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Update of annual catches for blue shark caught by Japanese coastal fisheries in the North Pacific Ocean from 1994 to 2017¹

Mikihiko Kai² and Toshikazu Yano³

²National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency (FRA)
5-7-1 Orido, Shimizu-ku, Shizuoka 424-8633, JAPAN

³National Fisheries University, FRA
2-7-1 Nagata-Honmachi, Shimonoseki, Yamaguchi, Japan

Email: kaim@affrc.go.jp



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Abstract

This working paper provides update of Japanese annual catches of blue shark caught by Japanese coastal fisheries in the North Pacific Ocean during 1994 and 2017. Since Japanese official coastal landing data have no information about the species for pelagic sharks, the annual catches of coastal fisheries are estimated using the available other shark's species-specific data (i.e. a ratio of blue shark to sharks). The estimated annual catches showed that the proportion of total annual catches of blue shark caught by Japanese longline fisheries as well as large mesh drift net fishery were accounted for more than 97 %. The estimated annual catches had declined from 1994 to 1997, and then gradually increased and reached to the maximum value at 4,064 tons in 2007. Thereafter, the estimated annual catches have been decreasing due to the decrease of the catches by longline fisheries, while the catches of large mesh drift net fishery had significantly increased in 2016 and 2017.

Introduction

Blue shark (*Prionace glauca*) is incidentally caught by Japanese coastal fisheries such as Japanese coastal longline, Japanese other longline, Japanese large mesh drift net, Japanese bait fishing, Japanese trap-net and the other fisheries. Historical Japanese coastal catches of blue shark from 1951 to 2010 were estimated by Kimoto *et al.* (2012). Most of the Japanese coastal catches were occupied by the longline fisheries as well as large mesh drift net. Large scale drift net fishery was banned in the open sea area in 1993 (Yokawa, 2012), while Japanese large mesh drift net fishery has been operating in the coastal waters within the economic exclusive zone (EEZ) of north eastern Japan. Kai and Yano (2016) updated the annual catches of blue shark caught by Japanese coastal fisheries until 2014 using the same methods as used in the previous estimation and the annual catches were applied to the stock assessment for North Pacific blue shark (ISC, 2017). This document paper updates annual catches of blue shark (*Prionace glauca*) caught by Japanese coastal fisheries until 2017.

Materials and Methods

In the previous stock assessment in 2017 (ISC, 2017), annual catches of Japanese coastal fisheries were comprised of six types of fisheries: (1) Japanese coastal longline, (2) Japanese other longline, (3) Japanese large mesh drift net, (4) Japanese bait fishing, (5) Japanese trap net and (6) Japanese other fisheries. Since Japanese official coastal landing data have no information about the species for pelagic sharks, the annual catches of coastal fisheries were estimated using the available other shark's species-specific data (i.e. a ratio of blue shark to sharks including major pelagic sharks such as blue shark, shortfin mako, salmon shark, thresher sharks, hammerhead shark, silky shark and oceanic whitetip sharks etc.). Three types of data sources from 1994 to 2017 were used; (i) Japanese statistical year book ("Nourin-toukei"), (ii) Research project on Japanese bluefin tuna ("RJB"), (iii) Logbook data ("Gyoseki"). The details of these data were summarized in the **Appendix**. First, the annual catches of

North Pacific spiny dogfish (*Squalus suckleyi*) were excluded from the catches of sharks in “Norin Toukei” because the catches of spiny dogfish were not included in the other two data sources.

The estimation methods for six types of fisheries are as follows:

(1) Japanese coastal longline

Catch of blue shark = Catch of sharks (“Norin Toukei”) * Ratio of blue shark to sharks (“Gyoseki”)

(2) Japanese other longline

Catch of blue shark = Catch of sharks (“Norin Toukei”) * Ratio of blue shark to sharks (“Gyoseki”)

(3) Japanese large mesh drift net

Catch of blue shark = Catch of sharks (“Norin Toukei”) * Ratio of blue shark to sharks (“RJB”)

(4) Japanese bait fishing

Catch of blue shark = Catch of sharks (“Norin Toukei”) * Ratio of blue shark to sharks (“Nourin Toukei”),

The ratio of blue shark in “Nourin Toukei” from 1965 to 1967 (0.042) was used because RJB data have no information about the catches of this fishery.

(5) Japanese trap net

Catch of blue shark = Catch of sharks (“Norin Toukei”) * Ratio of blue shark to sharks (“RJB”)

The ratio was calculated using the only large-scale trap net fishery (S2) of RJB data. If there was no annual catch for blue shark, we used a mean catch ratio of blue shark between 1994 and 2017.

(6) Japanese other fisheries

Catch of blue shark = Catch of sharks (“Norin Toukei”) * Ratio of blue shark to sharks (“RJB”)

The ratio was calculated using the other fisheries (O1 and O2) of RJB data.

Results

The estimated annual catches showed that the proportion of total annual catches for longline fisheries as well as large mesh drift net fishery were accounted for more than 97 % (**Table 1** and **Fig. 1**). In contrast, the estimated annual catches by the remaining fisheries such as bait fishing, trap net, and other fisheries were very small amounts (**Table 1**). The estimated annual catches had declined from 1,956 tons in 1994 to 1,055 tons in 1997, and then gradually increased and reached to the maximum value at 4,064 tons in 2007. Thereafter, the estimated annual catches had decreased due to the decrease of the catches by longline fisheries, while the catches of large mesh drift net fishery had remarkably increased in 2016 and 2017.

Discussions

Annual catches of blue shark caught by Japanese coastal fisheries in the North Pacific Ocean were estimated based on the Japanese statistical year book from 1994 to 2017. The estimated annual catches were dominated by the coastal and the other longline fisheries as well as large mesh drift net fishery

(**Table 1** and **Fig. 1**). The estimated annual catches of blue shark had remarkably increased around mid of 2000s (**Fig. 1**) due to the increase in the catch ratio of blue shark to sharks (**Table A4**). These results were almost the same as those shown by Kai and Yano (2016). However, the estimated annual catches of blue shark in this study were slightly lower than those by Kai and Yano (2016) (**Fig. 2**) because Kai and Yano (2016) used incorrect conversion factor from processed weight into round weight in the previous estimation. The estimated annual catches may be underestimated due to the discard or release of the blue shark due to the lower values of pelagic shark compared to tunas and swordfishes. In future work, it is important to explore the estimation of the discard/released catches for Japanese coastal fisheries. The estimated annual catches of Japanese coastal longline fishery suddenly decreased in 2011 because the fishing operation was halted due to the influence of the huge earthquake of the Pacific coast of Tohoku.

Reference

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Table 1. Estimated annual catches (tons) of blue shark caught by various Japanese coastal fisheries from 1994 to 2017.

Year	Coastal longline (tons)	Other longline (tons)	Large mesh drift net (tons)	Bait fishing (tons)	Trap net (tons)	Other fisheries (tons)	Total (tons)
1994	856.7	468.4	599.1	3.9	9.2	19.1	1956
1995	575.4	436.6	501.9	3.9	7.3	10.7	1536
1996	448.6	256.5	492.2	3.9	6.8	18.8	1227
1997	275.7	135.1	620.9	6.2	8.9	7.8	1055
1998	585.9	230.1	634.3	4.0	7.3	5.0	1467
1999	358.4	132.0	859.3	2.1	7.6	6.6	1366
2000	921.1	419.9	757.7	1.3	7.6	10.7	2118
2001	515.3	175.5	758.5	2.4	7.8	9.4	1469
2002	718.4	260.2	767.7	1.4	6.7	13.2	1768
2003	776.7	316.6	1350.3	2.2	7.2	11.5	2464
2004	610.0	225.6	1202.4	2.8	7.6	7.5	2056
2005	1782.6	612.7	1321.2	2.1	0.0	12.9	3732
2006	1642.9	560.2	1204.1	2.1	5.0	2.0	3416
2007	1941.0	773.7	1322.6	1.6	5.2	19.3	4064
2008	1586.6	817.5	943.7	1.2	0.2	13.9	3363
2009	1382.4	715.6	1207.7	1.0	0.3	4.3	3311
2010	1024.3	787.3	962.5	1.0	4.1	8.9	2788
2011	63.8	858.5	793.8	2.9	7.5	1.4	1728
2012	829.1	759.5	1117.6	2.5	1.9	2.6	2713
2013	1124.2	622.1	1103.4	2.3	6.1	4.4	2862
2014	537.5	597.7	1059.6	1.5	3.8	0.0	2200
2015	550.9	386.5	697.4	2.3	20.6	0.2	1658
2016	375.5	224.8	1832.3	1.6	25.6	0.6	2460
2017	342.4	212.2	1365.7	1.5	3.6	0.4	1926

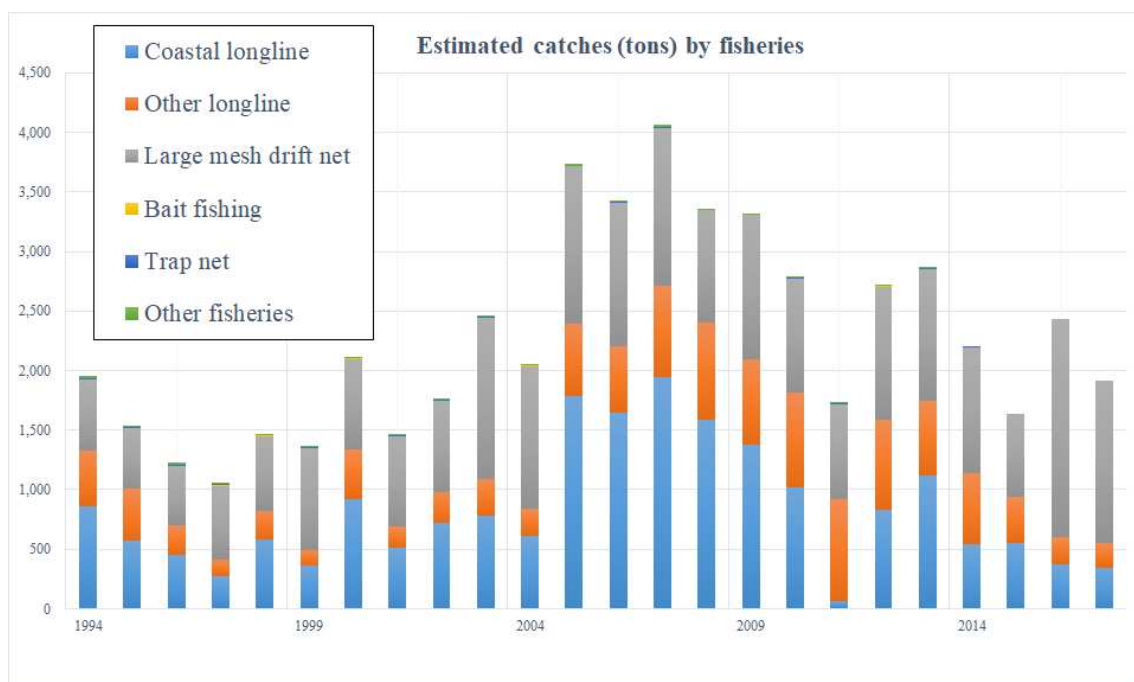


Figure 1. Estimated annual catches (tons) of blue shark caught by various Japanese coastal fisheries from 1994 to 2017.

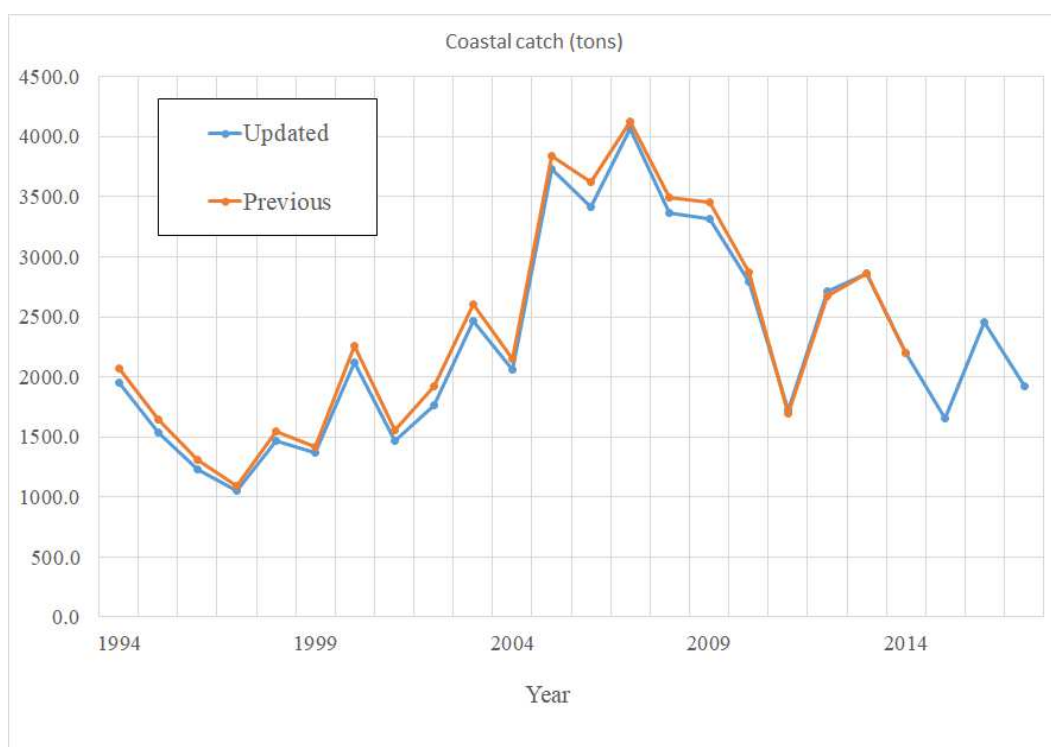


Figure 2. Comparison of updated annual catches from 1994 to 2017 with previous one until 2014.

Appendix

Information about Japanese major data sources

Three kinds of major data sources were used to estimate the annual catches of North Pacific blue shark

(i) Japanese statistical year book (“Nourin-toukei”)

Japan Fishery Agency (JFA) compiles this year book and opens the data to the public every year through Ministry of Agriculture, Forestry and Fisheries. This year book covers wide areas in Japan and long term from 1951 to 2017, however, it has a two-year time lag and shark species are aggregated into one category “sharks” after 1967. The statistics includes total amount of catches by different fishing gears, species and prefecture. Gear-specific annual catches of pelagic sharks from 1994 to 2017 are shown in **Table A1**. In addition, gear-specific annual catches of North Pacific spiny dogfish from 1994 to 2017 are shown in **Table A2**. The annual catches were also estimated based on the annual catches of sharks in Nourin-toukei and the ratio of spiny dogfish to all shark from 1964 to 1967.

(ii) Research project on Japanese bluefin tuna (“RJB”)

National Research Institute of Far Seas Fisheries (NRIFSF) commenced the survey program since 1992 to gather information about Pacific bluefin tuna landings from Japanese coastal and offshore fisheries. The data includes information about landed prefecture, landed local market, landed dates, fishing area, fishing gear, catch weight (Sales slips) for Pacific bluefin tuna as well as those of other species including pelagic sharks such as a blue shark etc., while the compilation of the data for pelagic sharks had started in 2002. Catch ratios of blue shark to all pelagic sharks caught by three types of fisheries during 1994 and 2017 are shown in **Table A3**. “Kesennuma” is a major fishing port located in the eastern part of Japan where most of the blue shark caught by Japanese longline fishery as well as large mesh drift net fishery are landed.

(iii) Logbook data (“Gyoseki”)

NRIFSF compiles the logbook data collected from Japanese coastal longline fisheries. The set by set data from 1994 to 2017 includes information on species of sharks, catch number, and catch weight etc.. Annual retained catches (tons) of blue shark, all sharks, and the ratio of blue shark to all sharks caught by coastal and other longline fisheries are shown in **Table A4**.

Appendix tables

Table A1. Gear-specific annual catches (tons) of sharks from Japanese statistical year book (“Nourin-toukei”) during 1994 and 2017.

Year	Coastal longline (tons)	Other longline (tons)	Large mesh drift net (tons)	Bait fishing (tons)	Trap net (tons)	Other fisheries (tons)
1994	2052	1783	1480	119	117	65
1995	1683	2030	1240	118	107	37
1996	1954	1775	1216	119	103	64
1997	2128	1658	1534	187	114	28
1998	2551	1592	1567	122	99	19
1999	2345	1373	2123	63	92	25
2000	2031	1472	1872	41	99	41
2001	2633	1425	1874	72	117	34
2002	2007	1155	2037	43	87	27
2003	1516	983	3000	66	86	20
2004	1552	912	2438	85	91	19
2005	2313	1263	2278	65	101	29
2006	2176	1180	2558	65	84	11
2007	2185	1385	2583	49	78	69
2008	1900	1556	2881	37	117	44
2009	1984	1632	3300	30	96	29
2010	1292	1579	3215	30	120	29
2011	70	1498	1961	88	100	6
2012	965	1405	2761	76	67	7
2013	1538	1352	3310	70	98	25
2014	741	1309	3867	46	90	0
2015	985	1098	3581	70	105	3
2016	845	804	3082	47	153	5
2017	1023	1008	3463	44	129	4

Table A2. Gear-specific annual catches (tons) of North Pacific spiny dogfish from Japanese statistical year book (“Nourin-toukei”) during 1994 and 2017.

Year	Other longline (tons)	Other bait fishing (tons)	Trap net (tons)	Other fishery (tons)
1994	661	25	58	4
1995	753	25	60	3
1996	658	25	59	4
1997	615	40	57	3
1998	590	26	52	3
1999	509	13	43	4
2000	546	9	50	7
2001	528	15	67	4
2002	428	9	44	3
2003	365	14	40	3
2004	338	19	42	3
2005	468	14	58	3
2006	438	14	51	3
2007	514	10	48	4
2008	577	8	66	3
2009	605	6	56	3
2010	586	6	62	2
2011	556	19	52	1
2012	521	16	53	0
2013	501	15	67	1
2014	485	10	76	1
2015	407	15	58	1
2016	298	10	80	2
2017	374	9	72	2

Table A3. Catch ratios of blue shark to all pelagic sharks caught by three types of fisheries during 1994 and 2018. The ratios were estimated using RJB data.

Year	Trap net	Other fisheries	Large mesh drift net in Kesennuma
1994	0.16	0.31	0.40
1995	0.16	0.31	0.40
1996	0.16	0.31	0.40
1997	0.16	0.31	0.40
1998	0.16	0.31	0.40
1999	0.16	0.31	0.40
2000	0.16	0.31	0.40
2001	0.16	0.31	0.40
2002	0.16	0.55	0.38
2003	0.16	0.68	0.45
2004	0.16	0.47	0.49
2005	0.00	0.50	0.58
2006	0.15	0.25	0.47
2007	0.17	0.30	0.51
2008	0.00	0.34	0.33
2009	0.01	0.16	0.37
2010	0.07	0.33	0.30
2011	0.16	0.27	0.40
2012	0.14	0.36	0.40
2013	0.20	0.18	0.33
2014	0.27	0.14	0.27
2015	0.44	0.11	0.19
2016	0.35	0.20	0.59
2017	0.06	0.18	0.39

Table A4. Retained annual catches (tons) of blue shark, all sharks, and the ratio of blue shark to all sharks caught by coastal and other longline fisheries and the data come from logbook data (“Gyoseki”) during 1994 and 2017.

Year	Blue shark (kg)	All sharks (kg)	Ratio
1994	138,679	332,188	0.42
1995	274,475	802,804	0.34
1996	307,424	1,338,926	0.23
1997	131,329	1,013,575	0.13
1998	112,854	491,354	0.23
1999	4,012	26,252	0.15
2000	20,108	44,339	0.45
2001	8,783	44,882	0.20
2002	24,273	67,813	0.36
2003	37,794	73,767	0.51
2004	73,779	187,704	0.39
2005	54,610	70,857	0.77
2006	96,575	127,914	0.75
2007	71,137	80,080	0.89
2008	396,987	475,389	0.84
2009	284,817	408,773	0.70
2010	317,100	399,968	0.79
2011	459,236	503,888	0.91
2012	523,453	609,238	0.86
2013	762,901	1,043,684	0.73
2014	728,954	1,004,898	0.73
2015	467,826	836,481	0.56
2016	958,949	2,158,076	0.44
2017	1,385,012	4,137,845	0.33