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

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Abstract

Blue marlin (*Makaira nigricans*) is a highly migratory pelagic species widely distributed throughout the Pacific Ocean and assessed as a single Pacific-wide stock. This study compiles updated fishery-dependent information on blue marlin catches and size composition from Taiwanese fisheries operating in the Pacific Ocean to support ongoing stock assessment efforts. Nominal catch data were assembled from official statistics, logbooks, landing declarations, and market records for distant-water tuna longline, offshore longline, and coastal fisheries. Size data, expressed as lower jaw fork length (LJFL), were obtained from onboard sampling and logbook records. The average annual blue marlin catch during 2009 – 2024 was approximately 5,310 metric tons, with offshore longline fisheries contributing the majority of catches, primarily from the North Pacific Ocean. Catches from the distant-water tuna longline fishery increased after 2000, while coastal fisheries accounted for only a small proportion of total landings. Length-frequency analyses for 2009 – 2024 showed relatively stable size composition, with most individuals ranging from 150 to 200 cm LJFL and limited interannual or seasonal variation. Mean LJFL remained consistent over time, although sample sizes declined in recent years and juveniles (<100 cm LJFL) were rarely observed. These updated catch and size data provide essential inputs for regional blue marlin stock assessments.

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). 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 tagging experiments, which have demonstrated that blue marlin migrate over long distances 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, 2025).

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 was retrieved without location information between 2000 and 2002. After 2016, all offshore longline fishery vessels operating outside the EEZ of Taiwan are required to report their daily fishery data through the 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, weight frequency was reported 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 2024 is 5,310 M.T. Most of the blue marlin catch came from the offshore longline fishery (**Table 1 and Figure 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, 2025).

The second largest blue marlin catches came from the distant-water tuna longline fishery (**Table 1** and **Figure 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 Figure 1**), with harpoon fishery being the primary source of blue marlin catch among them.

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 - 2024 is shown in **Figures 2 and 3**. The results indicated that the annual and seasonal variations in BUM length were minor, with most individuals ranging from 150 to 200 cm. In some periods, such as the second quarter of 2014 and 2023, and the first quarter of 2024, the length composition was smaller.

Table 2 provides summary information on blue marlin lower jaw fork length from 2009 to 2024. Except for the higher sample size (10,215) observed in 2010, the sample sizes showed a marked decline in the recent four years, all below 3,000. The mean length of the measured catches was relatively stable (ranged from 172.8 to 186.8 cm LJFL) during 2009 - 2024. However, the blue marlin with LJFL less than 100 cm were not found in 2014, 2016, 2023, and 2024.

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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	(7,737)		40	2	+	24	186	-	-
2001	209	376	(8,726)		56	+	1	18	229	-	-
2002	138	357	(8,685)		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	+	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	+	22	5	15	-	-
2011	675	656	3,950	1,115	2	9	16	3	17	-	-
2012	287	997	3,803	1,065	1	+	12	6	16	7	-
2013	253	802	4,354	1,254	-	+	6	2	16	-	-
2014	146	1,079	4,715	948	-	5	11	4	124	-	-
2015	468	1,560	3,838	938	-	+	14	3	177	-	-
2016	600	1,168	2,798	1,160	-	+	23	3	158	-	3
2017	498	761	3,479	1,144	-	+	7	-	138	-	-
2018	325	585	3,176	702	-	-	11	-	108	-	-
2019	280	404	3,079	720	-	+	22	-	99	-	-
2020	163	281	1,792	623	10	+	20	2	115	-	-
2021	159	215	1,939	386	2	1	28	2	107	-	-
2022	168	199	2,078	525	16	9	64	2	128	-	-
2023	127	261	2,171	505	7	1	30	2	75	-	-
2024	306	300	3,039	592	244	6	22	2	77	-	-

(): Inconsistent with the values disclosed in National Report of Chinese-Taipei of the ISC (Fisheries Agency, 2025). 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. "+"：bellow 499kg.

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 - 2024.

Year	Median	Mean	Min	Max	Sample size
2009	174	175.9	75	299	7,006
2010	175	176.2	60	298	10,215
2011	173	175.3	75	296	8,354
2012	178	179.0	70	297	7,530
2013	181	182.5	67	299	6,056
2014	178	180.5	102	298	7,019
2015	183	186.7	85	300	8,529
2016	181	180.1	105	300	7,969
2017	170	172.6	70	300	8,056
2018	178	179.3	79	300	6,355
2019	171	173.5	78	300	6,542
2020	173	175.2	68	300	4,283
2021	173	175.2	89	299	2,881
2022	180	182.8	98	296	2,997
2023	176	179.6	112	299	2,463
2024	171	173.5	101	299	2,527

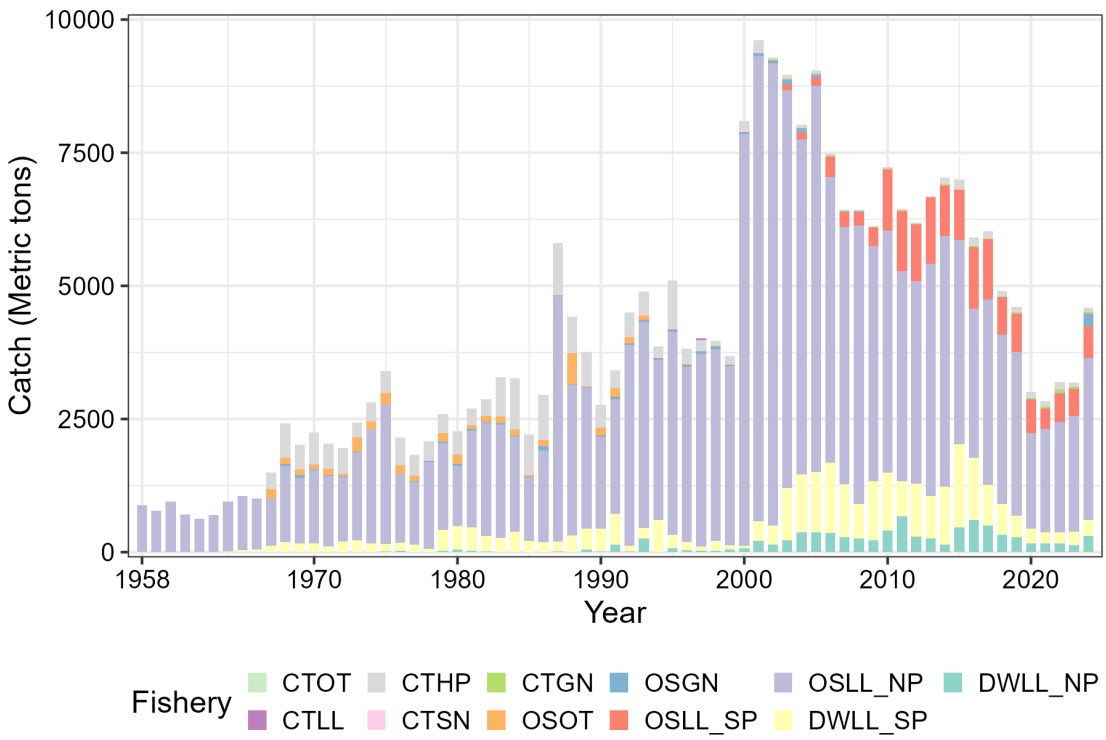

Figure 1. Catch estimates of blue marlin by the Taiwanese fisheries in the Pacific Ocean. DWLL: distant-water tuna longline; OSLL: offshore longline; OSGN: offshore gillnet; OSOT: offshore others; CTGN: coastal gillnet; CTSN: coastal set-net; CTHP: coastal harpoon; CTLL: coastal longline; CTOT: coastal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

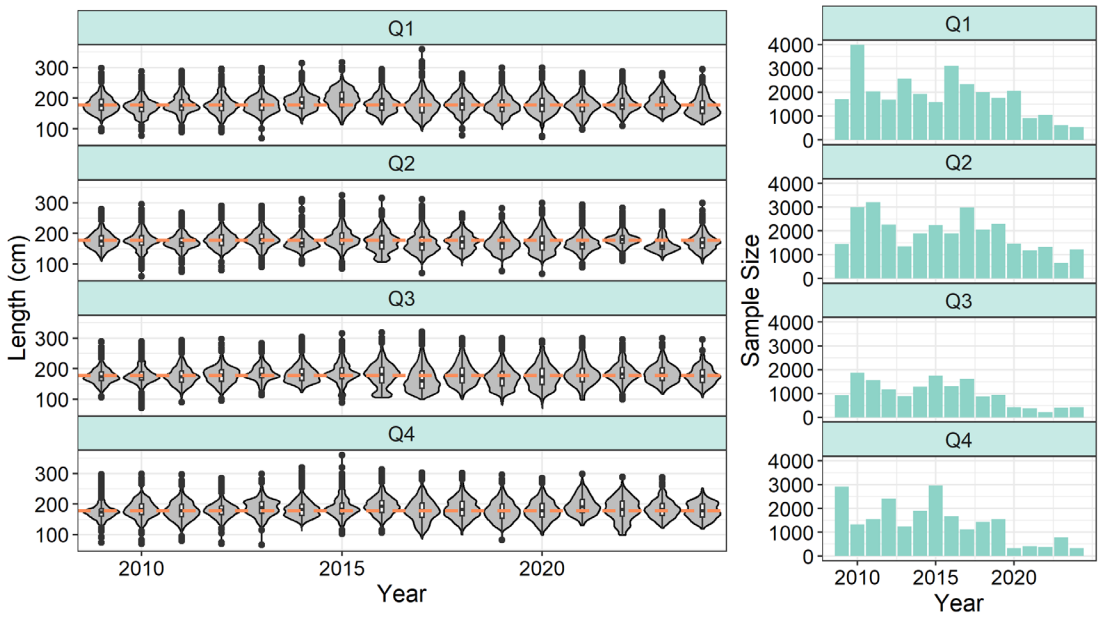

Figure 2. Length frequency distribution by year-season for blue marlin caught by the Taiwanese distant-water tuna longline fishery in the Pacific Ocean. The left panel shows violin plots of length distributions by season across years, while the right panel presents the sample sizes by season across years.

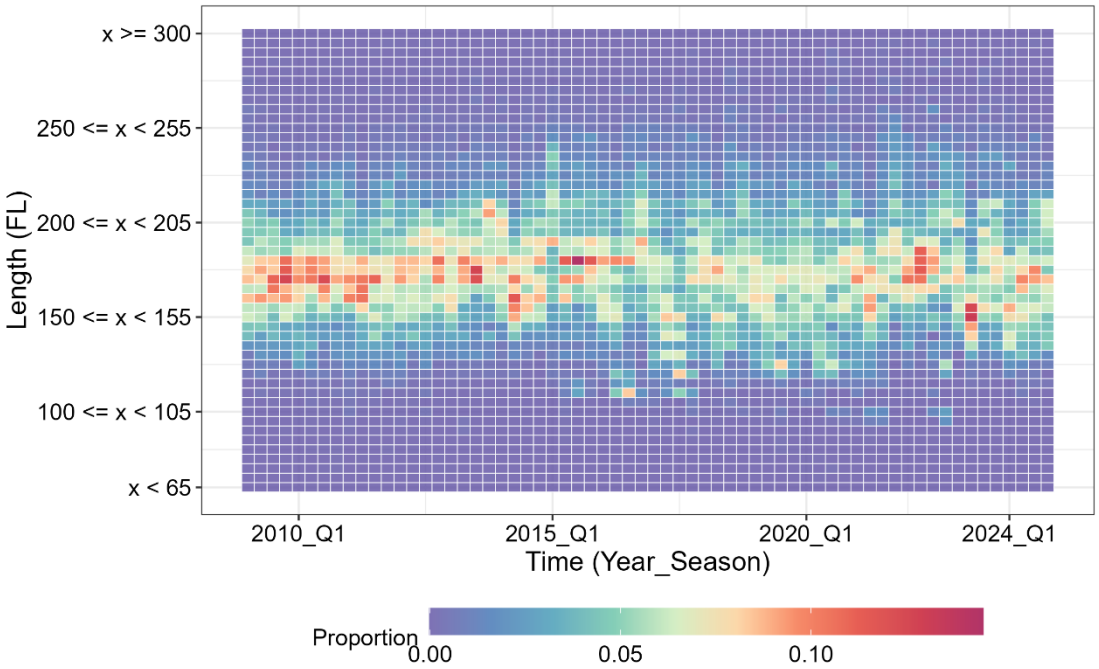

Figure 3. Length frequency heatmap by year-season for blue marlin caught by the Taiwanese distant-water tuna longline fishery in the Pacific Ocean.