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Update of catches for North Pacific blue shark caught by Japanese coastal fisheries¹

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Abstract

This working paper provides with update of Japanese catches of blue shark (*Prionace glauca*) caught by Japanese coastal fisheries during 1994 and 2014. Since the species-specific shark's data is not included in Japanese official coastal landing data, the catches of coastal fisheries are estimated using the available species-specific data (i.e. a ratio of blue shark to sharks). Estimated catches of blue shark by coastal fisheries by year showed that the total annual catches of longline fisheries as well as large mesh drift net were accounted for more than 99 % of annual total catches. Yearly changes in the estimated total catches had a decreasing trend from 2,071 tons in 1994 to 1,094 tons in 1997, and then it had gradually increased and reached to the maximum value at 4,124 tons in 2007. Thereafter, the trends in the estimated catches tended to decrease. In 2011, the total catches were very small due to a reduction of the coastal longline due to the influence of the huge earthquake of the Pacific coast of Tohoku.

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 fishery. 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). However, Japanese large mesh drift net fishery is operating in the coastal waters of Japan off the Pacific coast of "Tohoku" where the water is within the economic exclusive zone (EEZ) of Japan. This document paper provides catches of blue shark (*Prionace glauca*) caught by Japanese coastal fisheries during 1994 and 2014.

Materials and Methods

Japanese coastal fisheries used in the previous stock assessment 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, (6) Japanese other fishery. We estimated the catches from 1994 to 2014 using the three types of data sources:

- (i) Japanese statistical year book ("Nourin-toukei")

Japan fishery agency 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 2014, however, it has a two-year time lag and shark species are aggregated into one category "sharks" after 1967. That statistics includes total amount of catches by different fishing gears, species and prefecture. Yearly changes in gear-

specific catches of oceanic pelagic sharks from 1994 to 2014 are shown in Table A1. In addition, yearly changes in gear-specific catches of North Pacific spiny dogfish (*Squalus suckleyi*) from 1994 to 2014 are shown in Table A2.

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

National research institute of far seas fishery commenced the survey program since 1992 to accomplish collection of information on Pacific bluefin tuna landings by coastal and offshore fisheries. This source of data provides catch (Sales slips) and size sampling data collected at Japanese local fishing ports. The data includes the information on the catches for species, fishing gear, date etc.. However, the compilation of the shark’s data was started in 2002. Catch ratios of blue shark to all pelagic sharks caught by three types of fisheries during 1994 and 2015 are shown in Table A3. “Kesenuma” is a major fishing port located in the eastern part of Japan where the most of the blue shark caught by Japanese longline fishery as well as large mesh drift net are landed.

(iii) Logbook data (“Gyoseki”)

National research institute of far seas fishery compiles the logbook data collected from Japanese longline fishery. The set by set data from 1994 to 2014 includes information on species of sharks, catch number, and catch weight etc.. The processed weight was converted into round weight using conversion factors 1.2 for the data before 2011, and 2.1 (blue shark), 1.8(salmon shark), and 1.6(shortfin mako) for the data on and after 2011 (Note that the three conversion factors for each species were also applied to them in the original logbook data before 2011 in July, 2016). The weight data before 2011 were revised using the ratio 2.1/1.2, 1.8/1.2, and 1.6/1.2 for each species (IOTC 2013). Yearly changes in retained catches (tons) of blue shark, all sharks, and the ratio of blue shark to all sharks caught by coastal and other longline fishery are shown in Table A4.

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”) where the catch of spiny dogfish is excluded from the catch of sharks.

(3) Japanese large mesh drift net

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Catch of blue shark = Catch of sharks (“Norin Toukei”) * Ratio of blue shark to sharks (“RJB”), where the large mesh drift net for swordfish and billfish as well as the other drift net were included into the catch of sharks (Yokawa et al. 2012).

(4) Japanese bait fishing

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

where the catch of spiny dogfish is excluded from the catch of sharks (“Norin Toukei”) and the catch of sharks (“Norin Toukei”) includes coastal squid bait fishery, troll fishery, and other bait fishery. The data of “Nourin Toukei” from 1965 to 1967 (average ratio: 0.042) was used to calculate the ratio of blue shark because RJB data had no information about the catches for those fisheries.

(5) Japanese trap net

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

where the catch of spiny dogfish is excluded from the catch of sharks (“Norin Toukei”) and the ratio is calculated using the only large scale trap fishery (S2) of RJB data. When the annual catch of blue shark is 0, we used a mean catch ratio of blue shark between 1994 and 2015 that was calculated using only positive catches.

(6) Japanese other fishery

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

where the catch of spiny dogfish is excluded from the catch of sharks (“Norin Toukei”) and the ratio is calculated using the other fishery (O1 and O2) of RJB data.

Results

Estimated catches of blue shark by coastal fisheries by year showed that the total annual catches of longline fisheries as well as large mesh drift net were accounted for more than 99 % of annual total catches (Table 1 and Figure 1). In contrast, the estimated catches by other fisheries such as bait fishing, trap net, and other fishery were very small below 21 tons throughout the years. Yearly changes in the estimated total catches had a decreasing trend from 2,071 tons in 1994 to 1,094 tons in 1997, and then it had gradually increased and reached to the maximum value at 4,124 tons in 2007. Thereafter, the trends in the estimated catches tended to decrease. In 2011, the total catches were very small due to a reduction in the catch of coastal longline due to the influence of the huge earthquake of the Pacific coast of Tohoku. The annual trends in the estimated total catch were almost similar to those in the previous estimates (Figure 2). However, the scale of the estimates were slightly different between them.

Discussion

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Japanese coastal catches of blue shark were estimated using the Japanese statistical year book from 1994 to 2014. The total estimated catches were dominated by the coastal and other longline fisheries as well as large mesh drift net fishery. The estimated catches of blue shark had remarkably increased around mid of 2000s (Figure 1) due to the increase in the ratio of retained catch of blue shark to sharks (Table A4). These results were similar to those shown by Kimoto *et al.* (2012). However, the estimated catches of blue shark in this study were slightly different with those by Kimoto *et al.* (2012) because we calculated the catch of the blue shark by the ratios of the blue shark catch form 1994 and 2014, and the ratios were slightly changed by adding the new data. We also changed the conversion factor from processed weight into round weight. Probably, the estimated total catch is underestimated due to the discard or release of the blue shark due to the lower values. In future work, it is important to explore the estimation of the discard/released catches.

Reference

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Table 1. Yearly changes in estimated total catches (tons) of blue shark caught by various fisheries from 1994 to 2014.

	Coastal longline	Other longline	Large mesh drift net	Bait fishing	Trap net	Other fishery
1994	944.8	516.6	576.9	3.9	8.6	20.2
1995	648.2	491.8	483.4	3.9	6.8	11.3
1996	514.5	294.1	474.0	3.9	6.4	19.9
1997	317.4	155.6	598.0	6.2	8.3	8.3
1998	659.1	258.9	610.9	4.0	6.8	5.3
1999	420.7	155.0	827.6	2.1	7.1	7.0
2000	1034.7	471.8	729.8	1.3	7.1	11.3
2001	601.4	204.9	730.5	2.4	7.3	9.9
2002	834.1	302.1	767.7	1.4	6.2	13.2
2003	873.2	356.0	1350.3	2.2	6.7	11.5
2004	676.6	250.2	1202.4	2.8	7.1	7.5
2005	1864.8	640.9	1321.2	2.1	0.0	12.9
2006	1796.8	612.7	1204.1	2.1	5.0	2.0
2007	1984.0	790.9	1322.6	1.6	5.2	19.3
2008	1670.5	860.8	943.7	1.2	0.2	13.9
2009	1477.8	765.0	1207.7	1.0	0.3	4.3
2010	1072.2	824.1	962.5	1.0	4.1	8.9
2011	63.8	858.5	764.5	2.9	7.0	1.4
2012	829.1	759.5	1076.3	2.5	1.9	2.6
2013	1124.2	622.1	1103.4	2.3	6.1	4.4
2014	537.5	597.7	1059.6	1.5	3.8	0.0

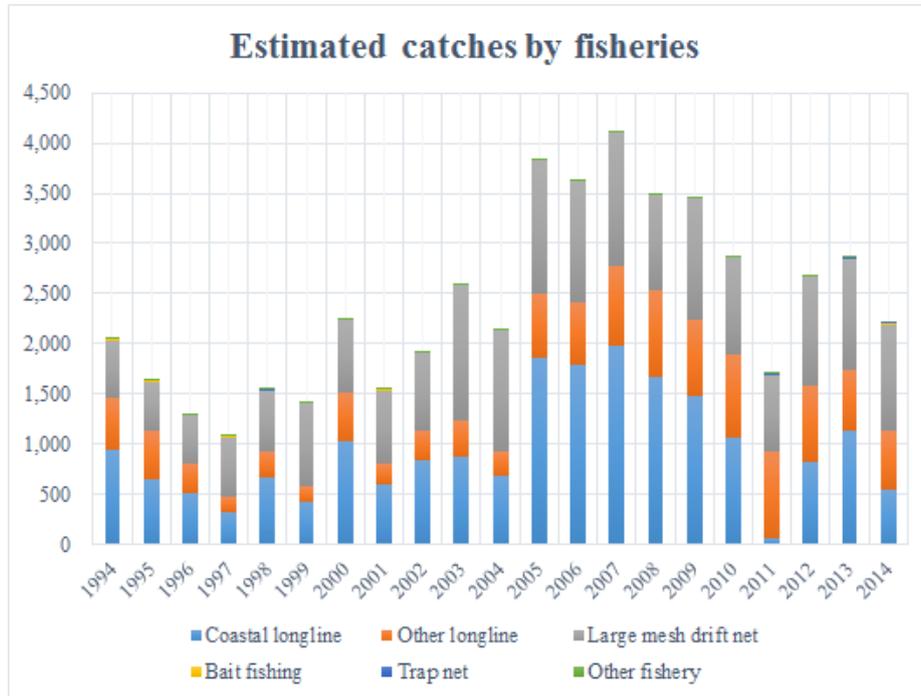


Figure 1. Yearly changes in estimated total catches (tons) of blue shark caught by various fisheries from 1994 to 2014.

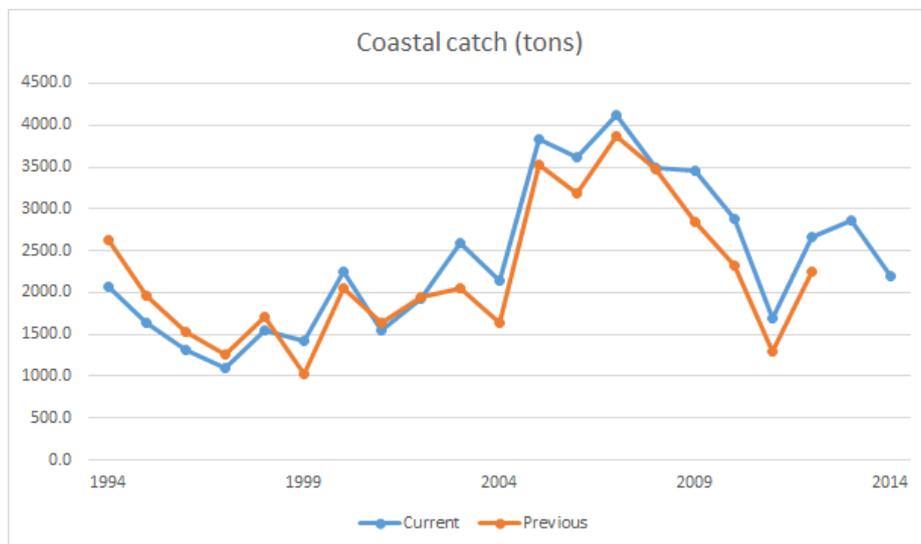


Figure 2. A comparison of the yearly changes in estimated total catches (tons) of blue shark between current and previous estimates.

Appendix tables

Table A1. Yearly changes in gear-specific catches (tons) of sharks from Japanese statistical year book (“Nourin-toukei”) during 1994 and 2014.

Year	Coastal longline	Other longline	Large mesh drift net	Bait fishing	Trap net	Other fishery
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

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Table A2. Yearly changes in gear-specific catches (tons) of North Pacific spinydog fish from Japanese statistical year book (“Nourin-toukei”) during 1994 and 2014.

Year	Other longline	Other bait fishing	Trap net	Other fishery
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

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Table A3. Catch ratios of blue shark to all pelagic sharks caught by three types of fisheries during 1994 and 2015. The ratios were estimated using RJB data.

Year	Trap net	Other fishery	Large mesh drift net in Kesenuma
1994	0.145	0.332	0.390
1995	0.145	0.332	0.390
1996	0.145	0.332	0.390
1997	0.145	0.332	0.390
1998	0.145	0.332	0.390
1999	0.145	0.332	0.390
2000	0.145	0.332	0.390
2001	0.145	0.332	0.390
2002	0.145	0.551	0.377
2003	0.145	0.678	0.450
2004	0.145	0.466	0.493
2005	0.001	0.496	0.580
2006	0.152	0.255	0.471
2007	0.175	0.297	0.512
2008	0.004	0.340	0.328
2009	0.007	0.164	0.366
2010	0.071	0.328	0.299
2011	0.145	0.272	0.390
2012	0.137	0.364	0.390
2013	0.198	0.182	0.333
2014	0.272	0.135	0.274
2015	0.438	0.113	0.195

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Table A4. Yearly changes in retained catches (tons) of blue shark, all sharks, and the ratio of blue shark to all sharks caught by coastal and other longline fishery and the data come from logbook data (“Gyoseki”) during 1994 and 2015.

Year	Blue shark	All sharks	Ratio
1994	242688	527077	0.460
1995	480331	1247142	0.385
1996	537992	2043344	0.263
1997	229826	1540715	0.149
1998	197495	764412	0.258
1999	7021	39135	0.179
2000	35189	69070	0.509
2001	15370	67295	0.228
2002	42478	102207	0.416
2003	66140	114821	0.576
2004	129113	296151	0.436
2005	95568	118537	0.806
2006	169006	204669	0.826
2007	124490	137100	0.908
2008	694727	790150	0.879
2009	498430	669151	0.745
2010	554925	668693	0.830
2011	459236	503888	0.911
2012	523453	609238	0.859
2013	762901	1043684	0.731
2014	728954	1004898	0.725
2015	467826	836481	0.559

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