "free operating" vessels. "Permitted A" and "permitted B" are operated by the vessels of 10-19 GRT. "Free operating" are operated by the vessels smaller than 10 GRT. "Permitted A" vessels are allowed to operate west of 170°E (north of 20°N) and west of 150°W (between 0° and 20°N) in the north Pacific, although they were allowed to operate only in the north of 2°N and west of 180° before April 2005. On the other hand, "permitted B" and "free operating" vessels are allowed to operate only within Japanese EEZ area. Logbook coverage by "permitted A" vessels is high, but that for "permitted B" vessels is low and free operating vessels don't submit logbooks.

#### 3. Process of creating catch data for SS3 in the last stock assessment

Two kinds of data were mainly used. One is the Annual Report of Catch Statistic on Fishery and Aquaculture published by the Statistics and Information Department, Ministry of Agriculture, Forestry and Fisheries (SID report). This report provides comprehensive statistics for Japanese fisheries including catch and number of vessels by species and/or kind of fishery, although information on season and area is not available. SID reports for up to 2008 were used when SS3 data for last assessment were created. The other is logbook database which has been compiled at National Research Institute of Far Seas Fisheries (NRIFSF) based on the logbook mandatory submitted by fishermen.

Logbook databases for coastal longliners are available from 1994 onward. Non-raised logbook database both in weight and number, which was aggregated by month and 5X5° block, was used for coastal longline vessels. Logbook coverage of coastal longline in terms of albacore catch was about 60-80% (Table 3).

Based on decision at ISC ALBWG meeting in October 2010, catch of Japanese coastal longline fisheries in weight (mt) was calculated based on each SS3 fishery definition.

Raising factor calculated by (landed catch based on SID and logbook) / (reported catch based on logbook) was used to estimate entire catch assuming that reporting rate of logbook does not differ depending on area and season. As for coastal longline fishery operated by vessels smaller than 10GRT, which do not have logbook data, proportion of catch by area and quarter was assumed to be the same as that for the vessels of 10-19 GRT.

As for the catch during 1966-1997, the proportion of catch by area and quarter over year  $(R_{q,a})$  is initially calculated from the logbook data for the coastal longline during 1998-2001.

$$R_{q,a} = \frac{\sum_{y=1998}^{2001} CW_{y,q,a}}{\sum_{y=1998}^{2001} \sum_{q} \sum_{a} CW_{y,q,a}} \qquad \left(\sum_{q} \sum_{a} R_{q,a} = 1.0\right)$$

where  $CW_{y,q,a}$  is catch in weight in y year, quarter q and area a. Then, quarterly catch by area is calculated by

$$CW'_{y,q,a} = R_{q,a}\alpha_y$$

where  $a_y$  is annual catch in weight in y year based on SID report and logbook.

There are three problems in this estimation. First, the proportion of catch by area and quarter for the vessels which did not submit logbooks was assumed to be the same as that for the vessels which submitted logbooks. However, logbook coverage differs depending on category of vessels, and the area of operation also differs depending on vessel categories, and so season and area of operation can't be regarded as same. Second, temporal and spatial proportion of catch for 1994-1997, in which logbook data are available, was estimated based on total catch in that period and proportion of catch for 1998-2001 average. Third, temporal and spatial proportion of catch before 1994 was based on that for 1998-2001 average, which is not closest period.

## 4. Catch estimated by alternative scenario

**Fig. 5** shows the procedure for estimating the catch. Based on the problems mentioned above, alternative catch data for coastal longline was created using another scenario. Most of the vessels which do not submit logbooks, including the vessels smaller than 10 GRT, are operating only within Japanese EEZ area. Therefore, area of operation of these vessels was regarded as north of 25°N (F7 in the 1st and 2nd quarter, and F9 in the 3rd and 4th quarter, **Fig. 4**) only. It was assumed that the amount of effort of these vessels does not differ depending on season, and quarterly proportion of catch was assumed to be the same as that of nominal CPUE in the Japanese EEZ area (25-45°N, 120-145°E) by coastal longline vessels which submitted logbooks.

Temporal and spatial proportion of catch before 1994 was assumed to be the same as that of 1994-1997 average of the catch estimated by the method mentioned here (**Fig. 6**). Table 4 and **Fig. 7** shows comparison of catch between the data for the last stock assessment and the one estimated based on the scenario mentioned here. There are slight differences between them especially in the catch of F9 between 1994 and 1997.

Catch data estimated in this way seem to be more realistic because estimation of temporal and spatial proportion of catch by the vessels which don't submit logbooks is based on the actual situation and proportion of catch before 1994 was estimated based on logbook data of the closest period. Therefore, we suggest using catch data of coastal longline estimated based on the method mentioned in this paper.

#### 5. Reference

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- Satoh, K., Uosaki, K., Matsumoto, T. and Okamoto, H. 2012. A review of Japanese albacore fisheries in the North Pacific as of June 2012. ISC/12/ALBWG-3/02. 15pp. ISC/10/ALBWG-3/04. 21pp.

		5	Fishery boundaries and			
Fleet	Fisherv	Fishery boundaries and	temporal coverage for	Catch		CPUE data
No.	descriptions*	temporal coverage	CPUE standardization	unit	Size data	(survey No.)
F6	Offshore-LL	25-40°N latitude by	25-40°N latitude by	1.000	$\sqrt{(C@S)}$	$\sqrt{1966-(86)}$
		120°E-180° longitude	120°E-180° longitude	fish	1966-	
		in Q1 and Q2	in Q1 and Q2			
	(Fishery I -	25-40°N latitude by	(Catch and effort data			
	smaller	120°W-180° longitude	for F6 and F7 were			
	average-size fish)	in Q1	combined)			
F7	Coastal-LL	25-40°N latitude by	,	mt		
		120°E-180° longitude				
		in Q1 and Q2				
	(Fishery I -					
	smaller					
	average-size fish)					
F8	Offshore -LL	25-40°N latitude by	25-40°N latitude by	1,000	$\sqrt{(C@S)}$	√1966- (S7)
		120°E-180° longitude	120°E-180° longitude	fish	1966-	
		in Q3 and Q4	in Q1 and Q2			
	(Fishery II - larger	25-40°N latitude by	10-25°N latitude by			
	average-size fish)	120°W-180° longitude	120°E-120°W			
		in Q2-Q4	longitude all year round			
		10-25°N latitude by	(Catch and effort data			
		120°E-120°W	for F8 and F9 were			
		longitude all year round	combined)			
F9	Coastal -LL	25-40°N latitude by		mt		
		120°E-180° longitude				
		in Q3 and Q4				
	(Fishery II - larger	10-25°N latitude by				
	average fish)	120°E-120°W				
		longitude all year round				

**Table 1.** Summary of Japanese longline fisheries for SS3 analyses used for 2011 assessment.

 Table 2. Summary of categorization of Japanese coastal longline vessels.

Category Size of vessels		Area of operation	Logbook coverage		
Permitted A	10-19 GRT	Mainly northwest Pacific	High		
Permitted B	10-19 GRT	Japan EEZ area	Low		
Free operating	<10 GRT	Japan EEZ area	None		

	Catal ha	- 1 1 1				
Catch by logbooks				Total	Raising	Coverage rate of
Year	F7	F9	Total (a)	catch (b)	factor (b/a)	logbooks (a/b)
1994	5790	5837	11627	16366	1.408	71.0%
1995	5389	7438	12827	17497	1.364	73.3%
1996	6550	7400	13950	18627	1.335	74.9%
1997	8763	7224	15987	24926	1.559	64.1%
1998	8178	7972	16150	23403	1.449	69.0%
1999	6367	8636	15003	21219	1.414	70.7%
2000	7005	7949	14954	19228	1.286	77.8%
2001	5427	6921	12348	17539	1.420	70.4%
2002	6327	4408	10735	16918	1.576	63.5%
2003	6506	5456	11962	16309	1.363	73.3%
2004	4527	4337	8864	12960	1.462	68.4%
2005	6221	4778	10999	15208	1.383	72.3%
2006	7224	5592	12816	16452	1.284	77.9%
2007	8421	5793	14214	18319	1.289	77.6%
2008	6083	3971	10054	13680	1.361	73.5%
2009	6493	7030	13523	13680*	1.012	98.9%

 Table 3. Albacore catch by Japanese coastal longline vessels in the north Pacific used for SS3 for last stock assessment.

\*Provisional figure as of last assessment

	Catch by alternative estimation						Data	for last	assessm	nent	<u>.                                    </u>				
	F7	Cuton	F9		nution		F7	Dutu	F9	<u>ussessii</u>					
	QT1	QT2	QT1	QT2	QT3	QT4	QT1	QT2	QT1	QT2	QT3	QT4			
1966	127	35	25	6	18	95	109	33	42	18	21	84			
1967	157	43	31	7	23	117	134	40	51	23	26	104			
1968	345	96	69	15	50	258	296	88	113	50	57	229			
1969	386	107	77	17	56	288	331	99	126	56	63	256			
1970	701	194	140	31	102	523	601	179	229	102	115	464			
1971	701	194	140	31	102	523	601	179	229	102	115	464			
1972	1147	317	230	50	167	857	984	294	375	167	188	760			
1973	1872	518	375	82	272	1398	1605	479	612	272	307	1241			
1974	1291	357	259	56	188	964	1107	330	422	188	212	855			
1975	1285	356	257	56	187	960	1102	329	420	187	211	851			
1976	1567	434	314	68	228	1170	1344	401	513	228	257	1038			
1977	1729	479	346	76	251	1292	1483	443	566	251	284	1146			
1978	1161	321	232	51	169	867	995	297	380	169	191	769			
1979	1084	300	217	47	158	810	929	277	355	158	178	718			
1980	1233	341	247	54	179	921	1057	316	403	179	202	817			
1981	1205	334	241	53	175	900	1034	309	394	175	198	1000			
1982	1523	421	305	66	221	1137	1306	390	498	221	250	1009			
1983	1578	437	316	69	229	1179	1353	404	516	229	259	1046			
1984	1389	384	278	61	202	1037	1191	356	454	202	228	920			
1985	16/6	464	336	/3	244	1252	1438	429	548	244	275	1111			
1980	1953	540	391	85	284	1459	10/5	500	639 746	284	321	1294			
198/	2280	631	457	100	332 227	1704	1950	502	/40	226	3/4	1511			
1988	2514	041 540	404	101	201	1/29	1985	595	(2)	220 284	201	1554			
1989	1952 2600	540 747	541	80 110	284	1458	10/4	500	039	284	521 442	1294			
1990	2099	747 764	552	110	392 402	2010	2313	707	004	592 401	445	1/89			
1991	2702	04	555 667	145	402	2005	2308	707 853	904 1000	401	433 547	2207			
1992	6875	1003	1377	300	1000	2400 5136	2830 5896	1760	2250	404	1120	4557			
1995	6489	2091	1082	136	1121	5447	5817	1736	2230	986	1129	4337			
1995	6688	1476	2152	295	1104	5782	6218	1856	221)	1054	1190	4805			
1996	6872	2309	1233	431	968	6814	6620	1976	2572	1122	1267	5116			
1997	12032	3003	1958	539	1471	5923	8859	2645	3380	1501	1696	6846			
1998	10393	2584	2168	534	1353	6372	9374	2477	3142	774	1193	6444			
1999	7554	2179	1271	397	2069	7750	6876	2129	1798	561	2075	7780			
2000	7516	2247	2305	1310	1600	4250	6954	2053	2964	1684	1287	4286			
2001	6650	2305	2182	1280	982	4141	5733	1976	3099	1818	974	3939			
2002	8381	2287	1668	633	910	3039	7836	2135	2629	998	555	2766			
2003	7338	2418	2142	587	709	3115	6577	2293	2920	800	856	2862			
2004	5609	1272	780	422	657	4220	5493	1126	1140	617	735	3848			
2005	6047	2755	1017	497	991	3901	5846	2756	1406	687	961	3552			
2006	6212	3262	978	629	446	4926	6127	3146	1255	807	461	4655			
2007	8018	3009	996	537	563	5196	7984	2869	1284	692	601	4890			
2008	6224	2375	780	451	755	3095	6080	2186	1064	615	776	2960			
2009	4532	2053	1175	700	793	4426	4544	2055	1194	711	793	4383			

**Table 4.** Comparison of catch (in MT) of albacore by Japanese coastal longline fishery between the data used for the last assessment and the data created based on alternative scenario in the present study.



Fig. 1. Distribution of effort for Japanese coastal longline fishery in 2010 and 2011.



Fig. 2. Distribution of catch for Japanese coastal longline fishery in 2010 and 2011.



Fig. 3. Annual amount of fishing effort employed (unit: 1000 hooks) by size of vessel for the Japanese longline fishery in the North Pacific (north of 10°N). Values for 20-199 and over 200 GRT are raised (Satoh et al., 2012).



**Fig. 4.** Area definition of Japanese longline fishery for SS3. F1 and F2 correspond to F6+F7 and F8+F9, respectively, in Fig. 6 and Fig. 7.



Procedure for creating catch data of Japanese coastal longline for SS3 (1994-)

Procedure for creating catch data of Japanese coastal longline for SS3 (-1993)



Fig. 5. Procedure for alternative methods for estimating catch of Japanese coastal longline fishery for SS3.



Fig. 6. Proportion of catch of albacore in weight by Japanese coastal longline vessels estimated by alternative scenario.



**Fig. 7.** Comparison of catch of albacore by Japanese coastal longline vessels between the data for the last stock assessment and data based on alternative scenario. Left: quarterly, right: annual.