

Blue marlin (*Makaira nigricans*) catch and size data of Taiwanese fisheries in the Pacific Ocean

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Abstract

The average annual catch of blue marlin of Taiwanese fisheries in the Pacific Ocean from 2009 to 2018 was 6,356 M.T., and the major catch caught by the offshore longline fishery. The mean length of blue marlin catch seemed relatively stable (ranging between 172.8 and 186.8 cm LJFL, lower jaw fork length) for the distant-water tuna longline fishery during 2009-2018, and the sample size had not changed much over the last 10 years.

Keywords: fishery information, catch and length data, blue marlin, Taiwan

Introduction

Blue marlin (*Makaira nigricans*) is a highly migratory species which inhabits widely in the Pacific Ocean between the latitudes of 45°N and 45°S (Molony, 2008; Su et al., 2011). Based on genetic analyses (Graves and McDowell, 2003) and fishery-dependent catch-rate data (Kleiber et al., 2003), blue marlin has been considered a single stock in the Pacific Ocean. The foregoing assumptions have also been confirmed by the tagging experiments which have demonstrated that blue marlin migrate long distances and throughout the Pacific basin (Hinton, 2001).

This paper aims to provide updated available fishery data for blue marlin caught in the Pacific Ocean by Taiwanese fisheries, including catch estimates by fishery and size frequency data in lower jaw fork length.

Materials and methods

Nominal catch data of blue marlin by fisheries in the Pacific Ocean were compiled from the Oversea Fisheries Development Council (OFDC), as well as the Taiwan Fisheries Yearbooks. For the Taiwanese distant-water tuna longline fishery, the blue marlin catches were estimated based on recovered logbooks, commercial data (before 2014), and landing declaration data (after 2014) (Fisheries Agency, 2019). For the Taiwanese offshore longline fishery, the blue marlin catches were estimated based on

the landing records from local fishing markets due to a low recovery rate of logbook in early years. Landing reports from foreign ports for the offshore longline fishery have been available since 2000 (Su et al., 2014), and the blue marlin catches can be further estimated. However, the information on those landing reports retrieved without location information between 2000 and 2002. After 2016, all offshore longline fishery vessels operating outside the EEZ of Taiwan all are requested to report their daily fishery data through e-logbook system. And the blue marlin catches of those offshore longline fishery vessels were estimated based on logbooks and landing declaration data as the data reporting requirement of Taiwanese distant-water tuna longline fishery. Catch information of the coastal fisheries such as gillnets, set-nets, and harpoons were compiled from municipal fishery data collection system.

The size data, length and weight (after 2009) of individual catch of all species are compiled from the first 30 fish caught for each setting recorded on logbook since 2003. The size data were collected through on-board sampling, in which the measurement was carried out by fishermen. Since 2017, our government has reported weight frequency instead of length data as size data to ISC.

Results and discussion

Blue marlin catch estimates of Taiwanese fisheries in the Pacific Ocean are summarized in Table 1, and the average annual catch from 2009 to 2018 is 6,356 M.T..

Most of blue marlin catch came from the offshore longline fishery (Table 1 and Fig. 1), and most of them were caught in the North Pacific Ocean (Table 1). The blue marlin catches of the offshore longline fishery have gradually increased from about 900 M.T. in the late 1950s to about 4,000 M.T. in the 1990s. Since landing reports from foreign ports have been collected after 2000, the blue marlin catches increased by 3,066 - 4,375 M.T. in the early 2000s with a decreasing trend to about 2000 M.T after 2006. It should be noted that, as mentioned in the “Materials and methods”, landing reports from foreign ports have incomplete information between 2000 and 2002, and these catches have not been disclosed in National Report of Chinese-Taipei of the ISC (Fisheries Agency, 2019).

The second largest blue marlin catches came from the distant-water tuna longline fishery (Table 1 and Fig. 1). With the development of deep freezer of this fishery since 2000 (Liu et al., 2015), there is an increasing trend in catches of blue marlin from this fishery. It can be explained with the characteristic of blue marlin prefers to inhabit the tropical warm waters of temperature above 26°C (Block et al., 1992).

In contrast, very small catches of blue marlin were taken from the coastal fisheries, e.g. coastal gillnet, coastal set-net, coastal longline and coastal other fisheries (Table 1 and Fig. 1).

Lower jaw to fork length (LJFL) frequency distributions of blue marlin catch of the Taiwanese distant-water longline fishery in the Pacific Ocean during 2009-2018 is shown in Fig.2. Table 2 provides summary information on blue marlin lower jaw fork length from 2009 to 2018. Except for the higher sample sizes (10,215) observed in 2010, the sample sizes in other years were not significantly varied, ranged from 6,065 to 8,539. The mean length of the measured catches was relatively stable (ranged from 172.8 to 186.8 cm LJFL) during 2009-2018. However, the blue marlin with LJFL less than 100 cm were not found in 2014 and 2016.

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Table 1. Catch estimates of blue marlin by the Taiwanese fisheries in the Pacific Ocean.

DWLL_NP: North Pacific catches of distant-water tuna longline; DWLL_SP: South Pacific catches of DWLL; OSLL_NP: North Pacific catches of offshore longline; OSLL_SP: South Pacific catches of OSLL; OSGN: offshore gillnet; OSOT: offshore others; CTGN: coastal gillnet; CTSN: coastal set-net; CTHP: coastal harpoon; CTLL: coastal longline; CTOT: coastal other fisheries.

	DWLL NP	DWLL SP	OSLL NP	OSLL SP	OSGN	OSOT	CTGN	CTSN	CTHP	CTLL	CTOT
1958			887								
1959			781								
1960			948								
1961			703								
1962			628								
1963			691								
1964	-	19	934								
1965	-	40	1,016								
1966	-	52	957								
1967	-	113	898		-	167	-	-	317	-	-
1968	-	193	1,433		30	120	-	-	649	-	-
1969	2	158	1,230		58	103	-	-	465	-	-
1970	-	163	1,385		21	70	-	1	604	-	-
1971	-	104	1,331		13	118	-	-	473	-	-
1972	-	203	1,205		14	50	-	-	490	-	-
1973	-	225	1,650		12	265	-	-	275	-	-
1974	2	159	2,139		6	146	-	1	355	3	-
1975	10	138	2,628		3	207	-	-	421	-	-
1976	24	152	1,291		9	162	-	-	511	-	-
1977	8	137	1,175		11	110	-	-	391	-	-
1978	-	63	1,633		15	7	-	1	364	-	-
1979	20	402	1,626		19	164	-	3	362	-	-
1980	51	439	1,134		35	170	-	-	444	-	-
1981	26	437	1,813		35	69	-	-	313	1	-
1982	10	294	2,129		7	120	-	-	306	-	-
1983	1	271	2,121		26	127	-	-	741	-	-
1984	-	382	1,789		22	111	-	-	960	-	-
1985	-	212	1,187		11	43	-	9	747	-	-
1986	-	184	1,723		90	107	-	4	839	-	-
1987	9	189	4,617		9	1	-	12	973	1	-
1988	-	320	2,822		8	589	-	20	658	-	-
1989	47	398	2,644		13	8	1	10	640	-	1
1990	19	418	1,730		24	143	-	3	427	-	-
1991	136	584	2,152		48	152	2	4	338	-	-
1992	13	109	3,771		34	110	6	25	432	2	-
1993	259	190	3,876		38	81	3	44	400	-	1
1994	-	603	3,007		30	7	-	12	206	-	-
1995	76	250	3,820		33	5	3	15	895	-	-
1996	39	148	3,298		33	10	2	13	270	-	-
1997	20	84	3,625		44	-	4	5	194	38	-
1998	21	188	3,603		58	-	1	8	91	-	1
1999	53	78	3,362		30	-	2	21	135	2	-
2000	75	39	(7737)		40	2	0	24	186	-	-
2001	209	376	(8726)		56	0	1	18	229	-	-
2002	138	357	(8685)		52	6	11	13	32	-	-
2003	218	989	7,467	110	89	4	18	20	52	-	-
2004	372	1,084	6,300	121	84	5	9	14	36	-	4
2005	376	1,130	7,254	150	55	16	10	8	48	-	-
2006	363	1,315	5,366	385	-	-	15	12	30	-	-
2007	275	996	4,842	278	6	0	11	3	20	-	-
2008	255	655	5,222	259	1	1	15	10	15	-	-
2009	225	1,113	4,413	343	3	1	9	9	9	-	-
2010	409	1,081	4,550	1,144	5	0	22	5	15	-	1
2011	675	656	3,950	1,115	2	9	16	3	17	-	-
2012	287	997	3,803	1,065	1	0	12	6	16	7	-
2013	253	802	4,354	1,254	-	0	6	2	16	-	-
2014	146	1,079	4,715	948	-	5	11	4	124	-	-
2015	468	1,560	3,838	938	-	0	14	3	177	-	-
2016	600	1,168	2,798	1,160	-	0	23	3	158	-	3
2017	498	761	3,479	1,144	-	0	7	-	138	-	-
2018	325	585	3,176	702	-	-	11	-	108	-	-

(-): Inconsistent with the values disclosed in National Report of Chinese-Taipei of the ISC (Fisheries Agency, 2019). Due to landing reports from foreign ports with incomplete information between 2000 and 2002, so the value disclosed in National Report of Chinese-Taipei does not include value of landing reports from foreign ports, which are 3,681, 4,202 and 4,375.

Table 2. Summary of blue marlin length (Lower jaw to fork length, LJFL in cm) data collected from the Taiwanese distant-water tuna longline fishery in the Pacific Ocean during 2009-2018.

Year	sample size	Mean	Median	Min	Max
2009	7,006	175.9	174	75	299
2010	10,215	176.2	175	60	298
2011	8,354	175.3	173	75	296
2012	7,530	179.0	178	70	297
2013	6,056	182.5	181	67	299
2014	7,028	180.7	178	102	320
2015	8,539	186.8	183	85	360
2016	7,975	180.2	181	105	318
2017	8,069	172.8	170	70	360
2018	6,826	180.3	178	47	314

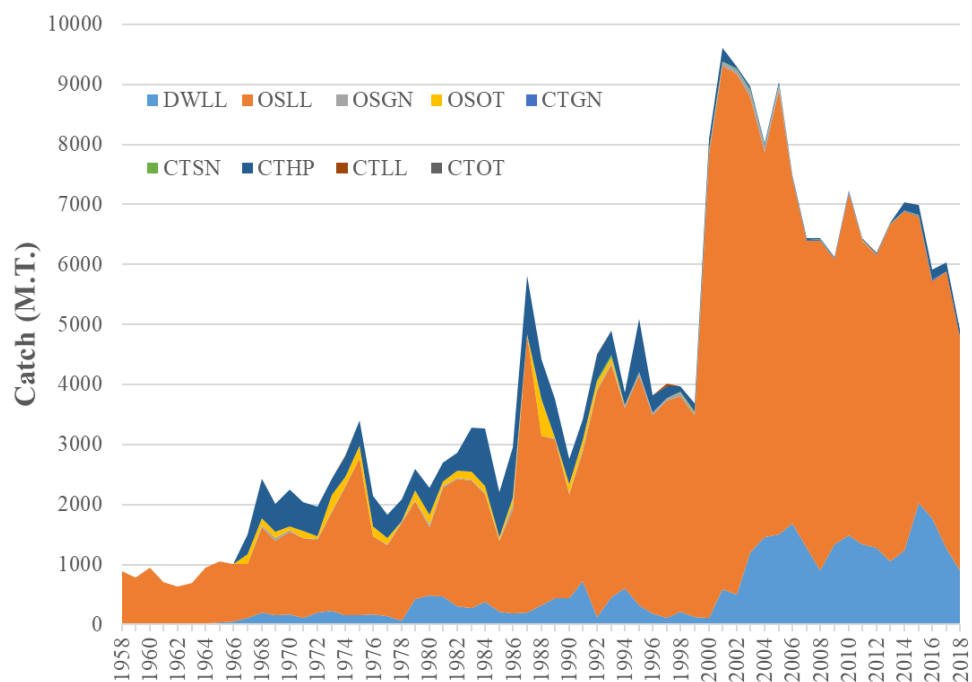


Fig. 1 Catch estimates of blue marlin by the Taiwanese fisheries in the Pacific Ocean. DWLL: distant-water tuna longline; OSLL: offshore longline; OSGN: offshore gillnet; OSOT: offshore others; CTGN: coastal gillnet; CTSN: coastal set-net; CTHP: coastal harpoon; CTLL: coastal longline; CTOT: coastal other fisheries.

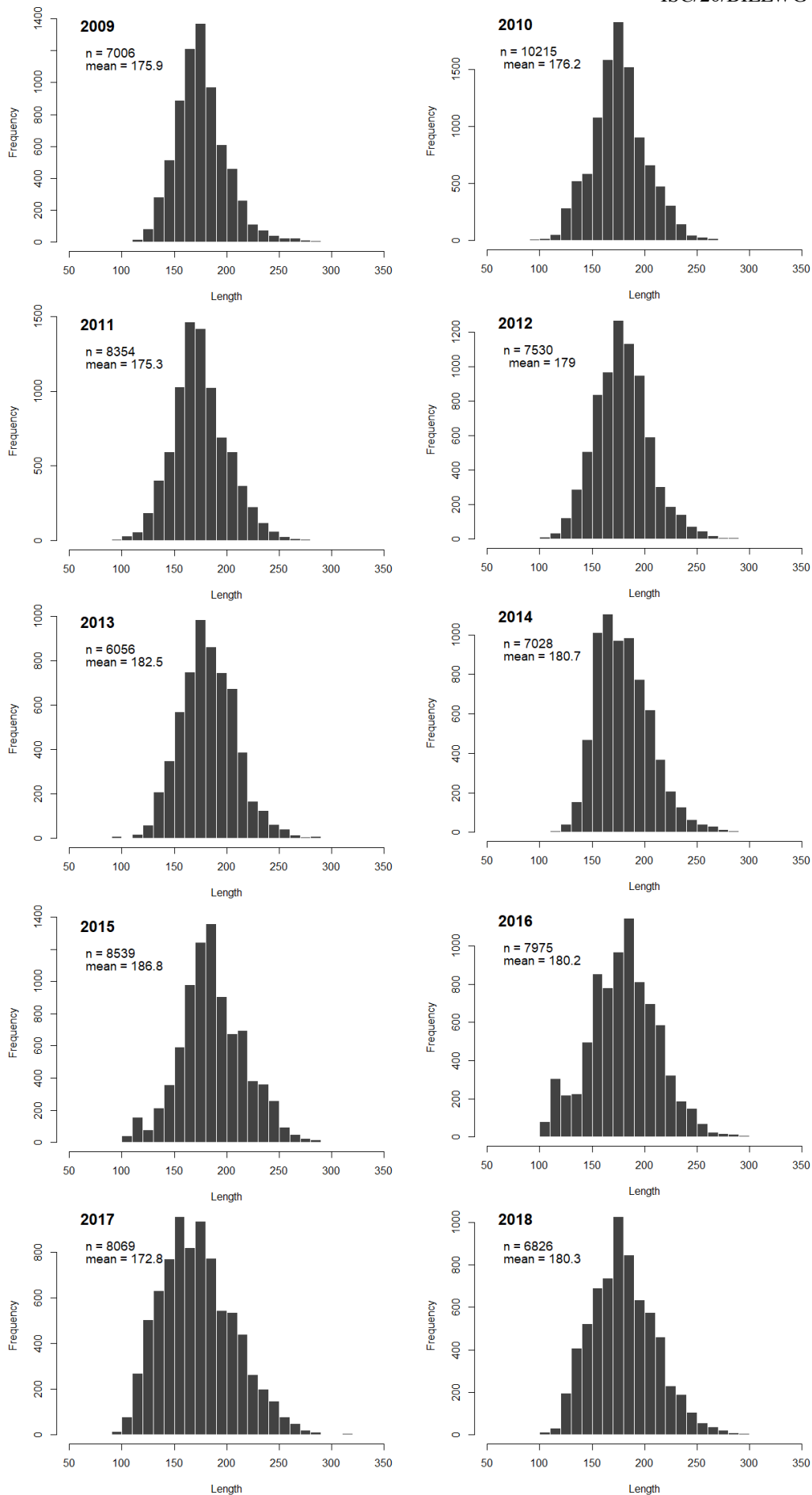


Fig. 2 Length frequency distributions by year for blue marlin caught by the Taiwanese distant-water tuna longline fishery in the Pacific Ocean.