

RECENT TRENDS IN CATCH, EFFORT AND SIZE FOR WHITE AND BLUE MARLINS
 BASED ON DATA FROM THE JAPANESE ATLANTIC FISHERY

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Japanese longline effort now strongly tends to concentrate in particular areas and seasons. The effort concentration is mainly directed at the bluefin tuna and the bigeye tuna in the North Atlantic. It is expended mostly to the bigeye tuna and the southern bluefin tuna in the South Atlantic. The effect of such effort concentration that may have on the billfish catch could not be neglected in the use of current Japanese data. This manuscript provides the recent trend in this point for a particular area, with updated basic estimates for the white marlin and the blue marlin on the Atlantic-wide basis as necessary procedures.

Catch and effective effort from 1956 to 1977

In estimating the effective effort, we followed Honma (1974) as previously. Three underlying assumptions to have it calculated were used; the single Atlantic-wide stock and the discrete North and South Atlantic stocks. The catch and effective effort from 1956 to 1977 are given in Tables 1 and 2 for the white marlin and blue marlin, respectively.

White marlin: The most noticeable change in these basic figures in recent years occurred in 1977 on all of the three stock hypothesis. For the North Atlantic, the 1977 catch plummeted suddenly as low as roughly 17 percent of the 1976 catch. The calculated effective effort also reduced, although in lesser degree. The resultant CPUE in 1977 was about 36 percent of the 1976 value. For the South Atlantic, where only a small amount of effective effort has exerted after 1973, the 1977 catch increased nearly 10 times the catch in 1976 with increased effective effort, although in lesser degree. The 1977 CPUE was roughly 3 times the value of the preceding year. The prominent 1977 low in CPUE for the whole Atlantic is attributed to the drop in catch for the North Atlantic.

Blue marlin: The 1977 low in catch and effective effort for the North Atlantic and, consequently, for the whole Atlantic is indicated for the blue marlin, too. The 1977 high in these estimates for the South Atlantic is also observed. In any of the three cases, the difference between the 1976 and 1977 CPUE's is not so remarkable as for the white marlin. The gradual downward trend in CPUE to the lowest level from 1973 to 1977 is indicated.

Shift in nominal effort and its possible effect especially on the 1977 white marlin catch

Fig. 1 shows the change in nominal effort from the inception of the Japanese fishery to 1977 for six ICCAT billfish areas as given in Fig. 2. In Area 5 of the western South Atlantic, substantially no fishing effort

has been expended after 1973. The recent highest occurred in 1975 in Area 4, where the effort is mostly directed at the bigeye tuna and bluefin tuna from off the West African coast to the Mediterranean. However, especially important for the white marlin and blue marlin are the western tropical and subtropical areas of the North Atlantic Ocean. These areas are represented by Areas 1, 2 and 3. The white marlin catch in these three areas is accounted for around 90 percent of the total North Atlantic catch during the recent several years (Table 3). Of these areas, the proportion of catch from Area 1 has recently increased and reached well over half of the total North Atlantic catch after 1973. The blue marlin catch in Areas 1, 2 and 3 is also accounted for roughly 90 percent of the total North Atlantic catch recently (Table 4). The largest proportion of catch (below half on the average) is shared by Area 3.

The effort expended in a recent few years in Area 1 which is the most representative for the white marlin catch is obviously not for the white marlin but for the bluefin tuna. The seasonal change in nominal effort in this area indicates directly the recent shift in the strategy of Japanese longline fleets. Fig. 3 shows the quarterly changes in nominal effort and hook rate of the white marlin in the northern half of Area 1 (Gulf of Mexico area north of 25°N) from 1972 to 1977. Fig. 4 indicates these changes in the southern half of Area 1 (Gulf of Mexico area between 20°N and 25°N) during the same period. In the northern area, the nominal effort peaks in the third quarter in 1972 and 1973. It peaks in the second quarter after 1974, with rapidly increasing amount. The shift from the third quarter to the second quarter of the peak corresponds to the shift from the yellowfin tuna to the bluefin tuna of the target species. In addition, the proportion of effort in the third quarter has decreased considerably, as this situation proceeds, and fell to the lowest in 1977. The hook rate of the white marlin, on the other hand, consistently peaks in the third quarter, except for 1972. Consequently, the substantial part of effort expended in this area is not exerted effectively upon the capture of the white marlin during a recent few years, especially in 1977.

In the southern area, effort has been mainly expended in the second and third quarters and no such shift in effort as seen in the northern area is indicated until 1976. In 1977, however, effort drastically reduced as nearly all of it was shifted out of this area. Especially, the lack of effort in the third quarter seems to be responsible for very few number of the white marlin caught in 1977.

It is clear that, in 1977, nearly all of effort in the total Area 1 or the Gulf of Mexico area was expended during the period in which the availability of the white marlin is very low. This will explain the sharp 1977 low in the effective effort for the North Atlantic. However, it is another question whether or not this reduction is large enough to describe the change in availability of the white marlin in recent Japanese data in connection with the status of the stock.

Enlarged annual size frequencies

Tables 5 and 6 present the size frequencies of the white and blue marlins simply enlarged from the limited pooled data to the annual catch in Tables 1 and 2. For the North Atlantic, the data used are essentially the same as those in our previous report (Kikawa and Honma 1978). The size frequencies are here shown in the 10 cm class interval and smoothed by the moving average of three. Prior to 1974, size data of billfishes are generally scarce. Years not furnished with size data over 50 individuals are neglected. Some contradiction occurs in the earliest statistical figures, where the number of fish measured exceeds the total estimated catch (South Atlantic white marlin for 1956 and North Atlantic white marlin for 1957). In that case, the size frequencies give the actual numbers measured. After 1975, Japanese longline fishermen in the Atlantic Ocean have provided size data made on board on the continuing basis.

In many years after 1956, the white marlin have occurred as a broad uni-modal group on the smoothed size frequencies in the 10 cm class interval. Generally, the South Atlantic fish are larger in the average size, as already known (Ueyanagi et al. 1970). Throughout the period covered, the average size of fish has changed from year to year but indicates no definite trend for both the North and the South Atlantic fish.

The blue marlin have much wider range in size. During the period covered after 1956, two broad modal groups are discernible at intervals, one with mode below 200 cm and the other with mode above 200 cm eye-fork length, for both the North and the South Atlantic fish. The annual change in the average size has been rather limited since the earlier years, except for the 1956 data from the South Atlantic fish. No definite trend in the average size is indicated for both.

Literature cited

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- Kikawa, S. and M. Honma 1978. Status of the billfish caught by the longline fishery in the North Atlantic Ocean, 1956-1975. ICCAT Col. Vol. Sci. Pap., VII (SCRS-1977), 170-174.
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Table 1 Estimates of Japanese longline catch, effort and CPUE for Atlantic white marlin, 1956-1977.

Year	Whole Atlantic			North Atlantic			South Atlantic		
	C	X	U	C	X	U	C	X	U
1956	5	80	0.066	0	13	0	5	76	0.007
1957	825	1,210	0.069	145	203	0.072	683	1,169	0.059
1958	1,355	4,347	0.031	522	2,747	0.019	833	1,537	0.054
1959	6,779	14,812	0.046	1,133	6,009	0.019	5,646	9,754	0.059
1960	11,306	13,451	0.084	1,311	2,565	0.044	9,993	13,122	0.076
1961	33,114	11,483	0.332	2,155	1,565	0.138	35,959	12,109	0.297
1962	112,557	46,711	0.243	20,379	12,074	0.169	93,278	44,061	0.212
1963	65,513	48,537	0.179	32,521	25,215	0.129	54,417	29,220	0.185
1964	153,415	116,035	0.141	75,458	62,486	0.121	87,957	71,744	0.123
1965	129,367	76,233	0.170	55,870	35,635	0.159	72,497	50,874	0.143
1966	89,186	54,874	0.163	50,139	28,521	0.176	39,047	33,893	0.115
1967	42,510	22,353	0.150	13,011	8,878	0.147	29,499	17,219	0.171
1968	42,957	25,500	0.169	12,513	8,559	0.146	30,444	22,079	0.139
1969	26,976	18,443	0.146	16,248	9,554	0.170	10,728	10,729	0.100
1970	31,787	26,715	0.119	19,692	14,854	0.132	12,105	15,239	0.079
1971	36,359	28,659	0.127	34,438	27,079	0.127	1,921	1,322	0.105
1972	15,333	15,428	0.099	12,361	12,358	0.100	2,972	4,220	0.070
1973	13,215	10,101	0.131	12,502	8,982	0.139	713	913	0.078
1974	12,412	8,759	0.142	12,233	8,637	0.142	179	139	0.129
1975	15,192	16,484	0.052	14,766	16,650	0.089	426	877	0.049
1976	15,839	12,947	0.122	15,785	13,413	0.118	54	133	0.040
1977	3,156	6,556	0.048	2,628	6,184	0.043	528	442	0.119

C: Catch in number X: Effective number of hooks ($\times 10^3$) U: CPUE

Table 2 Estimates of Japanese longline catch, effort and CPUE for Atlantic blue marlin, 1956-1977.

Year	Whole Atlantic			North Atlantic			South Atlantic		
	C	X	U	C	X	U	C	X	U
1956	500	126	0.395	96	17	0.538	404	133	0.202
1957	8,704	3,055	0.284	1,120	295	0.383	7,574	3,578	0.212
1958	9,957	6,754	0.147	3,399	2,810	0.121	6,558	4,825	0.136
1959	22,607	14,403	0.157	6,347	4,416	0.144	16,260	12,754	0.129
1950	27,080	17,542	0.154	5,829	4,570	0.128	21,251	17,819	0.119
1961	43,001	17,424	0.247	4,213	2,556	0.165	38,788	29,723	0.187
1962	111,635	52,781	0.212	51,958	19,640	0.266	59,677	46,065	0.120
1963	95,713	68,945	0.139	51,858	32,448	0.160	43,855	28,561	0.154
1964	83,956	91,867	0.091	80,284	49,747	0.101	33,672	54,103	0.062
1965	44,505	72,961	0.061	26,878	37,374	0.072	17,627	44,404	0.040
1966	21,582	42,682	0.051	11,367	19,438	0.059	10,215	31,139	0.033
1967	10,573	19,854	0.063	5,008	8,051	0.062	5,565	15,803	0.036
1968	9,055	15,937	0.057	4,785	7,926	0.060	4,270	10,683	0.040
1969	13,581	19,891	0.068	9,869	12,339	0.080	3,712	8,721	0.043
1970	11,327	19,823	0.055	8,908	13,866	0.064	2,419	6,013	0.040
1971	18,078	40,321	0.045	16,309	30,818	0.053	1,769	4,649	0.038
1972	5,338	13,712	0.039	4,389	10,331	0.043	949	2,883	0.033
1973	4,626	5,444	0.049	3,273	6,354	0.052	1,353	2,748	0.049
1974	3,593	7,631	0.047	3,389	6,370	0.053	204	435	0.047
1975	8,840	20,051	0.044	8,254	16,947	0.049	586	1,762	0.033
1976	3,265	11,129	0.029	3,227	9,914	0.033	38	256	0.015
1977	1,427	5,837	0.024	1,261	4,428	0.029	166	620	0.027

C: Catch in number X: Effective number of hooks ($\times 10^3$) U: CPUE

Table 3 Proportion of white marlin catch in major North Atlantic billfish areas, 1968-77.

Year	Catch in number		Proportion to North Atlantic catch			
	Whole Atlantic	North Atlantic	Areas 1, 2 & 3	Area 1	Area 2	Area 3
1968	42,957	12,513	0.625	0.127	0.262	0.237
1969	26,976	16,248	0.721	0.036	0.279	0.406
1970	31,787	19,632	0.792	0.372	0.332	0.089
1971	36,359	34,438	0.862	0.302	0.497	0.063
1972	15,333	12,361	0.718	0.388	0.236	0.094
1973	13,215	12,502	0.972	0.538	0.395	0.040
1974	12,412	12,233	0.939	0.597	0.236	0.107
1975	15,192	14,766	0.917	0.718	0.106	0.093
1976	15,839	15,785	0.945	0.515	0.388	0.041
1977	3,156	2,625	0.814	0.573	0.152	0.089

Table 4 Proportion of blue marlin catch in major North Atlantic billfish areas, 1968-77.

Year	Catch in number		Proportion to North Atlantic catch			
	Whole Atlantic	North Atlantic	Areas 1, 2 & 3	Area 1	Area 2	Area 3
1968	9,055	4,785	0.474	0.181	0.135	0.158
1969	13,581	9,869	0.746	0.023	0.252	0.471
1970	11,327	8,908	0.764	0.188	0.372	0.204
1971	18,078	16,309	0.904	0.136	0.202	0.566
1972	5,338	4,389	0.681	0.175	0.151	0.355
1973	4,626	3,273	0.955	0.314	0.384	0.257
1974	3,593	3,389	0.875	0.286	0.297	0.292
1975	8,840	8,254	0.669	0.243	0.054	0.571
1976	3,265	3,227	0.917	0.213	0.380	0.325
1977	1,427	1,261	0.770	0.218	0.106	0.446

Table 5 Enlarged size (eye-fork length) frequencies of white marlin in the Atlantic Ocean.

a. North Atlantic white marlin

e-f	1957	1965	1966	1968	1971	1972	1973	1975	1976	1977
61- 70										
71- 80				350				7		4
81- 90				913				31	14	8
91-100	3		1370	1781			596	368	398	47
101-110	12		3794	3040	4206		2234	1531	2520	275
111-120	28	1194	8707	3128	9057	3189	3596	2958	4188	502
121-130	79	8132	12033	3128	10079	3943	3417	3829	4520	720
131-140	101	15753	11298	2302	7185	2493	1809	2938	2641	557
141-150	92	17099	6785	780	654	927	325	1708	1016	408
151-160	41	10343	3226					625	321	190
161-170	10	3052	1533		92			403	84	147
171-180			568					197	32	83
181-190			84					76	11	48
191-200								29	7	27
201-210								14	7	11
211-220									14	4
221-230									7	
231-240										7
241-250										
251-260										
Mean	134.7	141.7	129.8	119.4	128.6	136.1	128.8	137.9	132.5	142.6

b. South Atlantic white marlin

e-f	1956	1957	1965	1966	1967	1973	1974	1975
61- 70								
71- 80								
81- 90					79			
91-100					236			
101-110			179	1705	236		18	
111-120	22	19	246	2512	560	31	43	88
121-130	46	107	8187	6300	1681	94	58	168
131-140	54	195	16935	8535	4541	172	46	160
141-150	40	198	20782	9332	6952	187	25	113
151-160	18	118	14659	6287	7934	139	13	37
161-170	6	30	6309	2746	4956	63	9	13
171-180		10	2465	1171	2242	19	5	8
181-190		2	645	273			2	7
191-200			89					6
201-210								4
211-220								
221-230								
231-240								
241-250								
251-260								
Mean	135.2	141.3	145.4	140.8	149.6	143.1	140.9	145.2

Table 6 Enlarged size (eye-fork length) frequencies of white marlin in the Atlantic Ocean.

a. North Atlantic blue marlin

e-f	1957	1966	1968	1972	1975	1976	1977
61- 70							
71- 80							
81- 90							
91-100					3		1
101-110				28	8		6
111-120	5	273		28	19	11	4
121-130	27	439	43	28	30	27	14
131-140	36	595	109	83	104	64	32
141-150	93	758	185	83	303	159	72
151-160	142	668	430	139	784	257	114
161-170	208	858	502	193	1403	372	136
171-180	177	595	588	414	1645	418	141
181-190	142	361	557	468	1464	543	140
191-200	75	577	531	496	875	440	125
201-210	49	850	617	413	498	350	112
211-220	13	1034	388	496	250	152	76
221-230	9	868	258	580	206	130	66
231-240	18	811	100	470	157	108	49
241-250	35	648	100	249	124	82	44
251-260	35	485	72	83	74	54	37
261-270	27	325	57	56	69	26	25
271-280	18	163	29		52	11	21
281-290	9	220	14		60	7	13
291-300		110	28		33	4	14
301-310			29		19	4	10
311-320						4	7
321-330						2	3
331-340						4	
341-350						2	
351-360							
361-370							
371-380							
Mean	180.6	190.9	190.4	202.3	183.5	213.4	194.2

b. South Atlantic blue marlin

e-f	1956	1957	1955	1966	1968
61- 70					
71- 80					
81- 90					
91-100					
101-110	2				
111-120	26				26
121-130	43				
131-140	60	126	129	89	155
141-150	56	189	323	293	161
151-160	51	399	388	433	311
161-170	41	795	776	685	285
171-180	24	1172	1428	893	363
181-190	21	1275	2473	1145	363
191-200	19	1105	2538	1213	389
201-210	21	833	1951	1058	338
211-220	15	500	970	798	259
221-230	9	313	647	788	181
231-240		188	711	583	181
241-250		164	840	661	181
251-260		164	840	481	234
261-270		144	517	413	207
271-280		645	300	155	
281-290		104	775	116	130
291-300			517	116	78
301-310			388	24	130
311-320			65		51
321-330					
331-340			65		
341-350			65		
351-360					
361-370					
371-380					
Mean	156.7	192.2	215.1	207.5	209.7

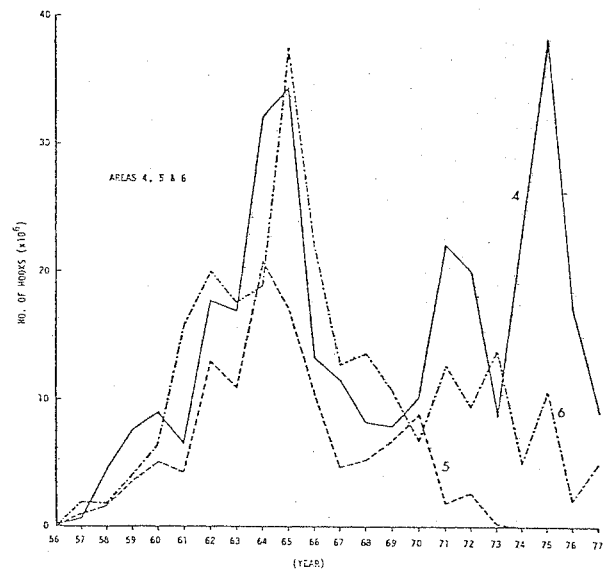
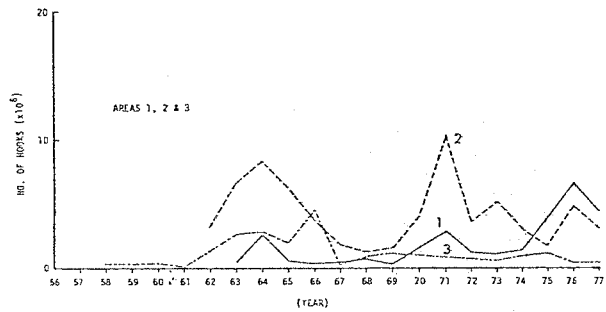


Fig. 1 Change in Japanese nominal effort for ICCAT billfish areas from 1956 to 1977.

Fig. 2 ICCAT billfish areas.

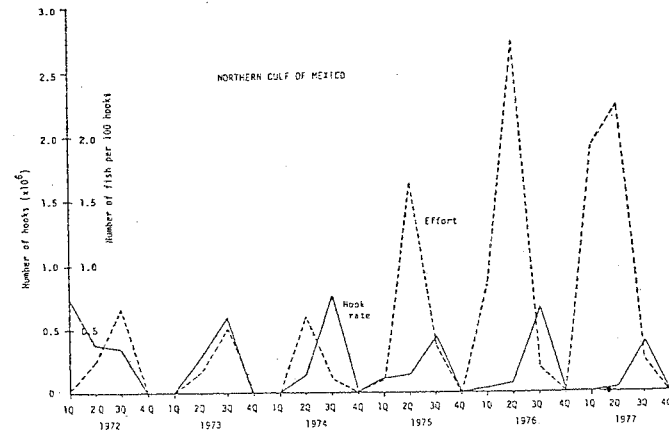
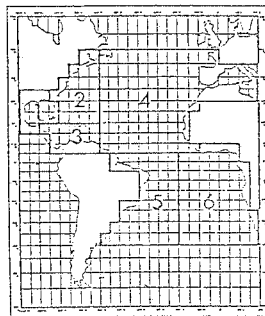


Fig. 3 Quarterly changes in nominal effort and hook rate of white marlin by Japanese longline fishery in the northern Gulf of Mexico (25° - 30° N, 80° - 100° W) from 1972 to 1977. Where no effort is expended, hook rate is shown as 0. Solid line, hook rate; Hashed line, number of hooks used.

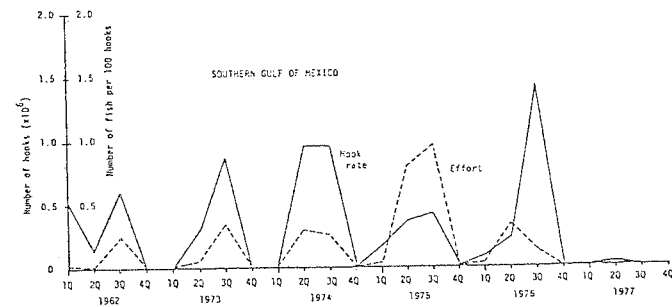


Fig. 4 Quarterly changes in nominal effort and hook rate of white marlin by Japanese longline fishery in the southern Gulf of Mexico (20° - 25° N, 80° - 100° W) from 1972 to 1977. Legend as in Fig. 3.