# Update of input information of the North Pacific striped marlin caught by Japanese fisheries to stock assessment

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## Summary

Size and catch information in the period between 2009 and 2013/2014 of striped marlin caught by Japanese fisheries in the northwest and central Pacific, which was updated one form last stock assessment, was reviewed. As in the previous assessment, almost size data collected by longline and coastal drift net, data widely covered the operational area of these fisheries except for southern and southeastern areas of longline. In the latitudinal band of 10N - 30N in the northcentral Pacific, mode of smaller sized fish observed which supposed to indicate entries of some higher level of recruitments in recent years. Japanese total catch of striped marlin showed continuous decreasing trend since last stock assessment primarily due to the decrease of offshore and distant-water longline and coastal drift net fisheries. The catch of coastal drift net fishery largely dropped in 2011 due to the Great Eastern Earthquake.

## Introduction

In this document, the update information of catch and size data of striped marlin caught by Japanese fisheries in the western and central north Pacific. In 2011, the Great Eastern Earthquake and Tsunami caused by this earthquake attacked Pacific side of Japan, and gave serious damages on fisheries by damaging fishing boats, landing facilities as well as fish processing facilities. In consequence of this, catch of striped marlin in 2011 dropped largely and one in 2012 also affected.

### Materials and Methods

Catches of pelagic longline fisheries, except for small artisanal types of one which classified as "other longline", was obtained by log-book. Other fisheries than pelagic longline obtained by Japanese year book. The estimations of quarterly catches of fisheries was conducted by assuming the quarterly catch pattern of these fisheries being same as those having log-book system. Though the coastal drift net fishery have log-book system, the annual catch was obtained from year book as the submission ratio of lob-book is lower than 100 %. The quarterly catch of the coastal drift net fishery was estimate by assuming the drift net boats without log-book had same seasonal catch pattern of those with log-book.

There are two main sources of information of size data, one is on-board sampling and other is port sampling. On-board sampling was conducted by fishers as volunteer bases and it has fine resolution of one day, 1 x 1 degree of latitude and longitude. The port sampling was conducted by port samplers and size data obtained by port sampling aggregated by cruise and compared with log-book information of corresponding vessels to determine the resolution of data. Several level of resolution was sets like 5x5xmonth, 5x10xmonth, as well as 10x20xmonth/quarter. In the present study, port sampling data of higher resolution (5x5xmonth and 5x10xmonth) was used in the analysis. In the analysis of size data, one obtained by on-board sampling and port sampling were combined and analyzed together. In the present study, size data collected since 2009 was analyzed. Area stratification used in this study is the same one as in the last stock assessment conducted in 2009, e.g., area 1; south of 10N, area 2; north of 10N and west of 165E, area 3; north of 10N and east of 165E.

#### **Results and Discussions**

The most of size data of striped marlin obtained by longline and coastal drift net fisheries (Table 1), and mainly obtained from subtropical area (north of 20N or 30N)(Fig. 1). The number of size data of the coastal drift net dropped in 2011 due to the influence of the Great East Japan Earthquake. In this year, catch by this fishery largely decreased from 913 tons in 2010 to 347 tons in 2011 (Fig. 6). The almost size data of area 1 and southern and eastern part of area 3 obtained by training and research vessels whose size data have high resolution (1x1xday) (Fig. 1). The number of size data in area 1 is rather limited. Almost sexed size data collected by training and research longline boats and availability is limited to their operational area (Fig. 4).

The size composition of longline fishery in recent years (2009 - 2014) is apparently different by area (Fig. 2), and largest mode observed in area 1 and smallest model in area 3. The position of the peak of the single mode of the catch by the coastal drift net fishery is slightly larger than that by longline in area 2. Fine scale analysis of size data revealed largest mode obtained in area 1 is in the outside of stock area of the northwest and central Pacific but in the area of the northeastern stock (Fig. 4), and actual fishes in area 1 is almost occupied by ones smaller than 170 cm. Small striped marlin caught in the southern part of areas 2 and 3 (10N - 30N, 140E - 140W), and in the northern parts of areas 2 and 3 occupied by larger sized fish. Fine scale analysis of annual size data revealed that the magnitude of modes of fishes smaller than 130 cm, which observed southern parts if areas 2 and 3, changed by year (Fig. 5). In 2009, 2011, 2011, 2012, and 2014, the clear mode of smaller sized fish can be observed and the magnitude of these modes were larger than those in other years. This would suggest higher recruitment level of these years than others.

The catch of striped marlin in the northwest and central Pacific peaked in the 1960s at around 16,000 tons (Fig. 6) when it started general decreasing trend with some fluctuations. Up to the end of the 1990s, offshore and distant-water longliners occupied largest part of the catch, and high seas drift net fishery contributed  $2^{nd}$  largest part in the period between 1973 and 1993. In the 2000s, the coastal drift net fishery and the coastal longline fishery occupied relatively larger part of the catch due to the decrease of catch by offshore and distant-water longline, and these three fisheries obtained more than 90 % of total catch. In the period between 2004 and 2010, largest catch obtained by the coastal drift net. In the most recent years (2011 – 2013), the catch of offshore and distant-water longline increased and one of coastal longline stayed in lower level, and thus, the total catch stayed in the historical low level.

	2009	2010	2011	2012	2013	2014	Total
Longline	1860	2589	2864	3332	2922	2094	15661
Coastal drift net	2602	5394	656	5917	1151	655	16375
Harpoon			7				7
Total	4462	7983	3527	9249	4073	2749	32043

Table 1. Number of size data by fishery collected in 2009 - 2014. Value in 2014 is not containing data collected later part of the year.



Fig. 1. Distribution of size data obtained in the period between 2009 and 2013. Data of different resolution overlapped.



Fig. 2. Accumulated size composition of striped marlin by area caught by Japanese pelagic longline fisheries in the period of 2009 - 2014. Some of data in the northeastern area included.



Fig. 3. Accumulated size composition of striped marlin caught by Japanese coastal drift net fisheries in the period of 2009 - 2014. All size data collected in area 2.



Fig. 4. Aggregated size composition of striped marlin by10x20 degree blocks in the period of 2009 - 2014. Green is unsexed, blue is male and red is female.



Fig. 5. Annual size composition of striped marlin by10x20 degree blocks in the period of 2009 - 2014. Green is unsexed, blue is male and red is female.



Fig. 6. Historical catch (ton) of striped marlin in the period of 1951 - 2013 in the northwest and central Pacific. Catches in 2012 and 2013 are preliminary.

	Offshore &	Coastal	Other	Squid	Drift	Bait	Net	Trap	Others <sup>1)</sup>	Total
	distant-water	longline	longline	drift	net	fishing	fishing	net		
	lognline			net						
1951	2494	-	673	-	0	39	0	92	1149	4447
1952	2901	-	722	-	0	39	1	203	1321	5187
1953	2138	-	47	-	0	26	10	126	793	3139
1954	3068	-	52	-	0	67	0	82	938	4208
1955	3082	-	28	-	0	46	36	106	850	4149
1956	3729	-	59	-	0	40	1	133	1822	5785
1957	3189	-	119	-	0	48	28	71	2312	5766
1958	4106	-	277	-	3	69	58	82	2704	7301
1959	4152	-	156	-	2	153	47	87	2905	7501
1960	3862	-	101	-	4	74	13	161	1689	5905
1961	4420	-	169	-	2	58	40	161	1538	6388
1962	5739	-	110	-	8	36	72	197	1607	7770
1963	6135	-	62	-	17	243	49	92	1527	8124
1964	14304	-	42	-	2	24	17	81	2223	16691
1965	11602	-	19	0	1	46	27	81	2640	14416
1966	8419	-	112	0	2	25	6	226	1313	10103
1967	11698	-	127	0	3	38	37	82	1394	13379
1968	15913	-	230	0	0	39	19	71	914	17186
1969	8544	600	3	0	3	40	41	71	2516	11818
1970	12996	690	181	0	3	149	4	55	824	14902
1971	10965	667	259	0	10	280	27	61	1674	13943
1972	7006	837	145	0	243	90	4	72	827	9224
1973	6357	632	118	0	3265	74	72	80	476	11074
1974	6700	327	49	0	3112	104	0	90	581	10963
1975	5281	286	38	0	6534	88	1	105	492	12825
1976	5136	244	34	0	3561	93	14	37	441	9560
1977	3019	256	15	0	4424	106	1	103	337	8261
1978	3957	243	27	0	5593	114	129	93	210	10366
1979	5561	366	21	0	2532	132	1	66	327	9006
1980	6378	607	5	0	3467	59	0	80	397	10993
1981	4106	259	12	0	3866	64	5	88	385	8785
1982	5383	270	13	0	2351	116	12	52	476	8673
1983	3722	320	10	22	1845	121	35	124	547	6746
1984	3506	386	9	76	2257	177	0	144	398	<u>69</u> 52
1985	3897	711	24	40	2323	151	2	81	499	7728
1986	6402	901	33	48	3536	97	6	131	343	$11\overline{497}$

1987	7538	1187	6	32	1856	167	0	102	244	11132
1988	6271	752	7	54	2157	205	0	63	400	9909
1989	4740	1081	13	102	1562	145	0	47	345	8035
1990	2368	1125	3	19	1926	192	1	65	287	5986
1991	2845	1197	3	27	1302	130	1	56	320	5881
1992	2955	1247	10	35	1169	94	1	71	137	5719
1993	3476	1723	1	-	828	371	2	27	308	6736
1994	2911	1284	1	-	1443	90	2	73	218	6022
1995	3494	1840	3	-	970	78	8	58	139	6590
1996	1951	1836	4	-	703	87	1	39	25	4646
1997	2120	1400	3	-	813	68	0	34	61	4499
1998	1784	1975	2	-	1092	146	1	34	123	5157
1999	1608	1551	4	-	1126	90	0	28	66	4473
2000	1152	1109	8	-	1062	91	0	41	165	3628
2001	985	1326	11	-	1077	36	0	51	150	3636
2002	764	796	5	-	1264	28	0	80	182	3119
2003	1013	842	3	-	1064	26	1	41	135	3124
2004	699	1000	2	-	1339	33	1	23	33	3130
2005	562	668	1	-	1214	35	0	28	35	2543
2006	623	538	1	-	1190	31	1	30	33	2447
2007	306	860	5	-	970	38	-	21	20	2220
2008	390	609	10	-	1302	28	-	26	43	2408
2009	166	622	21	-	821	39	-	17	34	1721
2010	187	832	42	-	913	36	-	20	26	2056
$2011^{2)}$	319	922	55	-	347	26	-	30	32	1731
$2012^{3)}$	326	966	29	-	597	34	-	52	33	2037
20133)	380	1019	29	-	300	34	-	52	33	1846

1); It contains trolling and harpoon but majority of catch obtained by harpoon.

2); Some data in Tohoku area were not available due to the earthquake in 2011.

3); Catch between 2012 and 2013 are preliminary, and some of values carried over from 2012