STATUS OF THE BILLFISHES CAUGHT BY THE LONGLINE FISHERY IN THE NORTH ATLANTIC OCEAN, 1956-1975

by

S. Kikawa, M. Honma

SUMMARY

Despite an increasing interest in billfish stocks in the Atlantic Ocean, little improvement has been made on their statistical data. This is mainly due to the difficulty of obtaining catch data broken down by species. Because of longlining by various countries and the coastal sports fishery that is directed towards billfishes, this difficulty is more serious for the North Atlantic Ocean.

RESUME

En dépit de l'intérêt accru pour les stocks de marlins dans l'Atlantique, les statistiques sur ces espèces se sont peu améliorées. Le principal obstacle est la difficulté de connaître la production totale au niveau des espèces. Ceci est plus grave dans l'Atlantique Nord, du fait de la pêche palangrière de divers pays, et de l'orientation vers ces espèces de la pêche sportive du littoral.

RESUMEN

Si bien ha aumentado el interés por los stocks de marlin en el Atlántico, los datos estadísticos no han mejorado sensiblemente. El principal obstáculo es la dificultad en conseguir el total de rendimientos a nivel de especies. Este hecho es más notable en lo que respecta al Atlántico Norte, debido a que varios países pescan allí con palangre y a que la pesquería costera deportiva está dirigida hacia el marlin.

Statistical data used

To have provisional total yields of billfishes by the longline fishery, data from the following sources were used in this manuscript: 1) Annual Report of Effort and Catch Statistics by Area on Japanese Tuna Longline Fisheries, 2) Statistical Report on the Tuna Longline Fisheries by Fishing Grounds, 3) Taiwanese longline data available on a computor tape at the FSFRL, 4) ICCAT Statistical Bulletin, 5) FAO Yearbook of Fishery Statistics and 6) other data from unpublished sources.

Method

We followed our last report (Kikawa and Honma 1977) for obtaining fishing intensity from Japanese and Taiwanese longline data.

Hook rate and size composition on Japanese data

Hook rate

Fig. 1 shows the yearly change in hook rate (number of fish per 100 hooks) of sailfish group, white marlin, blue marlin and sword fish in the western tropical area of the North Atlantic Ocean. The area is shown in Fig. 2. Previously, we used a similar area for white marlin and blue marlin (Kikawa and Honma 1976) and in our last report (Kikawa and Honma 1977), showed the pattern of their distribution on a monthly basis. The area indicated here bounds where they mostly occur on the longline fishery in the North Atlantic Ocean. Sailfish group comprises sailfish and spear fish. They are not separable on the Japanese catch record but in this area sailfish seems to be more representative.

Hook rate of sailfish group and white marlin is nearly level during the recent several years, with average hook rate of about 0.2 and 0.3 fish per 100 hooks, respectively. A slightly upward trend in hook rate of sailfish group from the early 1960's to 1975 seems to indicate more access of the longline gear to this group in recent years.

Hook rate of blue marlin is in a downward trend from the early 1960's to 1975. Recently, it averages 0.1 to 0.2 fish per 100 hooks. Sword fish in this area are sporadic visitors to longline fleets, with very low values of hook rate from inception of the fishery. Generally, low values before 1962are due to imperfect log book records on billfishes caught.

Size composition

Fig. 3 shows the length composition (in 5 cm-class intervals) of white marlin and blue marlin from Japanese data (Kikawa 1976). Eye-fork length is used that represents the distance from posterior margin of eye to tips of mid caudal rays. Number of fish measured are generally small, so individual size data for different areas and seasons are put together into the length composition for entire fishing grounds north of the equator on a yearly basis. In 1975, rather large number of size data were collected with the co-operation of commercial fishermen.

White marlin: Yearly change in the length composition is not very large, with the mode at 131-135 cm class in 1957 and at 136-149 cm class in 1975. The size of fish averages 135.5 cm in 1957 and 138.6 cm in 1975 and no clear trend is seen during this period (Table 1). Fish smaller than 100 cm and larger than 180 cm are very few.

Blue marlin: Due to very small number of fish measured, yearly size compositions are not clearly shaped except for 1975. Yearly change in the average size is rather large but shows no apparent trend, with 181.8 cm in 1957 and 185.6 cm in 1975 (Table 1). The size composition in 1975 has a definate mode at 176-180 cm class. Generally, fish smaller than 120 cm and larger than 280 cm are very few.

Provisional values for total yields of white and blue marlins

To consider the status of billfishes on wider data sources than before (Kikawa and Honma 1977), we used the provisional values for historical yields by Korea, Cuba, Venezuela and Panama and added them to Japanese and Taiwanese yield estimates. Provisional values for the Korean yield are given in Table 2. These values are hypothetical ones that required the following steps:

1) To assume that in the Korean data record appearing in the ICCAT Statistical Bulletin, the category "others" embraces billfishes, sword fish and others.

2) To combine yields of billfishes, sword fish and others in the Japanese data record from 1966 to 1975 and get yearly ratios of billfish yield to the total. Using the average value of this ratio, to obtain the provisional values of billfish yield from the historical Korean yields of "others".

3) To make the species composition of billfishes by FAO areas (Table 3) and the between-area composition of billfishes (Table 4) from the Japanese yield statistical records from 1971 to 1975.

4) To obtain the rate for partitioning the provisional values of the Korean billfish yield (step 2) to each species, based on Tables 3 and 4. Final partitioning rate are weighed by the Korean yield of yellowfin tuna in each FAO area (Table 5)

Partitioning rates for combined billfish yields by Cuba, Venezuela and Panama are given in Table 6.

The Japanese yield statistics is not collated well with the Japanese catch-in number statistics throughout their historical records. This seems to be particularly true of billfishes. At present, annual yield and annual catch in number records can be better collated, as improvement was made at their data bases in 1971. According to these two sets of data from 1971 to 1975, the average body weight of fish during this period is 28.6 Kg for white marlin and 78.1 Kg for blue marlin, with variation by year in both. On the other hand, the average body length for the same period is 134.2 cm for white marlin and 190.7 cm for blue marlin (Table 1). According to the weight-length relationship by Lenarz and Nakamura (1974), the body weight corresponding to these average lengths is calculated as 21.9 Kg and 92.7 Kg, respectively. Difference in the average body weight from two sources is not small for both white and blue marlins. It does not seem, however, that it is unreasonably large. Historical Japanese catch in number of white and blue marlins were converted to yield values with the average body weight obtained from the above yield statistical data, assuming that there is no gradual change or a trend in fish size, as suggested in Fig. 3. Taiwanese catch in number of both species were also converted to yield values using the same average weight of body.

Provisional values of white and blue marlin yields by countries and their totals are shown in Table 7. Values of fishing intensity (f) corresponding to the total yields are also given in the table, which are values expanded from the estimates given to the Japanese and Taiwanese longline fisheries.

Relation between historical yield and fishing intensity

Fig. 4-A and -B are the plots of total values of both yield and fishing intensity (f) in Table 7. These historical values are provisional ones and at the same time the assumptive figures as seen from the process of estimation. An another constraint is that these values are completely lacking the yield from the coastal sports fishery. Comments made in this section, therefore, is in any respect not conclusive ones.

White marlin: As a whole, there has been an increase in yield associated with increase in f. From 1970 to 1975, values of f do not change greatly and appear stable at the highest level as was in 1964. At this level of f, yield fluctuates. To such a relation, it would be possible to apply the Schaefer model, if the early values of yield and f before 1962 are excluded because of unreasonable change in cpue probably due to imperfect log book records. The maximum sustainable yield is 1,800 metric tons and the corresponding f is 970 x 10^3 hooks (per 5-degree area) (Fig. 5). The average value of f from 1970 to 1975 is 838 x 10^3 hooks, so the recent magnitude in fisheries for white marlin does not reach the level of f that corresponds to the maximum sustainable yield.

Blue marlin: Chronologically, the relation between yield and f could be described as below. Yield has increased rapidly associated with a large and sudden expansion in f beyond a certain range. While f remains in the range, however, yield have dropped rapidly. For the past years, there are three such occasions of a large increase in f associated with a rapid increase in yield, that is, 1961-1962, 1969-1970 and 1973-1974. Three period are seen in respect of these occasions, that is, 1962-1969, 1970-1973 and 1974-1975. These periods have different ranges of f, roughly 300-800, 900-1200 and 1300-1500 (x10^3). With the increase in range of f, there have been a fall in the upper level of yield and a rise in the lower level of it. Consequently, the range of its variation has been reduced.

For the relation between yield and f that chronologically bears such a tendency, the hypothetical nature each plot represents should be examined before going any further.

References

Kikawa, S. 1976. Length composition of billfish caught by Japanese Atlantic longline fishery, 1956-1971. ICCAT Col. Vol. Sci. Pap., Vol. V (SCRS-1975), 348-349.

Kikawa, S. and M. Honma 1976. Catches and fishing intensity of billfish species caught by the Atlantic longline fisheries, 1956-1973. Ibid. 341-347.

Kikawa, S. and M. Honma 1977. Catch and fishing intensity of billfish species caught by the Atlantic longline fisheries, 1956-1974. Ibid. Vol. VI (SCRS-1976), 417-420.

Lenarz, W. H. and E. L. Nakamura 1974. Analysis of length and weight data on three species of billfish from the western Atlantic Ocean. NOAA Tech. Rep. NMFS SSRF-675, 121-125.

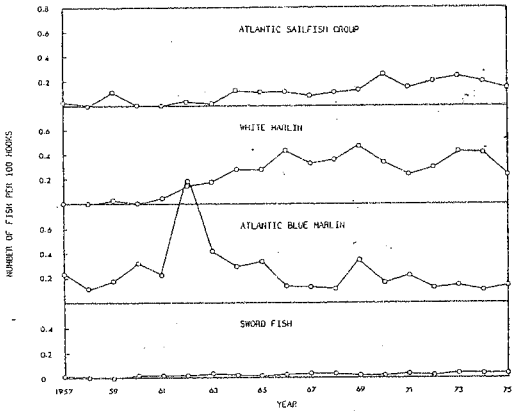

Fig. 1 Yearly change in hook rate of billfishes and sword fish in the western tropical Atlantic.

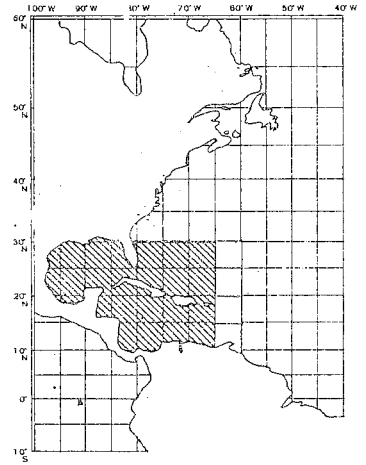

Fig. 2 Area for Fig. 1.

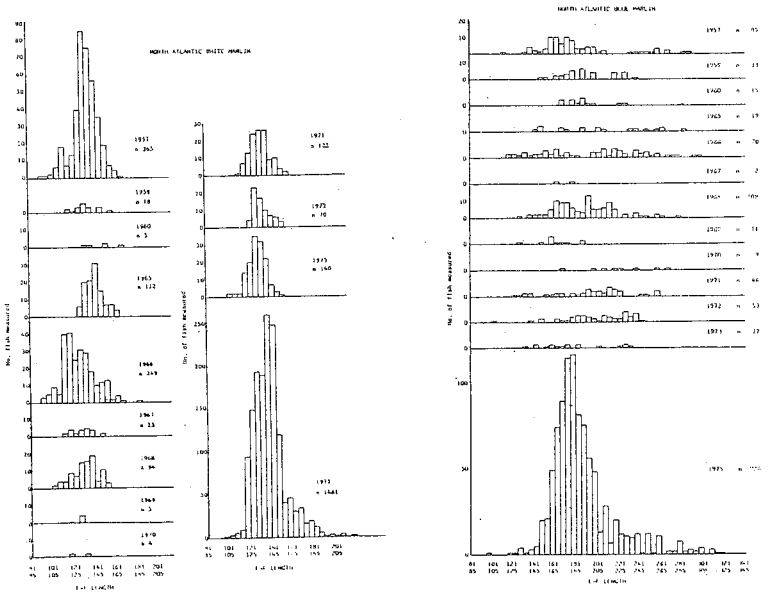

Fig. 3 Length composition by year for the North Atlantic Ocean.
Left White marlin Right Blue marlin

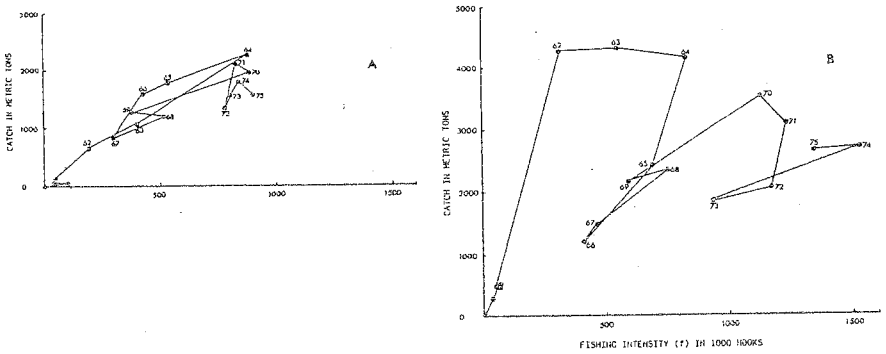

Fig. 4 Plots of catch in weight to fishing intensity for whole longline fleets in the North Atlantic Ocean.
A White marlin B Blue marlin

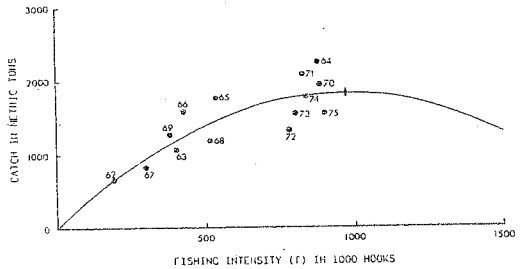

Fig. 5 Schaefer curve applied to white marlin catch and fsihing intensity relation from 1962 to 1975.

Table 1 Mean body length (e-f length) of white marlin and blue marlin in the Atlantic Ocean north of the equator.

Year	White marlin		Blue marlin	
1957	135.5	(365)	181.8	(85)
1958				
1959	134.7	(18)	189.5	(33)
1960	149.0	(5)	187.7	(15)
1961				
1962				
1963				
1964				
1965	142.2	(112)	203.8	(19)
1966	126.5	(249)	195.4	(70)
1967	129.1	(23)	170.5	(2)
1968	128.0	(94)	188.1	(109)
1969	126.0	(5)	162.5	(11)
1970	125.5	(4)	233.6	(9)
1971	134.0	(122)	194.4	(46)
1972	134.6	(70)	203.5	(53)
1973	129.5	(140)	179.2	(17)
1974				
1975	138.6	(1,481)	185.6	(926)

(No. of fish measured in the parenthesis)

Table 2 Provisional values of billfish yield and amount partitioned to each species for Korean longline fishery.

Year	Amount partitioned to species							
	North Atlantic				South Atlantic			
	Total	WM	BM	S&S	Total	WM	BM	S&S
1966	51	11	26	13				
1967	210	47	108	55				
1968	1,331	295	685	350				
1969	1,104	245	569	290				
1970	3,899	866	2,008	1,025				
1971	2,050	482	1,050	502				
1972	2,223	522	1,138	545				
1973	2,020	475	1,034	495				
1974	2,281	536	1,168	559				
1975	2,281	554	1,153	554	186	78	70	38

Table 3 Species composition of billfishes by FAO areas (From Japanese yield statistics, 1971-1975)

Species	21	27	31	34	41	47
White marlin	68.6	33.3	36.6	22.2	53.7	24.7 %
Blue marlin	26.5	66.7	48.4	51.5	26.6	53.6 %
Sailfish & spear fish group	4.9	0	15.0	26.3	19.7	21.7 %
	100.0	100.0	100.0	100.0	100.0	100.0 %

Table 4 Between-area composition of billfishes (From Japanese yield statistics, 1971-1975)

FAO area	White marlin	Blue marlin	Sailfish & spear fish
21	23.9	7.8	4.9 %
27	0.1	0.1	0 %
31	59.1	66.2	16.2 %
34	5.5	10.8	26.3 %
41	4.0	1.7	3.6 %
47	7.3	13.5	16.5 %
	100.0	100.0	100.0

Table 5 Pates used for partitioning provisional values of billfish yield to each species for Korean longline fishery.

Years to be referred	Areas fished by Korean fleet	Partitioning rates by species
1966-1970	FAO area 31	White marlin 0.222, Blue marlin 0.515, Sailfish & spear fish 0.263 (North Atlantic)
1971-1974	FAO areas 31, 34	White marlin 0.235, Blue marlin o.512, Sailfish & spear fish 0.253 (North Atlantic)
1975	FAO areas 31, 34	White marlin 0.245, Blue marlin 0.510, Sailfish & spear fish 0.245 (North Atlantic)
	FAO areas 41, 47	White marlin 0.415, Blue marlin 0.377, Sailfish & spear fish 0.205 (South Atlantic)

Table 6 Rates used for partitioning provisional values of billfish yield to each species for Cuba, Venezuela and Panama.

Years to be referred	Areas fished by fleets	Partitioning rates by species
1961-1968	FAO area 31	White marlin 0.222, Blue marlin 0.515, Sailfish & spear fish 0.263
1969-1973	FAO areas 31, 34	White marlin 0.294, Blue marlin 0.500, Sailfish & spear fish 0.207
1974-1975	FAO areas 31, 34	White marlin 0.241, Blue marlin 0.510, Sailfish & spear fish 0.248

Table 7 Provisional values of white and blue marlin yields by countries and fishing intensity (f) in the North Atlantic Ocean.

white marlin

Year	Japan	Taiwan	Korea	Cuba	Venezuela	Panama	Total	f (10^3)
1956								
1957	5						5	3
1958	15						15	42
1959	30						30	98
1960	40						40	43
1961	60			70			130	48
1962	580			90			670	191
1963	930			110			1,040	392
1964	2,160			90			2,250	883
1965	1,630			130			1,760	537
1966	1,430		10	110			1,550	428
1967	370	5	50	380			805	299
1968	360	100	300	290	130		1,180	519
1969	470	170	250	180	180		1,250	374
1970	560	120	870	180	180		1,910	882
1971	990	240	480	150	220		2,080	825
1972	350	130	520	90	220		1,310	773
1973	360	220	480	240		240	1,570	808
1974	350	390	540	480	30		1,790	835
1975	420	200	550	340	20		1,530	904

Blue marlin

Year	Japan	Taiwan	Korea	Cuba	Venezuela	Panama	Total	f (10^3)
1956	5						5	
1957	90						90	5
1958	270						270	47
1959	500						500	76
1960	460						460	74
1961	330			160			490	59
1962	4,060			210			4,270	315
1963	4,050			260			4,310	544
1964	3,930			210			4,140	828
1965	2,100			310			2,410	689
1966	890		30	260			1,180	412
1967	390	70	110	880			1,450	466
1968	370	430	690	670	170		2,330	748
1969	770	280	570	300	230		2,150	590
1970	700	300	2,010	300	230		3,540	1,133
1971	1,270	230	1,050	250	290		3,090	1,236
1972	340	110	1,140	150	290		2,030	1,168
1973	260	160	1,030	400		310	1,850	937
1974	270	230	1,170	1,020	40		2,730	1,534
1975	650	90	1,150	710	30		2,630	1,345