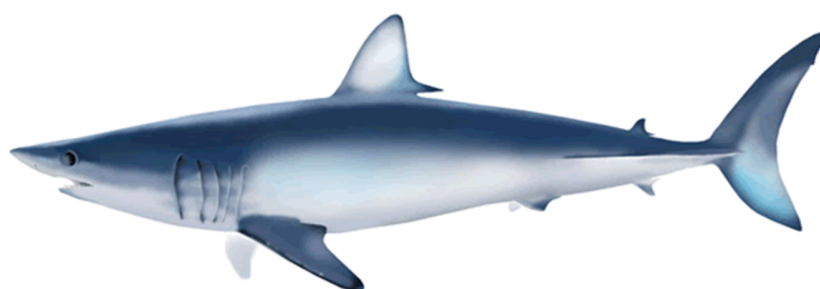


Estimation of catches for shortfin mako, *Isurus oxyrinchus*, caught by Japanese coastal fisheries¹

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Abstract

This working paper provides with Japanese catches of shortfin mako (*Isurus oxyrinchus*) caught by Japanese coastal fisheries during 1994 and 2016. 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 shortfin mako to sharks). Estimated catches of shortfin mako 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 90 % of annual total catches except for the catch in 2005. Yearly changes in the estimated total catches had a large fluctuations between 156 and 574 tons. Recently, it had gradually increased from 222 tons in 2011 to 506 tons in 2016.

Introduction

Shortfin mako (*Isurus oxyrinchus*) is incidentally caught by Japanese coastal fisheries. Most of the Japanese coastal catches of pelagic sharks are occupied by the longline fisheries as well as large mesh drift net (Kimoto et al. 2012). 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 shortfin mako caught by Japanese coastal fisheries during 1994 and 2016.

Materials and Methods

Japanese coastal fisheries can be 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 2016 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 2016, however, it has a one or two-year time lag and shark species are aggregated into one category “sharks” since 1968. 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 2016 are shown in **Table A1**. In addition, yearly changes in

gear-specific catches of North Pacific spiny dogfish (*Squalus suckleyi*) from 1994 to 2016 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 shortfin mako to all pelagic sharks caught by three types of fisheries during 1994 and 2016 are shown in **Table A3**. “Kesenuma” is a major fishing port located in the eastern part of Japan where the most of the shortfin mako 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 2016 includes information on species of sharks, catch number, and catch weight etc.. The processed weight was converted into round weight using the ratio of conversion factors 1.2 for the data before 2011, and 1.6 for the data on and after 2011. The weight data before 2011 were revised using the ratio 1.6/1.2 (IOTC 2013). Yearly changes in retained catches (kg) of shortfin mako, all sharks, and the ratio of shortfin mako 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 shortfin mako = Catch of sharks (“Norin Toukei”) * Ratio of shortfin mako to sharks (“Gyoseki”),

(2) Japanese other longline

Catch of shortfin mako = Catch of sharks (“Norin Toukei”) * Ratio of shortfin mako to sharks (“Gyoseki”), where the catch of spiny dogfish is excluded from the catch of sharks.

(3) Japanese large mesh drift net

Catch of shortfin mako = Catch of sharks (“Norin Toukei”) * Ratio of shortfin mako 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 shortfin mako caught by this fishery was not estimated because we have no information about the ratio of shortfin mako to all sharks.

(5) Japanese trap net

Catch of shortfin mako = Catch of sharks (“Norin Toukei”) * Ratio of shortfin mako 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.

(6) Japanese other fishery

Catch of shortfin mako = Catch of sharks (“Norin Toukei”) * Ratio of shortfin mako 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 and Discussion

Japanese coastal catches of shortfin mako were estimated based on the Japanese statistical year book from 1994 to 2016. Estimated annual catches of shortfin mako by coastal fisheries showed that the total annual catches of longline fisheries as well as large mesh drift net were accounted for more than 90 % of annual total catches except for 2005 (**Table 1** and **Figure 1**). In contrast, the estimated catches by other fisheries such as trap net and other fishery were very small below 15 tons throughout the years except 42 tons in 2005 and 26 tons in 2016. Yearly changes in the estimated total catches had a large fluctuations between 156 and 574 tons. Recently, it had gradually increased from 222 tons in 2011 to 506 tons in 2016. The estimated catches of shortfin mako had remarkably increased in 1996 and 2009 (**Figure 1**) due to the increase in the ratio of retained catch of shortfin mako to sharks (**Table A4**). However, the remarkable increase of the catch in 2016 had no relation with increase of the ratio. In this study, we did not show the total amount of the discard or release of the shortfin mako due to the lower values. In future work, it is important to explore the estimation of the discard/released catches.

References

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- Yokawa, K. 2012. Blue sharks caught by Japanese large mesh drift net fishery in the north Pacific in 1981 – 1993. ISC/12/SHARKWG-1/10.

Table 1. Yearly changes in estimated total catches (tons) of shortfin mako caught by various fisheries from 1994 to 2016.

Year	Coastal longline	Other longline	Large mesh drift net	Trap net	Other fishery
1994	37.4	20.5	123.0	14.1	3.6
1995	31.9	24.2	103.1	11.2	2.0
1996	221.6	126.7	101.1	10.5	3.5
1997	121.2	59.4	127.5	13.6	1.5
1998	13.0	5.1	130.2	11.2	0.9
1999	143.1	52.7	176.4	11.7	1.2
2000	61.4	28.0	155.6	11.7	2.0
2001	139.4	47.5	155.7	11.9	1.8
2002	78.2	28.3	121.9	4.1	0.6
2003	11.7	4.8	228.7	5.2	0.5
2004	16.2	6.0	133.5	0.4	0.3
2005	36.4	12.5	154.9	41.7	1.2
2006	5.9	2.0	177.9	5.4	0.3
2007	24.0	9.6	243.8	12.2	2.4
2008	64.1	33.0	212.5	12.5	1.2
2009	183.5	95.0	294.2	1.0	0.5
2010	68.0	52.3	272.0	18.4	1.3
2011	3.3	44.5	163.0	11.4	0.0
2012	5.0	4.5	229.5	1.0	0.9
2013	30.4	16.8	344.7	7.4	2.0
2014	3.4	3.8	263.2	3.3	0.0
2015	1.3	0.9	334.1	11.2	0.3
2016	20.0	12.6	448.3	25.7	0.0

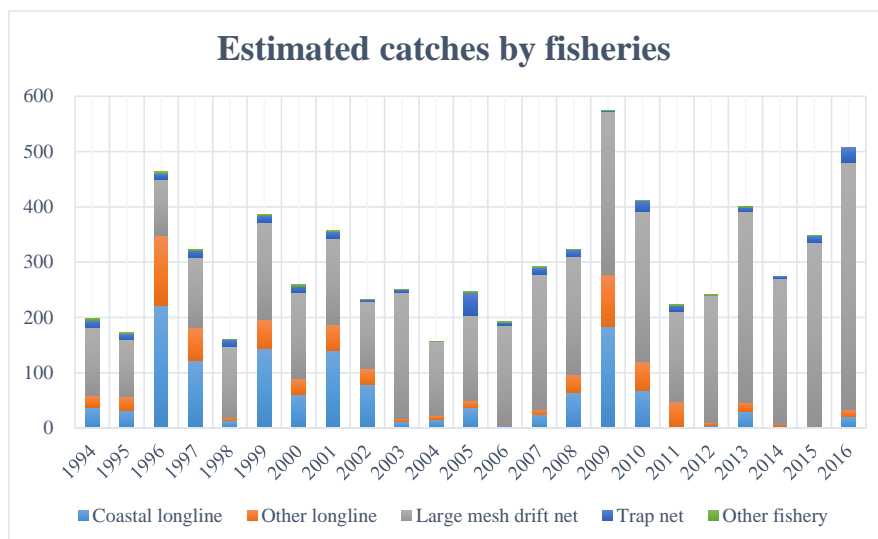


Figure 1. Yearly changes in estimated total catches (tons) of shortfin mako caught by various fisheries from 1994 to 2016.

Appendix tables

Table A1. Yearly changes in gear-specific catches (tons) of sharks from Japanese statistical year book (“Nourin-toukei”) during 1994 and 2016. The values in 2016 are provisional.

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
2015	985	1098	3581	70	105	3
2016	800	800	3100	0	200	0

Table A2. Yearly changes in gear-specific catches (tons) of North Pacific spiny dogfish from Japanese statistical year book (“Nourin-toukei”) during 1994 and 2016. The values in 2016 are provisional. Note that the catches of other gears unrelated to the shortfin mako catch are not included in this table.

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
2015	407	15	58	1
2016	297	0	78	0

Table A3. Catch ratios of shortfin mako to all pelagic sharks caught by three types of fisheries during 1994 and 2016. The ratios were estimated using RJB data.

Year	Trap net	Other fishery	Large mesh drift net in Kesenuma
1994	0.238	0.059	0.083
1995	0.238	0.059	0.083
1996	0.238	0.059	0.083
1997	0.238	0.059	0.083
1998	0.238	0.059	0.083
1999	0.238	0.059	0.083
2000	0.238	0.059	0.083
2001	0.238	0.059	0.083
2002	0.095	0.026	0.060
2003	0.112	0.030	0.076
2004	0.009	0.022	0.055
2005	0.969	0.046	0.068
2006	0.164	0.031	0.070
2007	0.408	0.037	0.094
2008	0.245	0.029	0.074
2009	0.025	0.018	0.089
2010	0.317	0.048	0.085
2011	0.238	0.007	0.083
2012	0.068	0.124	0.083
2013	0.238	0.084	0.104
2014	0.237	0.153	0.068
2015	0.238	0.127	0.093
2016	0.211	0.098	0.145

Table A4. Yearly changes in retained catches (kg) of shortfin mako, all sharks, and the ratio of shortfin mako to all sharks caught by coastal and other longline fishery and the data come from logbook data (“Gyoseki”) during 1994 and 2016.

Year	Shortfin mako	All sharks	Ratio
1994	9,617	527,077	0.018
1995	23,663	1,247,142	0.019
1996	231,759	2,043,344	0.113
1997	87,772	1,540,715	0.057
1998	3,887	764,412	0.005
1999	2,388	39,135	0.061
2000	2,087	69,070	0.030
2001	3,564	67,295	0.053
2002	3,981	102,207	0.039
2003	889	114,821	0.008
2004	3,092	296,151	0.010
2005	1,864	118,537	0.016
2006	559	204,669	0.003
2007	1,505	137,100	0.011
2008	26,655	790,150	0.034
2009	61,880	669,151	0.092
2010	35,212	668,693	0.053
2011	23,783	503,888	0.047
2012	3,128	609,238	0.005
2013	20,649	1,043,684	0.020
2014	4,638	1,004,898	0.005
2015	1,110	836,481	0.001
2016	51,571	2,066,504	0.025