

Japanese catch statistics of the Pacific Blue Marlin (*Makaira nigricans*): Update for a stock assessment

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Abstract

Japanese catch statistics of the Pacific blue marlin, i.e. catch amount and size composition data was one of the important source of inputs to the stock analysis using stock synthesis conducted by Using the ISC Billfish Working Group in 2011. This document updated them to prepare the next assessment of this stock. The catch amount data was provided Japanese year book and logbook data between 1971 and 2014. (These statistics defined ten types fisheries.) The reported total catch amount of the Pacific blue marlin by Japanese fisheries was 2,524.33 metric tons, and mainly caught by longline fisheries. The shape of the mode of size composition data, mostly obtained by offshore and distant water longline fisheries, in updated years were more or less the same as previous years.

Introduction

The ISC Billfish Working Group (BILLWG) conducted a stock assessment of the Pacific blue marlin using stock synthesis 3 (SS3) (ISC 2013) throughout the Pacific Ocean with the cooperation with IATTC and WCPFC.

SS3 is an integrated stock assessment model that needs several type of data sets (e.g. biological parameter and catch statistics). In terms of Japanese blue marlin catch statistics, catch amount and catch length and weight frequency data sets were submitted (Kimoto and Yokawa, 2013). Japanese blue marlin fisheries could be defined eight types; distant-water and offshore longline, coastal longline, other longline, squid drift net, drift net, bait fishing, trap net, and others (primarily harpoon and trolling). To compile the catch amount of blue marlin, Japanese logbooks and year books (1971-2011) were used in previous stock assessment, because several problems were indicated for the log book and the year books in early period (Kimoto and Yokawa, 2012). BILLWG is planning a simple update for next stock assessment. Thus, following previous method, this document provided updated Japanese historical catch amount of blue marlin compiled by eight fisheries between 1971 and 2014. This document also provided the updated length and weight frequency data between 1971 and 2014. Submitted length and weight frequency data sets were distant-water and offshore long line fishery and drift net fishery.

Distant-water and offshore long line fishery was measured length data. Drift net fishery was measured body weight data.

Material and Method

Data source and fishery definition

Japanese catch amount of blue marlin was compiled by three type of data source as: logbook data (1971-2014), year book data (1971-2014) and training vessels data (1973-1993). Logbook data was aggregated by year month, and 5x5 degree grids and was compiled by National Research Institute of Far Seas Fisheries (NRIFS). Year book was aggregated by year. In these data sets, fisheries of blue marlin were defined distant-water and offshore longline, coastal longline, other longline, squid drift net, drift net, bait fishing, trap net, and others (primarily harpoon and trolling).

NRIFS compiled the length and weight frequency data that were given by eye fork length (EFL, cm) or processed weight (kg). These data set has been logged various Japanese fisheries since 1970s and were measured on training vessel, or at fishing ports in Katsuura, Kesenuma, Yaizu, Tokyo, Shimizu and Kagoshima.

Catch amount data

1) Distant-water and offshore longline

Catch amount of Japanese distant-water and offshore longline fishery was calculated by logbook (1971-2014) and training vessels data (1973-1993). During 1973-1993 period, training vessels data were separated logbook reporting system of commercial vessel. Catch amount was made by four steps. Firstly, logbook data was aggregated by year, quarter, 4 area definition (Fig.1). Secondly, mean catch weight was calculated by aggregated logbook data. There are no catch weight data of training vessels between 1973 to 1993. Hence, thirdly, catch amount of training vessels (1973-1993) were given by multiplying the catch number by the logbook average weight. Finally, summed up aggregated logbook data and catch amount of training vessels by year, quarter.

2) Coastal longline

Catch amount of Japanese coastal longline fishery was calculated by logbook data (1994-2014) and year book data (1971-1993). Catch amount before 1993, there is no logbook data. Then, year book data was used for catch amount estimation. However, year book combined catch amount of blue and black marlins under the name of “Blue marlin”. To remove the catch amount of black marlin, blue marlin ratio that was calculated by logbook data between 1994 and 1998 period (Fig. 2), and blue marlin ratio was multiplied by year book data. After 1994, logbook data was aggregated by year for the catch amount of coastal longline catch.

3) Other fisheries

The other Japanese fisheries are other longline, squid drift net, drift net, bait fishing, net fishing, trap net, and others (primarily harpoon and trolling). Catch amount of these fisheries were estimated by year book and data sets of Research Project on Japanese bluefin tuna (RJB) since 2005. Year book of “blue marlin” catch include black marlin catch. To estimate the blue marlin catch using year book, average catch amount ratio of blue and black marlin between 2005 and 2010 from the RJB data was used (Fig. 2). This estimation method is same as previous stock assessment (Kimoto and Yokawa 2013).

Size and weight frequency data

A total number of 240,000 blue marlins were measured for size data or weight that caught mainly by commercial distant-water and off shore longline, training vessel and drift net fishery. Size data of Pacific blue marlin was observed eye fork length (EFL). SS3 used distant-water and offshore longline and drift net. Length frequency data was given by distant-water and offshore longline and training vessel. Weight frequency data was given by driftnet fishery.

Results and discussion

Catch amount data

The estimated total catch amount of Japanese distant water and offshore longline between 1970 and 1990 was over 6,000 metric tons (Table 1, Fig 2). After the late 1990s, the catch amount of these fishery was decreased significantly with the effort depletion of Japanese distant water longline (Table 1, Fig 32). Latest catch amount of Japanese distant water and offshore longline was 1716.71metric ton (Table 1, Fig 32). The percentage of quarterly catch amount has changed with approximately same ratio that was about 30, 30, 20, and 20 % for the 1st, the 2nd, the 3rd and the 4th quarter, respectively. After middle 1980s, the catch amount of Japanese coastal longline is the second largest in all fisheries (Fig. 32). The catch amount of bait fishing was about 200 metric ton in the recent years, which was the largest catch among the rest of the other fisheries (table 2).

Before 2009, the total catch amount used previous assessment was as same as updated total catch amount of Pacific blue marlin (Fig. 43). It was note that current catch data source of Japanese year book is very preliminary hence, drift net, trap net and other fisheries data was not available.

The year book data of 2014 is very preliminary because there is no data for some fishery. Hence Japanese catch data estimated by year book (table 2) were replaced for 2014 by using the 2013 catch data.

Size and weight frequency data

The annual EFL mode of the distant-water and offshore longline was between 156 and 175 cm (period between 1998 and 1999 is the largest) (Fig. [65](#)). There is a no difference between the EFL aggregated by quarterly (Fig. [76](#)). A female EFL is larger than male that difference is clear in training vessel data (Fig. [87](#)). A frequency of updated EFL data is approximately same as previous data that used stock assessment (Fig. [98](#)). Weight frequency given by drift net fishery is same as previous assessment which mode is about 110kg (Fig. [109](#)).

References

- ISC. 2013. Stock assessment of Blue marlin in the Pacific Ocean in 2013. ISC13 Plenary Report Annex 10.
- Kimoto, A. and Yokawa, K. 2012. Overview of the Japanese fisheries for blue marlin in the Pacific Ocean up to 2010. ISC/12/BILLWG/1/08.
- Kimoto, A. and Yokawa, K. 2013. Input Data of Blue Marlin Caught by Japanese Fisheries for the Stock Assessment in the Pacific Ocean. ISC/13/BILLWG/1/06.

Table 1. Japanese blue marlin quarterly catch (mt) by distant-water longline, 1971-2014. Catch amount of 2013 and 2014 are preliminary.

Year	Qt1	Qt2	Qt3	Qt4	Total
1971	1897.67	1667.37	1894.47	1404.09	6863.60
1972	2546.83	2241.32	2123.21	1581.47	8492.82
1973	2854.97	2606.59	1661.11	2001.90	9124.57
1974	2493.89	2081.18	1740.52	1757.23	8072.82
1975	1585.30	1269.16	1614.79	1187.95	5657.20
1976	1469.56	1817.87	2050.28	1807.69	7145.40
1977	2100.54	2033.47	1838.00	1877.47	7849.48
1978	2329.87	2629.79	2128.96	1705.27	8793.88
1979	2269.30	2761.66	2148.59	2184.34	9363.89
1980	3410.30	2755.63	2145.29	2075.43	10386.65
1981	2785.43	3085.01	2281.91	1951.21	10103.56
1982	3073.80	3152.07	2542.33	2049.47	10817.66
1983	2997.18	2753.73	1918.15	2116.48	9785.53
1984	3968.49	3271.98	2547.35	2465.36	12253.18
1985	3206.26	2718.28	1665.43	1761.95	9351.91
1986	3360.83	3616.61	2301.72	2075.93	11355.09
1987	2743.73	3506.59	3153.66	2296.02	11700.00
1988	3796.28	2883.85	1952.41	1475.81	10108.34
1989	2268.99	2446.85	2100.15	1931.51	8747.51
1990	2357.68	2171.76	1316.48	1867.96	7713.88
1991	2417.09	2675.61	1468.85	1774.14	8335.69
1992	2769.55	2748.52	1790.57	1598.98	8907.63
1993	2621.92	2704.83	2026.31	2111.89	9464.96
1994	3036.48	3004.13	2433.07	2660.12	11133.79
1995	2743.92	2659.89	2175.61	1737.23	9316.65
1996	1342.05	1308.94	1056.13	951.48	4658.60
1997	1207.89	1615.13	1679.47	1642.89	6145.38
1998	1609.17	1487.60	1257.28	1067.84	5421.88
1999	1167.38	989.24	997.04	934.58	4088.24
2000	1003.58	797.07	1198.45	1024.97	4024.06
2001	924.59	991.12	1091.73	1054.12	4061.56
2002	1098.63	1036.74	842.37	811.72	3789.45
2003	1235.84	947.81	712.44	811.81	3707.89
2004	1043.64	747.09	692.97	911.48	3395.18
2005	1111.69	697.26	639.65	437.66	2886.26
2006	589.68	719.05	600.25	597.12	2506.10
2007	786.95	537.45	452.37	388.43	2165.20
2008	510.53	525.50	429.61	377.34	1842.97
2009	550.08	396.81	398.20	581.96	1927.04
2010	704.65	658.31	452.95	420.66	2236.57
2011	584.12	564.48	444.30	370.18	1963.08
2012	445.59	458.41	462.08	471.53	1837.61
2013	541.74	532.28	427.35	287.84	1789.20
2014	453.25	494.21	409.61	359.64	1716.71

Table 2. Japanese blue marlin catch (mt) by fishery, 1971-2014; "--" indicates no effort or data not available, "0" indicates less than 1 metric ton, and catch of 2013 and 2014 are preliminary.

Year	Coastal longline	Other longline	Squid drift net	Drift net	Bait fishing	Net fishing	Trap net	Others
1971	112.93	-	-	-	5.90	-	0.98	48.21
1972	211.27	-	-	7.87	6.89	0.98	1.97	49.19
1973	211.27	-	-	263.67	22.63	45.26	1.97	86.58
1974	181.08	0.98	-	226.28	61.00	1.97	3.94	45.26
1975	464.39	1.97	-	782.15	145.61	0.98	2.95	75.76
1976	424.48	4.92	-	571.61	199.72	4.92	2.95	309.91
1977	516.97	0.98	-	981.87	190.86	23.61	1.97	127.90
1978	826.56	0.98	-	869.71	196.77	2.95	2.95	386.65
1979	747.70	0.00	-	504.71	165.28	5.90	2.95	256.78
1980	683.45	2.95	-	853.97	137.74	0.00	1.97	113.14
1981	798.33	3.94	-	1146.17	184.96	14.76	3.94	122.00
1982	702.92	2.95	-	939.56	169.22	25.58	3.94	214.48
1983	1030.04	4.92	-	915.95	227.27	147.58	11.81	275.47
1984	1271.49	1.97	2.95	239.07	182.99	204.64	2.95	215.46
1985	1009.60	11.81	6.89	394.52	298.10	127.90	13.77	202.67
1986	874.27	2.95	1.97	173.15	365.99	49.19	11.81	87.56
1987	1485.67	8.85	0.00	251.86	281.38	43.29	5.90	69.85
1988	1415.58	5.90	4.92	357.13	229.23	31.48	8.85	99.37
1989	1227.68	2.95	6.89	288.26	388.61	42.30	7.87	72.80
1990	1172.18	-	3.94	247.93	249.89	30.50	9.84	132.82
1991	1306.54	-	1.97	175.12	169.22	36.40	14.76	13.77
1992	1613.21	-	6.89	158.40	150.53	22.63	14.76	12.79
1993	2036.72	-	-	143.64	186.93	40.34	10.82	36.40
1994	1510.87	-	-	154.46	139.70	16.73	39.35	13.77
1995	1785.60	0.98	-	139.70	171.19	33.45	22.63	9.84
1996	1096.74	2.95	-	105.27	177.09	19.68	5.90	13.77
1997	950.98	0.98	-	74.77	233.17	16.73	11.81	4.92
1998	1088.63	1.97	-	54.11	282.36	1.97	9.84	14.76
1999	1090.47	0.98	-	75.76	170.20	0.98	4.92	4.92
2000	1208.29	9.84	-	20.66	193.82	0.98	9.84	11.81
2001	1155.23	7.87	-	159.38	135.77	0.98	5.90	6.89
2002	853.13	9.84	-	104.29	148.56	0.00	13.77	3.94
2003	977.29	3.94	-	36.40	175.12	0.00	12.79	3.94
2004	1139.19	6.89	-	19.68	191.85	0.00	9.84	16.73
2005	979.73	5.90	-	36.40	191.85	-	6.89	10.82
2006	988.46	1.97	-	31.48	138.72	0.00	11.81	7.87
2007	1103.65	0.98	-	74.77	159.38	0.00	18.69	12.79
2008	1146.69	1.97	-	31.48	199.72	2.95	32.47	9.84
2009	1094.39	3.94	-	57.06	157.41	0.00	16.73	13.77
2010	1482.15	2.95	-	93.46	222.35	0.00	24.60	5.90
2011	1192.08	6.89	-	100.35	234.15	0.00	21.64	14.76
2012	997.69	14.76	-	47.22	242.02	0.98	52.14	10.82
2013	1155.08	9.84	-	13.77	173.15	0.00	61.98	7.87
2014	1155.08	9.84	--	13.77	173.15	0.00	61.98	7.87

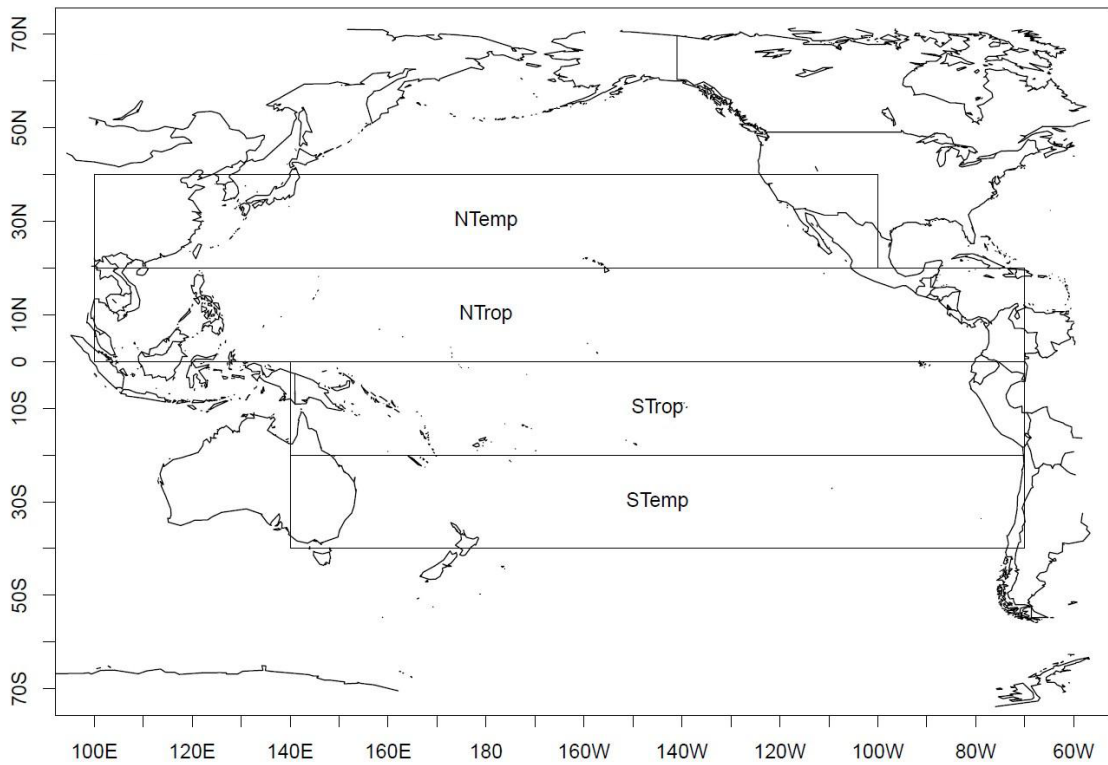


Fig 1. Area definition to calculate mean weight by year, quarter and area.

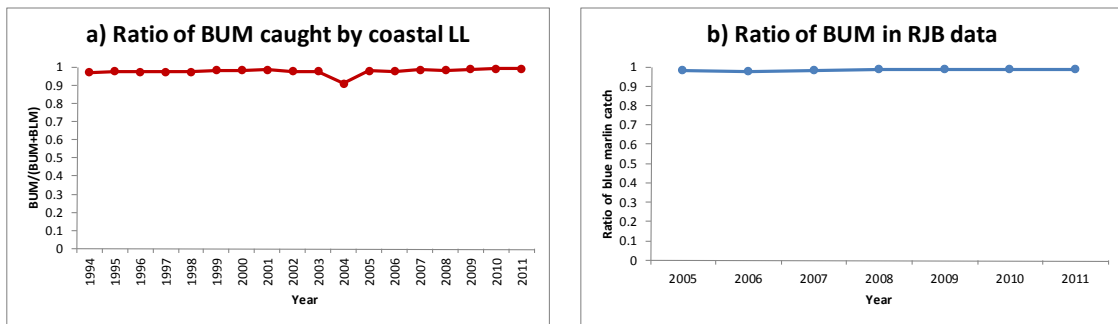


Fig 2. Ratio of blue marlin catch to the sum of blue and black marlin catch using coastal logbook data (right), and RJB data (left).

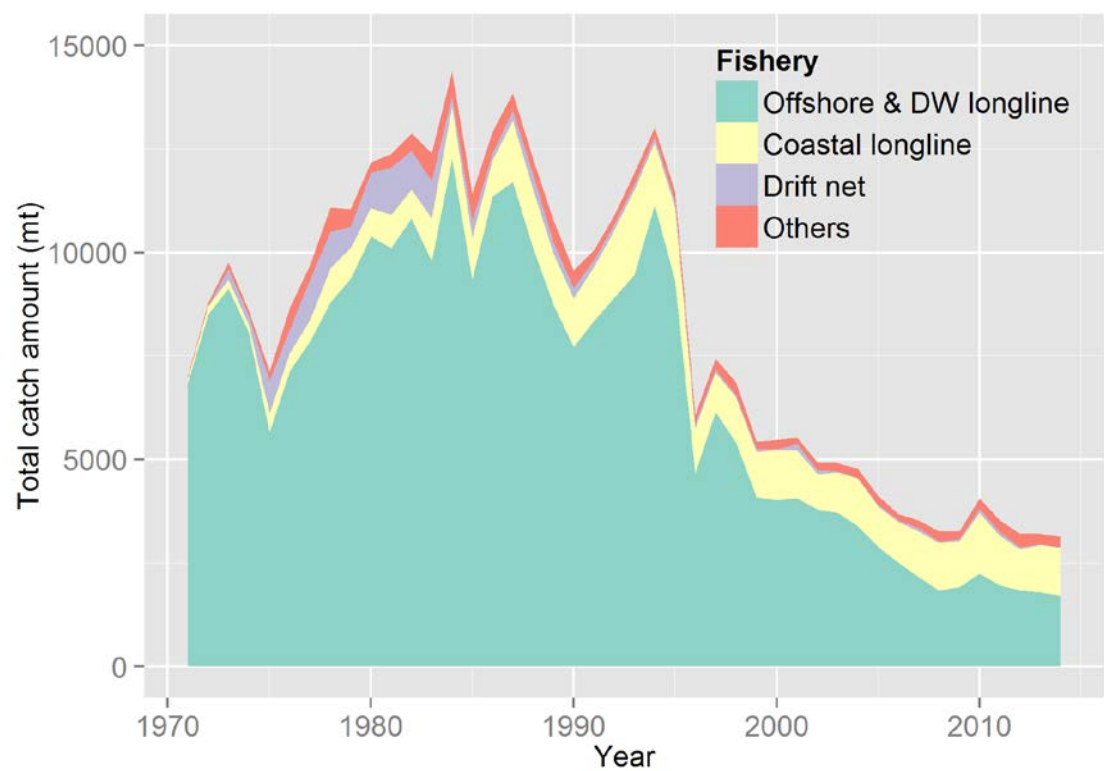
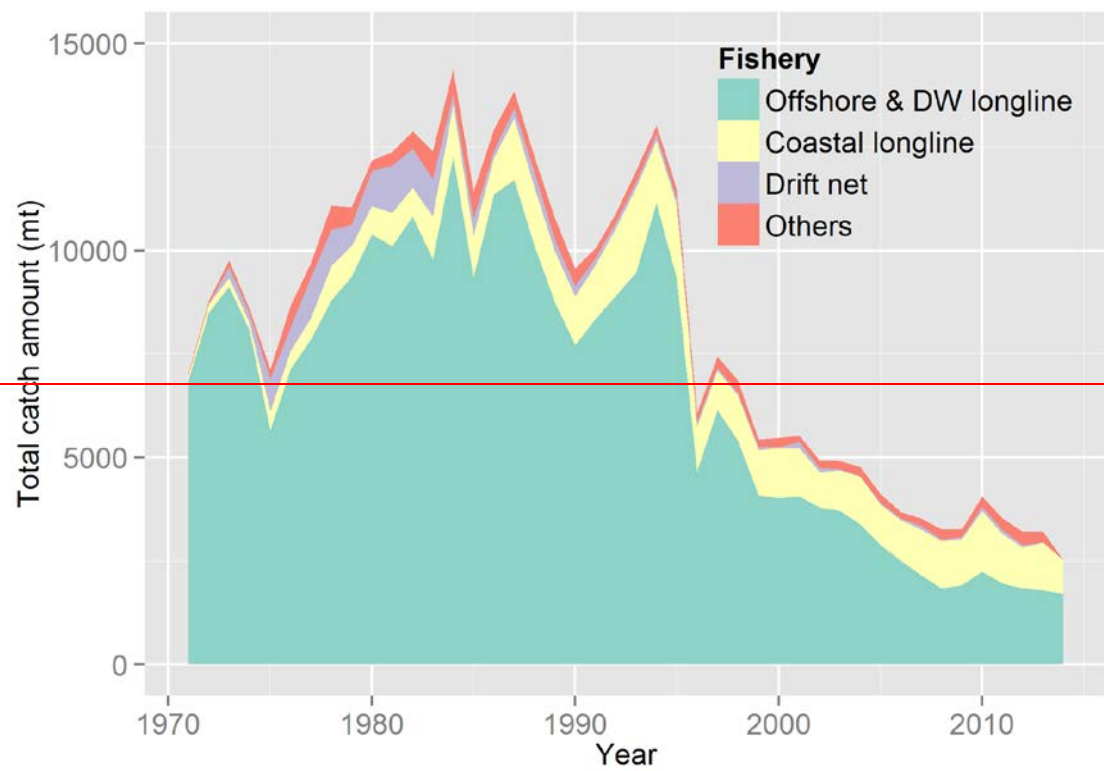


Fig 32. Catch amount of blue marlin by Japanese fishery. Catch of 2013 and 2014 are preliminary.

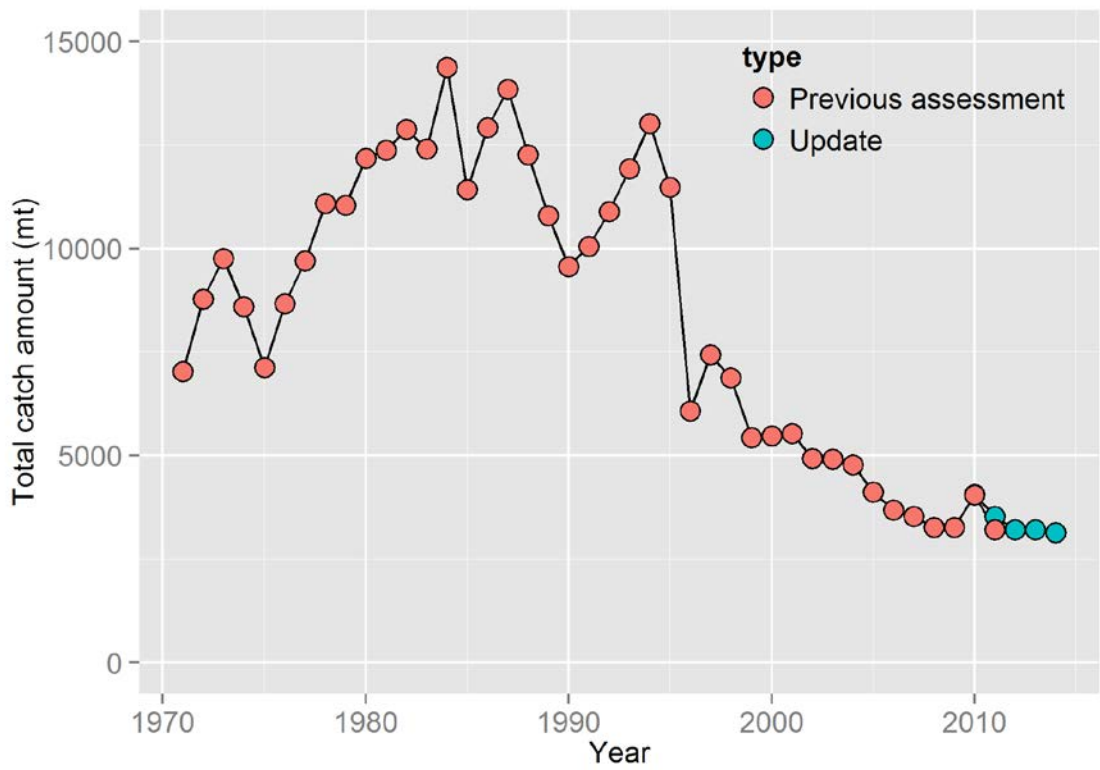
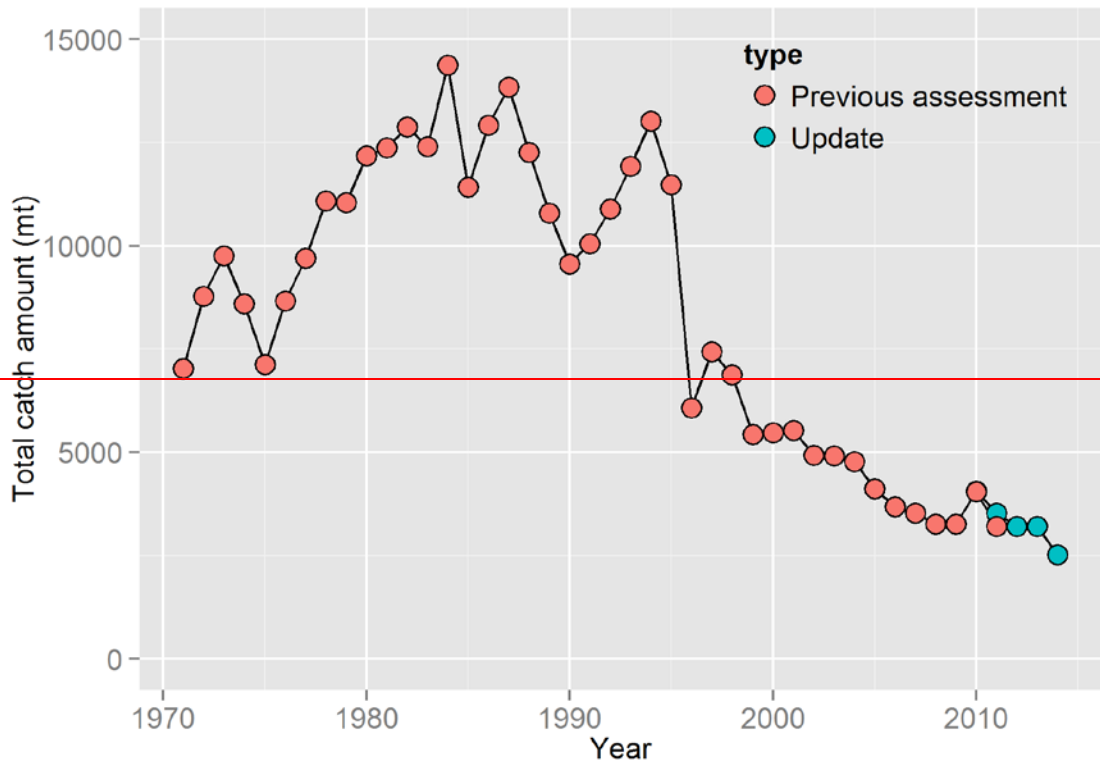
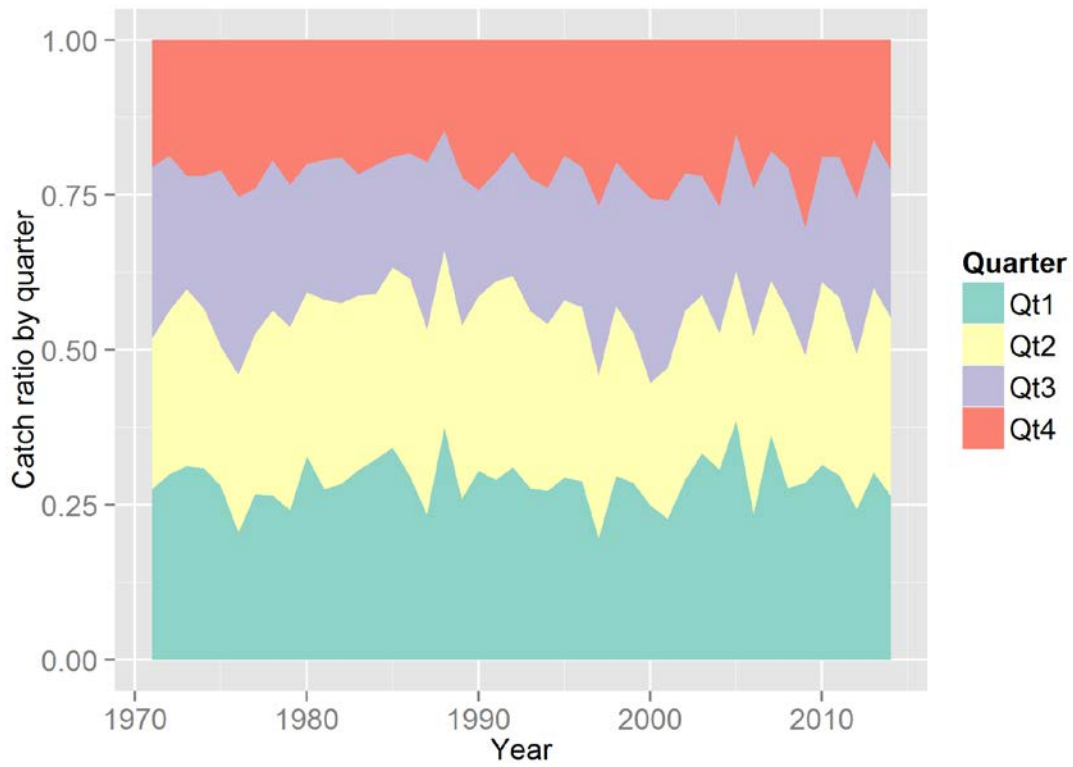
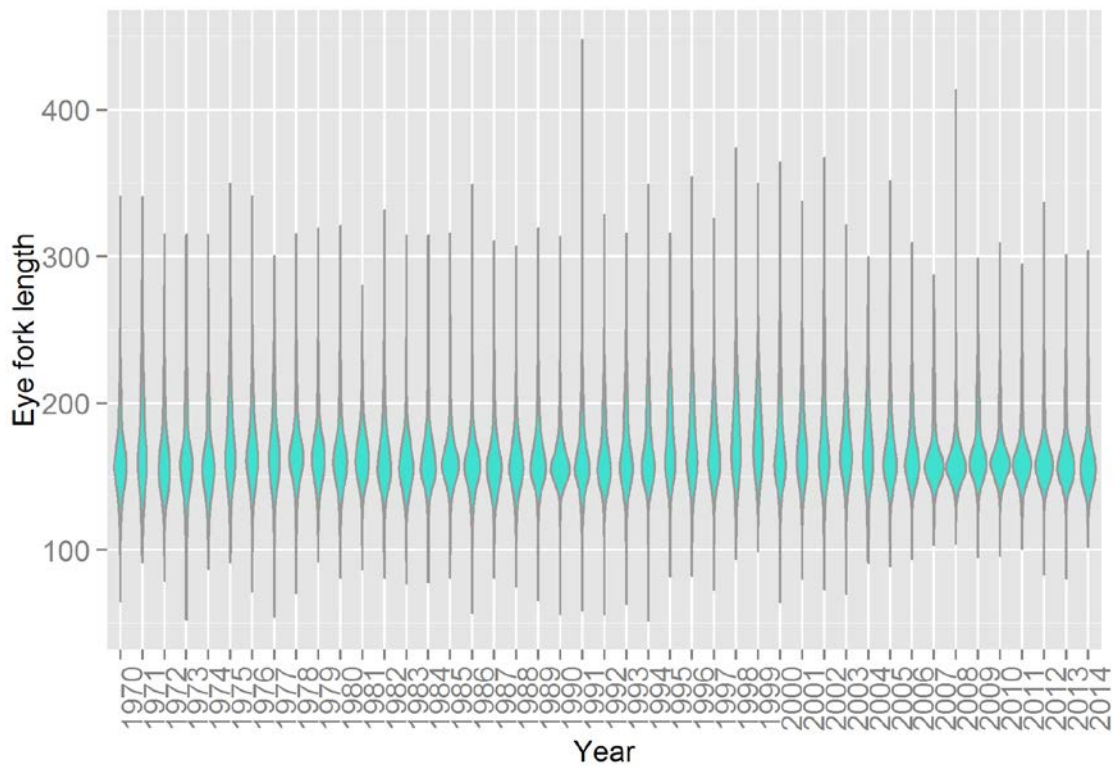


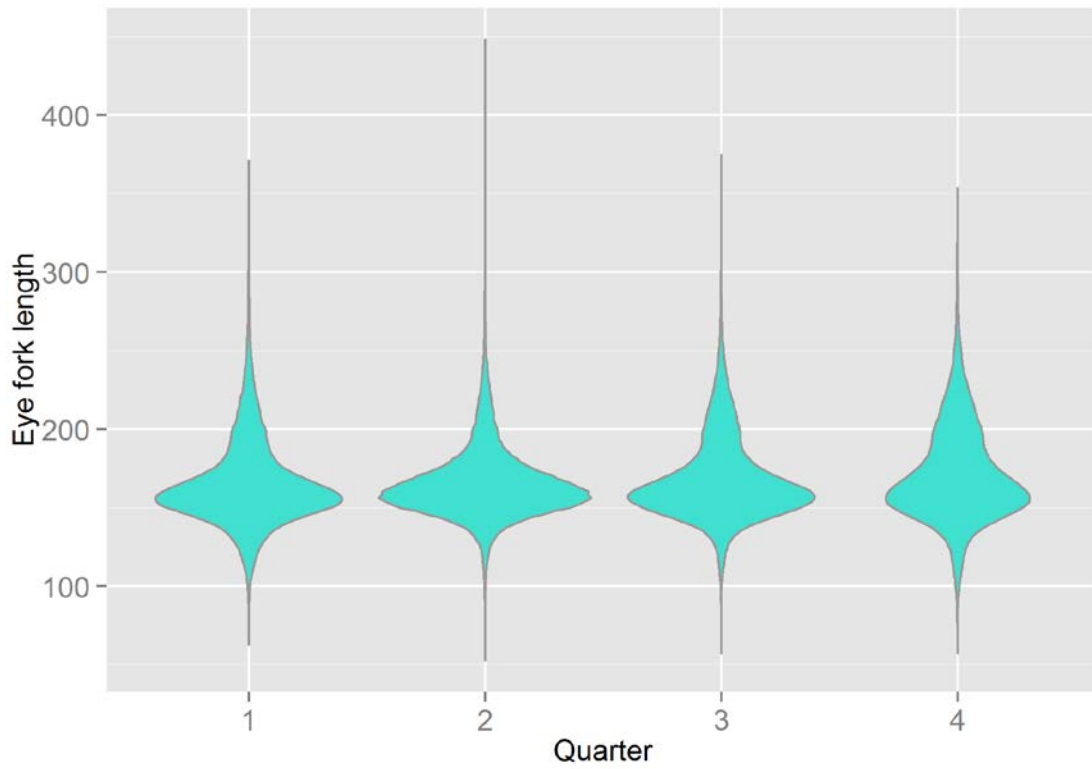
Fig 43. A comparison between previous assessment catch and updated catch. 2013 and 2014 are preliminary.



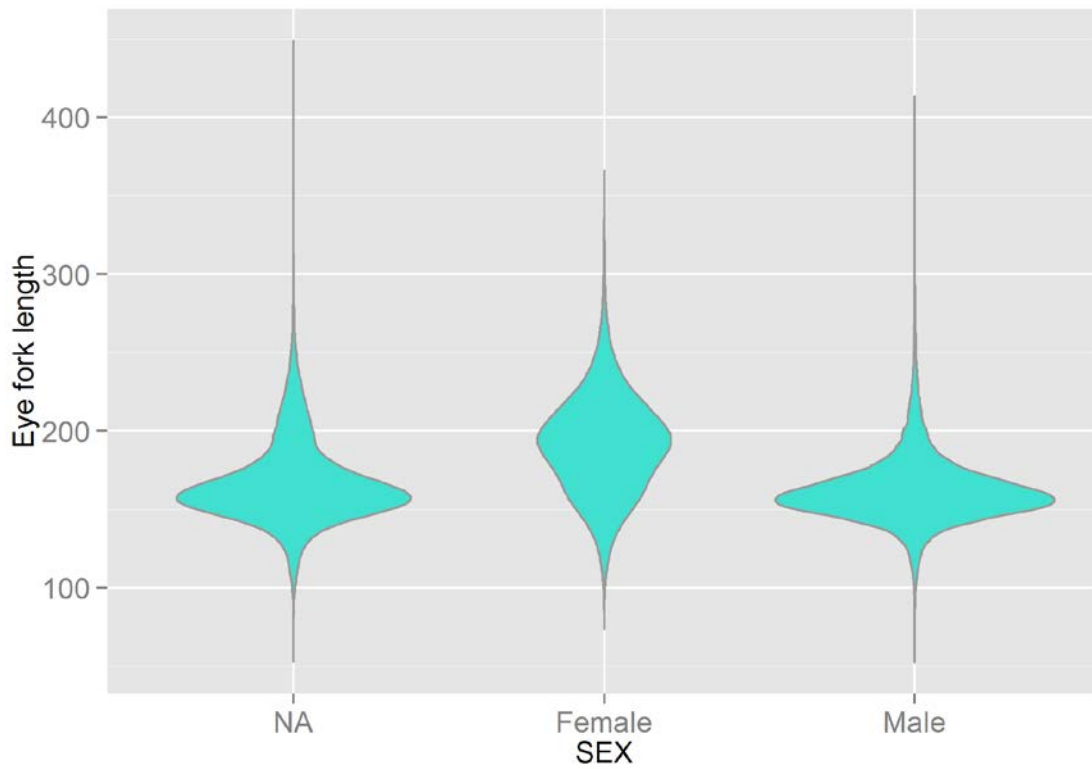
| Fig 54. A percentage of quarterly catch of blue marlin caught by Japanese distant-water and offshore longline.



| Fig 65. Annual trend of eye fork length of Pacific blue marlin caught by Japanese distant-water and offshore longline fishery.



| Fig 76. Quarterly eye fork length of Pacific blue marlin caught by Japanese distant-water and offshore longline fishery.



| Fig 87. Eye fork length of Pacific blue marlin caught by Japanese distant-water and offshore longline fishery aggregated by sex.

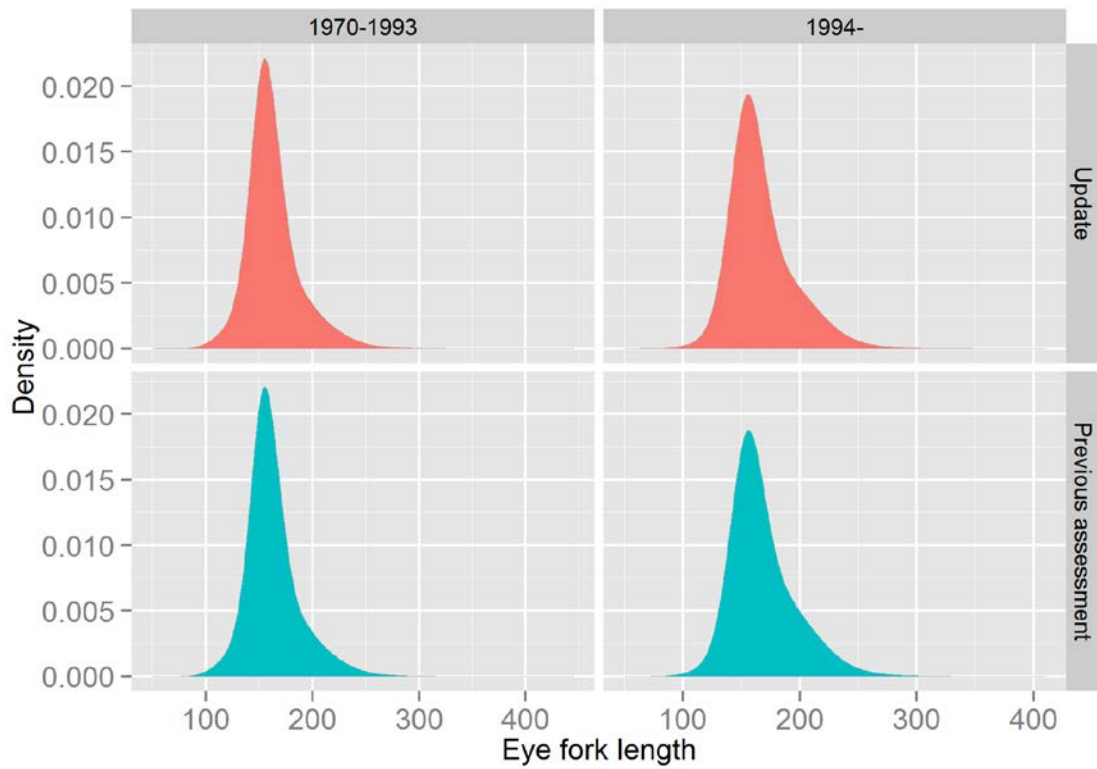


Fig 98. Eye fork length density of Pacific blue marlin. A comparison between previous assessment data and updated data.

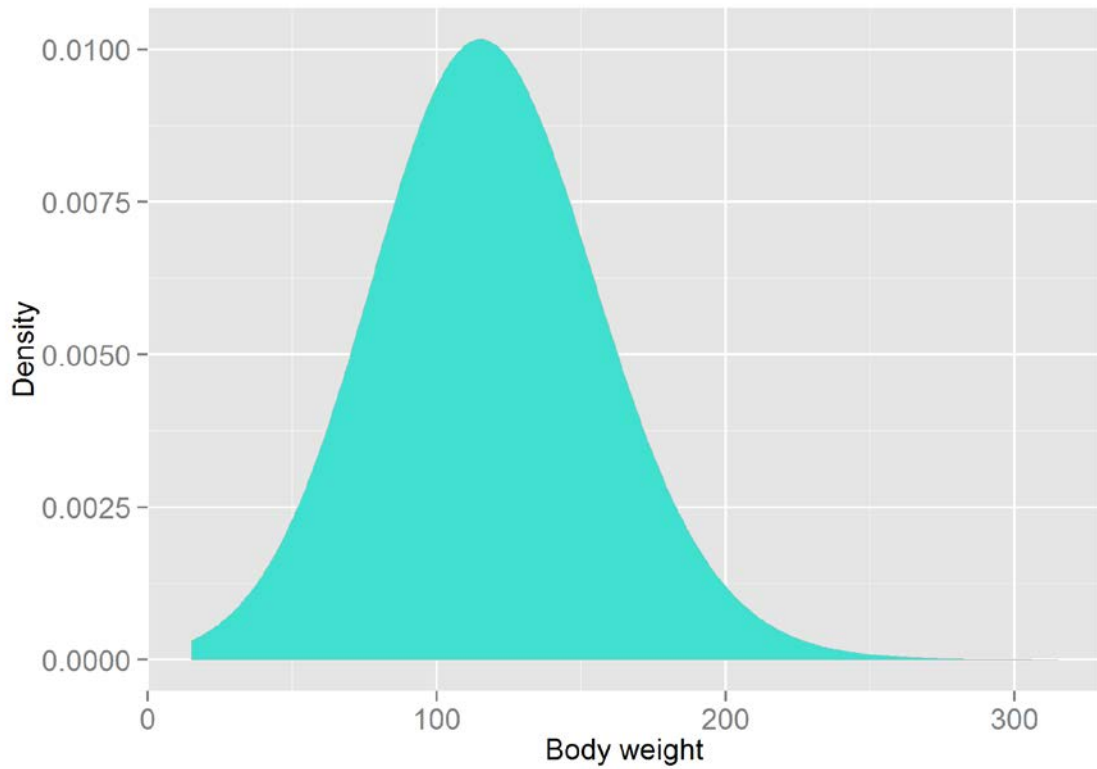


Fig 109. Body weight density of Pacific blue marlin caught by drift net fishery (1977-1999).