9.9 BUM - Blue marlin

The most recent assessment for blue marlin was conducted in 2024 through a process that included a data preparatory meeting in March 2024 (ICCAT, 2024a) and an assessment meeting in June 2024 (ICCAT, 2024i). The last year of fishery data used in the assessment was 2022.

BUM-1. Biology

The central and northern Caribbean Sea and northern Bahamas have historically been known as the primary spawning area for blue marlin in the western North Atlantic. Recent reports show that blue marlin spawning can also occur north of The Bahamas in an offshore area near Bermuda at about 32º-34º N. Ovaries of female blue marlin caught by artisanal vessels in Côte d'Ivoire show evidence of pre-spawning and post-spawning, but not of spawning. In this area females are more abundant than males (4:1 female/male ratio). Coastal areas off West Africa have strong seasonal upwelling, and may be feeding areas for blue marlin.

Atlantic blue marlin inhabit the upper parts of the open ocean. Blue marlin spend the majority of their time in the mixed surface layer (58% of daylight and 84% of nighttime hours), however, they regularly make short-duration dives to maximum depths of around 300 m, with some vertical excursions down to 800 m. They do not confine themselves to a narrow range of temperatures but most tend to be found in waters warmer than 17°C. The distribution of time at depth is significantly different between day and night. At night, the fish spent most of their time at or very close to the surface. During daylight hours, they are typically below the surface, often at 40 to 100+ m. These patterns, however, can be highly variable between individuals and also vary depending on the temperature and dissolved oxygen of the surface mixed layer. This variability in the use of habitat by blue marlin indicates that simplistic assumptions about habitat usage made during the standardization of catch per unit effort (CPUE) data may be inappropriate.

BUM-2. Fishery indicators

The decadal geographic distribution of the catches is given in **BUM-Figure 1**. The Committee used Task 1 catches as the basis for the estimation of total removals (**BUM-Figure 2**). Total removals (landings and dead discards) for the period 1990-2022 were obtained during the 2024 Blue Marlin Data Preparatory Meeting (ICCAT, 2024a) by modifying Task 1 values with the addition of blue marlin that the Committee estimated from catches reported as billfish unclassified. Additionally, the reporting gaps in landed catch reports were filled with estimated values for major fleets.

Over the last 20 years, Antillean artisanal fleets have increased the use of Moored Fish Aggregating Devices (MFADs) to capture pelagic fish. Catches of blue marlin caught around MFADs are known to be significant and increasing in some areas, however reports to ICCAT on these catches are incomplete. Although historical catches from some Antillean artisanal fleets have been recently included in Task 1 there is still an unknown number of Antillean artisanal fleets that may have unreported catches of blue marlin caught around MFADs. It is important that the amount of these catches be documented. Recent reports from purse seine fleets in West Africa suggest that blue marlin is more commonly caught with tuna schools associated with FADs than with free tuna schools. As of 21 September 2024, Task 1 catches of blue marlin (**BUM-Table 1**) for 2022 and 2023 amount to 1,789 t and 2,068 t, respectively. These catches are likely underestimated because few CPCs have reported discards.

A series of indices of abundance for blue marlin were presented and discussed during the 2024 Blue Marlin Data Preparatory Meeting (ICCAT, 2024a). Eleven standardized CPUE series from Japan (historical and current longline), Chinese Taipei (longline with three time series), USA (longline), Venezuela (longline, gillnet and rod & reel), Brazil (longline) and Ghana (gillnet) CPUE series were used in the assessment. The standard errors from the CPUE standardized series were applied as weighting factors in all assessment models. All estimated standardized CPUE indices for blue marlin showed a sharp decline during the period 1960-1975, and thereafter have fluctuated around lower levels (**BUM-Figure 3**).

BUM-3. State of the stocks

A full stock assessment was conducted for blue marlin in 2024, applying to the available data through 2022, using a grid approach for both surplus production and age-structured models to capture uncertainty around biological parameters.

The results of the final combined model of the 2024 assessment indicated that the estimated B/B_{MSY} and F/F_{MSY} were such that the current stock status is overfished but not subject to overfishing (**BUM-Figure 4**). By the end of the assessment period 2022, the stock relative biomass is below B_{MSY} and fishing mortality is below F_{MSY}.

The estimated MSY was determined to be 3,331 t with approximate 95% confidence limits of 2,323 to 4,659 t. The current status of the blue marlin stock is presented in **BUM-Figure 5.** The probability of the stock being in the red quadrant of the Kobe plot was estimated to be 39% by 2022. The probability of being in the yellow quadrant of the Kobe plot was estimated to be 46%, and of being in the green quadrant 16%.

However, the Committee recognizes the high uncertainty with regard to catch (landings and dead discards) data and the productivity of the stock.

BUM-4. Outlook

A combination of projection results from the Bayesian Surplus Production model and the age structure model was used to produce the advice outlook, including the Kobe strategy matrices. Projections were conducted until 2034 by assuming 12 constant catch (i.e., landings plus dead discards) scenarios (0 t, 1,000-3,500 t with 250 t intervals). All scenarios were equally weighted in the joint results. For the Stock Synthesis, projections were conducted using the multi-variate lognormal (MVLN) approach in each scenario, and reference point B/B_{MSY} was delivered from the spawning stock biomass for joint results.

The updated trends of joint projected relative stock biomass and fishing mortality are provided in **BUM-Figure 6**. The Kobe 2 matrices are available in **BUM-Table 2**.

The percentage of the model runs that resulted in biomass levels <= 10% or 20% of B_{MSY} (**BUM-Table 3**) were lower than 5% in constant catch scenarios equal to or less than 2,250 t during the projection period. These percentages increased with higher catch scenarios.

BUM-5. Effect of current regulations

A 2006 recommendation (Rec. 06-09) established that the annual amount harvested by pelagic longline and purse seine vessels and retained for landing must be no more than 33% for white marlin and 50% for blue marlin of the 1996 or 1999 landing levels, whichever is greater. Furthermore, in 2012, the Commission established a TAC for 2013, 2014, and 2015 of 2,000 t (Rec. 12-04), placed additional catch and commerce restrictions in recreational fisheries for blue marlin and white marlin, and requested methods for estimating live and dead discards of blue marlin and white marlin/spearfish. The Commission further strengthened the plan to rebuild blue marlin stock by extending for 2016, 2017, 2018, and 2019 the annual limit of 2,000 t for blue marlin (Rec. 15-05, Rec. 18-04). The Commission established a landings limits of 1,670 t beginning in 2020 (Rec. 19-05). Landings in 2020, 2021, and 2023 have substantially exceeded the limit in the Rec. 19-05.

The Committee is concerned with the significant increase in the contribution from non-industrial fisheries to the total blue marlin harvest and that the landings from these fisheries are not fully accounted for in the current ICCAT database. The Committee expressed its serious concern over this limitation on data for current and future assessments. Such data limitation impairs any analysis of the current regulations.

Currently, ICCAT Rec. 22-12 and four ICCAT Contracting Parties (Brazil, Canada, Mexico, and the United States) mandate or encourage the use of circle hooks on their pelagic longline fleets. Recent research has demonstrated that in some longline fisheries, the use of non-offset circle hooks resulted in a reduction of billfish mortality, while the catch rates of several of the target species remained the same or were greater than the catch rates observed with the use of conventional J hooks or offset circle hooks.

More countries have started reporting data on live releases since 2006. Additional information has come about, for some fleets, regarding the potential for modifying gears to reduce the bycatch and increase the survival of marlins. Such studies have also provided information on the rates of live releases for those fleets. However, there is not enough information on the proportion of fish being released alive for all fleets, to evaluate the effectiveness of the ICCAT Recommendation relating to the live release of marlins.

BUM-6. Management recommendations

The Committee emphasizes that unaccounted uncertainties, mostly associated with the levels of landings and dead discards, continue to hamper the ability of the Committee to provide sound management advice. Therefore, the Committee recommends that the Commission maintain or lower the current 1,670 t landings limit until the increasing biomass trend observed in the 2024 stock assessment is confirmed at the next blue marlin assessment. The Committee once again recommends instead of adopting landings limits (such as those adopted in Rec. 19-05) the Commission should adopt limits corresponding to true catch (i.e. landings + dead discards). The Committee reiterates that it is of the utmost importance that CPCs report their total catch of BUM (i.e. landings and dead discards).

ATLANTIC BLUE MARLIN SUMMARY TABLE

Maximum Sustainable Yield	3,331 t (2,323 – 4,659 t)[1]
Yield at last assessment year (2022)[2]	1,789 t
Yield (2023)	2,068 t
Relative Biomass (B_{2022}/B_{MSY})[4]	0.67 (0.30 – 1.35)[1]
Relative Fishing Mortality (F_{2022}/F_{MSY})	0.91 (0.40 -1.64)[1]
Stock Status (2022)	Overfished: Yes (84% probability of being overfished)[3] Overfishing: No (39% probability of be subject to overfishing)[3]
Conservation and management Measures in effect:	Rec. 18-05 and Rec. 19-05 Landing limit of 1,670 t beginning in 2020.

[1] Combined Bayesian surplus production model and age structured assessment model results. Values correspond to median estimates, 95% confidence interval values are provided in parenthesis.
[2] The term yield refers to the total catch (i.e. landings + dead discards).
[3] Based on the Kobe plot proportions by quadrant.
[4] Relative biomass from stock synthesis is on spawning stock biomass, while from Bayesian SPM is on total biomass.

BUM-Table 1. Estimated catches (t) of Atlantic blue marlin (*Makaira nigricans*) by area, gear, and flag.

			1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TOTAL	A+M		4216	4187	5366	5670	5637	5326	5395	4376	3807	4316	3106	3470	3070	4263	3602	3121	3005	2750	2758	2143	2769	2075	2128	2694	1962	1979	2394	2514	1789	2068
Landings		Longline	3115	3000	3835	4302	3721	3513	3233	2595	1924	2227	1824	1963	1940	2369	2479	2069	1977	1438	1339	991	1300	1268	1207	1539	1076	1231	1393	1224	929	1089
		Other surf.	870	956	1267	1098	1734	1658	2014	1635	1618	1765	1073	1430	989	1672	815	839	832	1019	1055	951	1212	584	636	780	489	495	743	985	558	529
		Sport (HL+RR)	120	77	68	132	130	72	69	123	216	305	174	51	103	179	269	152	177	237	289	142	200	112	220	276	255	134	136	152	136	307
Landings(FP)		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	12
Discards		Longline	111	153	197	139	51	83	60	22	37	19	34	24	38	42	37	40	19	56	70	55	54	106	52	73	44	55	58	45	36	47
		Other surf.	0	0	0	0	1	0	0	2	11	0	1	1	0	0	1	21	1	0	5	4	3	5	13	27	97	65	64	108	80	83
Landings	CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0
		Barbados	19	31	25	30	25	19	19	18	11	11	0	0	25	0	0	0	9	13	14	11	12	34	11	24	21	13	22	12	9	10
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	3	3	7	47	19	8	5	13	1	6	0	2	0	0	0
		Brazil	81	180	331	193	486	509	467	780	387	577	195	612	298	262	182	150	130	63	48	114	105	89	79	64	37	20	13	2	3	5
		Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
		China PR	62	73	62	78	120	201	23	92	88	89	58	96	99	65	13	77	100	99	61	45	40	44	30	40	42	46	37	4	10	35
		Costa Rica	0	0	0	0	0	3	2	2	0	0	2	1	3	2	11	9	12	19	14	19	34	53	48	74	35	27	15	24	11	8
		Curaçao	40	40	40	40	40	40	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	2	20	15	2	6	1
		Côte d'Ivoire	151	134	113	157	66	189	288	208	111	171	115	21	8	132	66	72	54	17	48	48	87	15	72	44	32	163	41	148	6	70
		EU-España	55	40	138	122	195	125	140	94	28	12	51	24	91	38	55	160	257	131	190	147	209	287	225	321	106	103	437	460	203	53
		EU-France	149	154	197	232	257	285	305	329	340	340	345	360	361	358	395	265	281	284	263	162	303	190	167	209	152	170	282	131	170	215
		EU-Portugal	11	10	7	3	61	20	22	18	8	32	27	48	105	135	158	106	140	54	55	25	23	46	50	57	74	18	28	37	36	48
		El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
		FR-St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Gabon	2	0	304	5	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Ghana	441	471	422	491	447	624	639	795	999	415	470	759	405	683	191	140	116	332	234	163	236	88	44	162	60	44	53	278	121	196
		Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Grenada	52	50	26	47	60	100	87	109	69	72	45	42	33	49	54	32	69	53	32	63	63	56	53	54	62	69	49	31	30	37
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	23	0	15	0	0	0
		Japan	1523	1409	1679	1349	1185	790	883	335	267	442	540	442	490	920	1028	822	731	402	430	189	280	293	296	430	287	357	293	284	327	468
		Korea Rep.	56	56	144	56	2	3	1	1	0	0	1	6	33	64	91	36	85	57	34	24	10	3	26	25	25	13	20	12	10	13
		Liberia	0	87	148	148	701	420	712	235	158	115	188	304	162	274	76	56	46	133	94	178	293	35	127	65	24	18	21	119	25	55
		Marroc	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	4	7	82	64	46	27	46	39	37
		Mexico	13	13	13	13	27	35	68	37	50	70	90	86	64	91	81	93	89	68	106	86	67	72	66	60	68	51	39	43	29	44
		Namibia	0	0	0	0	0	0	0	0	3	0	5	9	57	0	50	2	23	10	0	8	36	8	32	57	84	53	51	70	8	99
		Panama	0	0	0	0	0	0	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	0	14	12	0	0
		Philippines	0	0	0	0	7	71	38	0	0	0	0	0	0	0	8	0	3	4	1	2	2	0	0	0	0	0	0	0	0	0
		Russian Federation	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		S Tomé e Príncipe	28	33	36	35	33	30	32	32	32	32	9	21	26	66	68	70	72	74	76	78	81	11	10	13	5	88	34	109	75	152
		Senegal	9	0	2	5	0	0	0	11	24	32	11	1	5	91	114	61	41	64	164	45	72	10	82	39	25	21	358	73	38	38
		South Africa	0	0	0	0	0	0	0	1	4	0	0	0	0	2	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0
		St Vincent and Grenadines	2	2	1	1	0	1	0	0	20	0	0	0	0	1	3	2	1	0	0	2	0	0	0	2	2	1	2	2	0	0
		Trinidad and Tobago	16	28	14	50	16	20	51	17	16	9	11	7	14	16	35	26	22	25	46	48	48	35	19	0	0	0	0	1	0	0
		UK-Bermuda	15	15	15	3	5	1	2	2	2	2	2	2	2	2	2	0	1	2	2	3	3	3	2	1	2	1	1	1	1	1
		UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		UK-St Helena	0	2	2	1	2	4	4	3	4	1	1	2	2	3	4	2	2	2	12	2	1	1	0	0	0	0	0	0	0	0
		UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		USA	88	43	43	46	50	37	24	16	17	19	26	16	17	9	13	6	4	6	14	9	1	9	19	13	20	17	17	22	22	23
		Uruguay	3	1	1	26	23	0	0	0	1	5	3	2	8	5	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0
		Venezuela	122	117	148	142	226	240	125	84	88	120	101	160	172	222	130	120	155	122	161	123	138	144	180	197	132	116	73	96	123	131
	NCC	Chinese Taipei	663	467	660	1478	578	486	485	240	294	319	315	151	99	233	148	195	153	199	133	78	62	61	75	73	74	40	70	76	40	58
		Guyana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	128	39	75	81	0
	NCO	Benin	5	5	5	5	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cuba	39	85	43	53	12	38	55	56	34	3	4	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Dominica	0	0	0	0	0	0	0	64	69	75	36	44	55	38	106	76	76	60	0	0	85	62	49	74	52	45	64	54	54	57
		Dominican Republic	0	0	0	41	71	29	23	23	115	207	142	30	38	47	67	60	65	100	98	99	96	73	170	183	176	87	58	72	72	67
		Jamaica	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Mixed flags (FR+ES)	133	126	96	82	80	83	147	151	131	148	171	150	136	135	139	164	178	186	181	191	173	176	0	0	0	0	0	0	0	
		NEI (BIL)	0	0	0	0	0	53	184	258	167	89	7	160	209	205	177	0	34	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (ETRO)	326	362	435	548	803	761	492	274	17	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	8	12	0	2	5	4	4
		St a Lucia	0	0	0	4	1	0	10	5	9	18	17	21	53	46	70	72	58	64	119	99	111	53	91	134	93	82	78	61	85	0
		Togo	0	0	0	23	0	73	53	141	103	775	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Vanuatu	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	7	8	6	3	2	0	0	0	0	0	0	0	0	
Landings(FP)	CP	EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	12
Discards		Brazil	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1	0	0	1	0	0	0
		EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	1	4	3	5	7	6	80	57	55	102	71	76
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	0	0	6	11	12	9	5	5	8	7
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	2	0	0	0
		Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	8	16	8	2	15
		Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	1	0	0	0	0	0	0	0	0
		Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	2	0	0	0
		UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		USA	111	153	197	139	52	83	60	25	49	19	35	25	36	42	38	42	19	50	39	55	53	81	25	47	22	24	20	9	16	19
	NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0	0	24	27	26	16	22	21	20	18	13

BUM-Table 2. Kobe II matrices for Atlantic blue marlin giving the probability that $F<F_{MSY}$, $B> B_{MSY}$ and the joint probability of $F<F_{MSY}$ and $B>B_{MSY}$, between 2025 and 2034, with various constant catch (landing plus dead discards) levels based on Bayesian Surplus Production model and Stock Synthesis model base case model results.

a) Probability that $F<F_{MSY}$.

Catch (t)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
0	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
1000	97%	98%	98%	99%	99%	99%	99%	99%	99%	99%
1250	93%	94%	95%	96%	96%	97%	97%	97%	98%	98%
1500	85%	87%	89%	90%	91%	92%	93%	94%	94%	95%
1750	74%	77%	80%	82%	84%	85%	86%	87%	88%	89%
2000	63%	66%	69%	71%	73%	75%	77%	78%	79%	80%
2250	52%	55%	58%	60%	62%	64%	66%	67%	69%	70%
2500	42%	45%	48%	50%	52%	53%	55%	56%	58%	59%
2750	35%	37%	39%	40%	42%	43%	44%	45%	46%	47%
3000	28%	30%	31%	32%	33%	34%	35%	36%	36%	37%
3250	23%	24%	24%	25%	26%	26%	27%	27%	27%	28%
3500	18%	19%	19%	19%	19%	20%	19%	20%	20%	20%

b) Probability that $B>B_{MSY}$.

Catch (t)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
0	35%	45%	56%	65%	72%	78%	83%	86%	89%	92%
1000	32%	39%	46%	53%	59%	64%	69%	73%	76%	79%
1250	31%	37%	44%	50%	55%	60%	65%	69%	72%	75%
1500	30%	36%	41%	47%	52%	56%	60%	64%	67%	70%
1750	29%	34%	39%	44%	48%	52%	56%	59%	62%	65%
2000	29%	33%	37%	40%	44%	47%	51%	54%	56%	59%
2250	28%	31%	35%	38%	41%	43%	46%	48%	51%	53%
2500	27%	30%	32%	35%	37%	39%	41%	43%	45%	46%
2750	27%	29%	30%	32%	34%	35%	37%	38%	39%	40%
3000	26%	27%	28%	29%	30%	31%	32%	33%	34%	34%
3250	25%	26%	27%	27%	27%	28%	28%	28%	29%	29%
3500	25%	25%	25%	24%	24%	24%	24%	24%	24%	24%

c) Probability that $F<F_{MSY}$ and $B>B_{MSY}$.

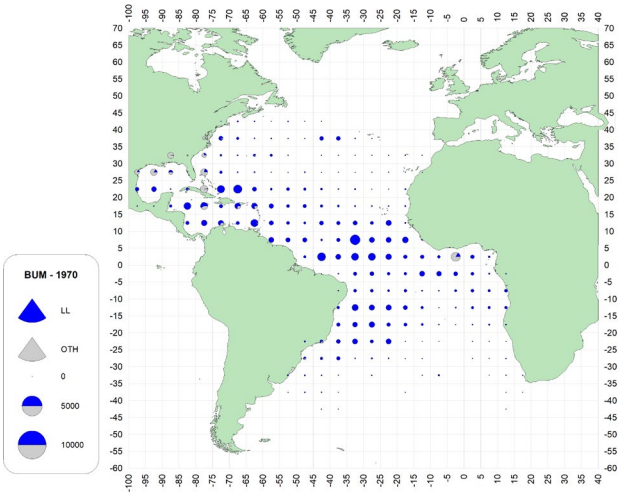
Catch (t)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
0	35%	45%	56%	65%	72%	78%	83%	86%	89%	92%
1000	32%	39%	46%	53%	59%	64%	69%	73%	76%	79%
1250	31%	37%	44%	50%	55%	60%	65%	69%	72%	75%
1500	30%	36%	41%	47%	52%	56%	60%	64%	67%	70%
1750	29%	34%	39%	44%	48%	52%	56%	59%	62%	65%
2000	29%	33%	37%	40%	44%	47%	51%	54%	56%	59%
2250	28%	31%	35%	38%	40%	43%	46%	48%	51%	53%
2500	27%	30%	32%	35%	37%	39%	41%	43%	44%	46%
2750	26%	28%	30%	31%	33%	34%	36%	37%	38%	39%
3000	24%	25%	26%	28%	29%	30%	30%	31%	32%	32%
3250	21%	22%	22%	23%	23%	24%	24%	25%	25%	25%
3500	17%	18%	18%	18%	18%	19%	18%	19%	19%	19%

BUM-Table 3. Estimated probabilities of biomass the Atlantic blue marlin stock levels < 10% of B_{MSY}. Catch (t) scenarios include landing and dead discards. It should be noted that the reference chosen, 10% of biomass that supports MSY, was selected only for informational purposes and is not intended to be a recommendation by the SCRS as a limited reference point.

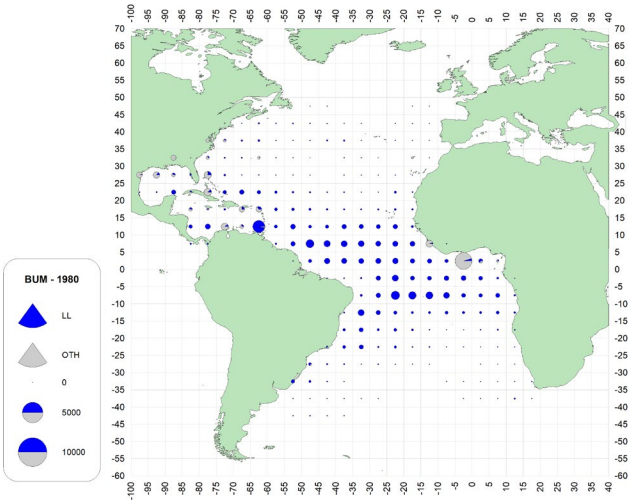
Catch (t)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1250	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1500	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1750	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
2000	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%
2250	0%	0%	0%	0%	1%	1%	1%	2%	2%	2%
2500	0%	0%	0%	1%	1%	1%	2%	3%	3%	4%
2750	0%	0%	0%	1%	2%	2%	3%	4%	5%	6%
3000	0%	0%	1%	1%	2%	4%	5%	6%	8%	9%
3250	0%	0%	1%	2%	4%	5%	7%	9%	11%	13%
3500	0%	0%	1%	3%	5%	8%	10%	13%	16%	18%

BUM-Table 4. Estimated probabilities of biomass the Atlantic blue marlin stock levels < 20% of B_{MSY}. Catch (t) scenarios include landing and dead discards. It should be noted that the reference chosen, 20% of biomass that supports MSY, was selected only for informational purposes and is not intended to be a recommendation by the SCRS as a limited reference point.

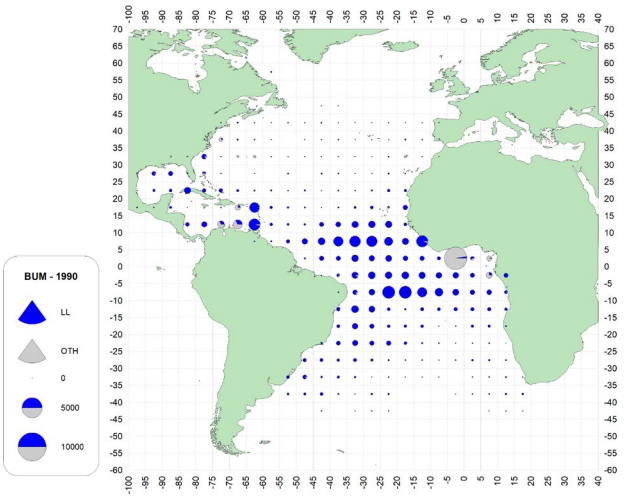
Catch (t)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1250	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1500	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%
1750	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
2000	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%
2250	1%	1%	1%	2%	2%	2%	3%	3%	3%	4%
2500	1%	1%	2%	2%	3%	3%	4%	5%	5%	6%
2750	1%	1%	2%	3%	4%	5%	6%	7%	8%	9%
3000	1%	2%	3%	4%	5%	7%	8%	10%	11%	13%
3250	1%	2%	3%	5%	7%	9%	11%	13%	15%	17%
3500	1%	2%	4%	7%	9%	12%	15%	18%	20%	23%



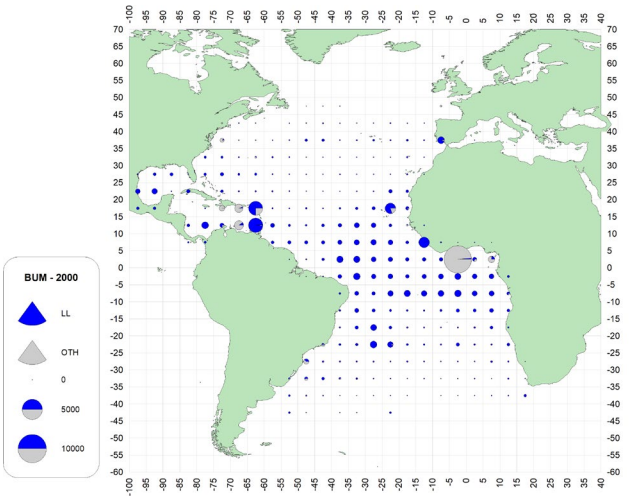
a) BUM (1970-79)



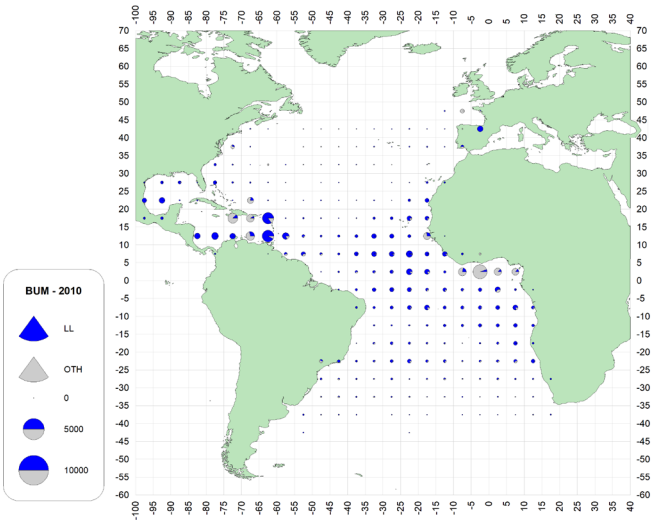
b) BUM (1980-89)



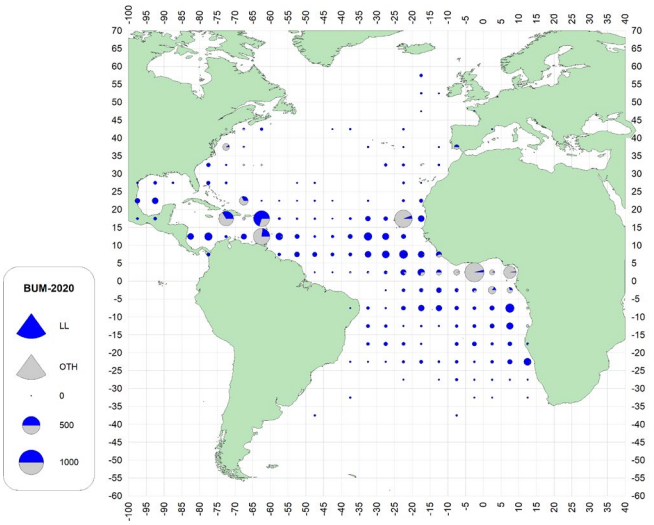
c) BUM (1990-99)



d) BUM (2000-09)

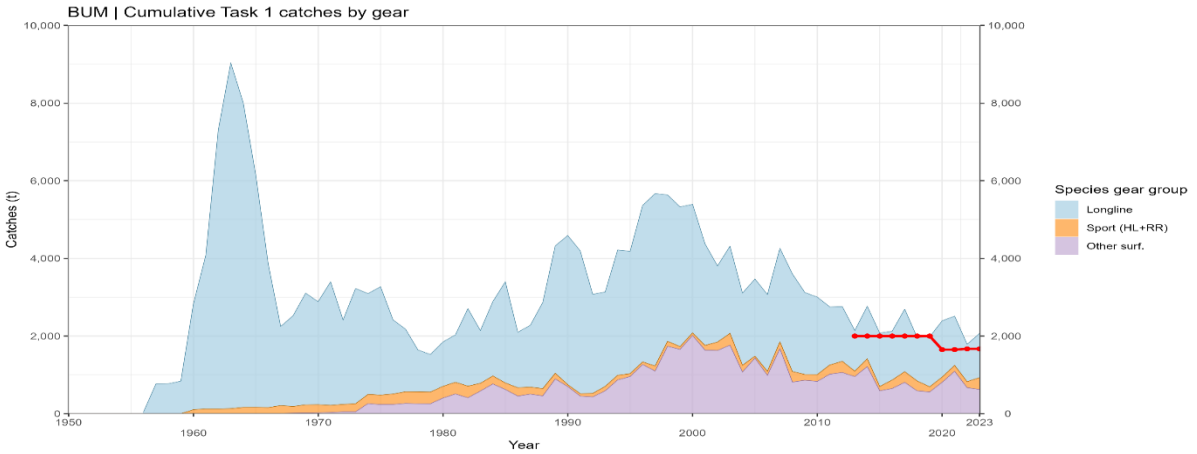


e) BUM (2010-19)

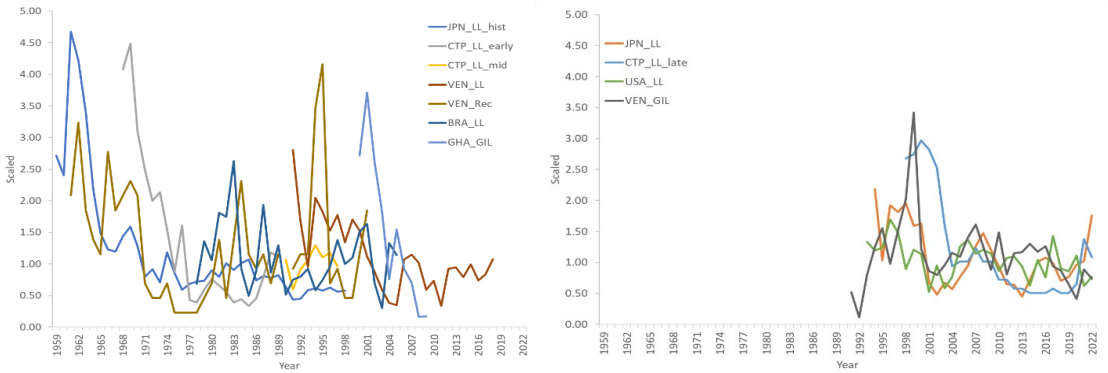


f) BUM (2020-22)

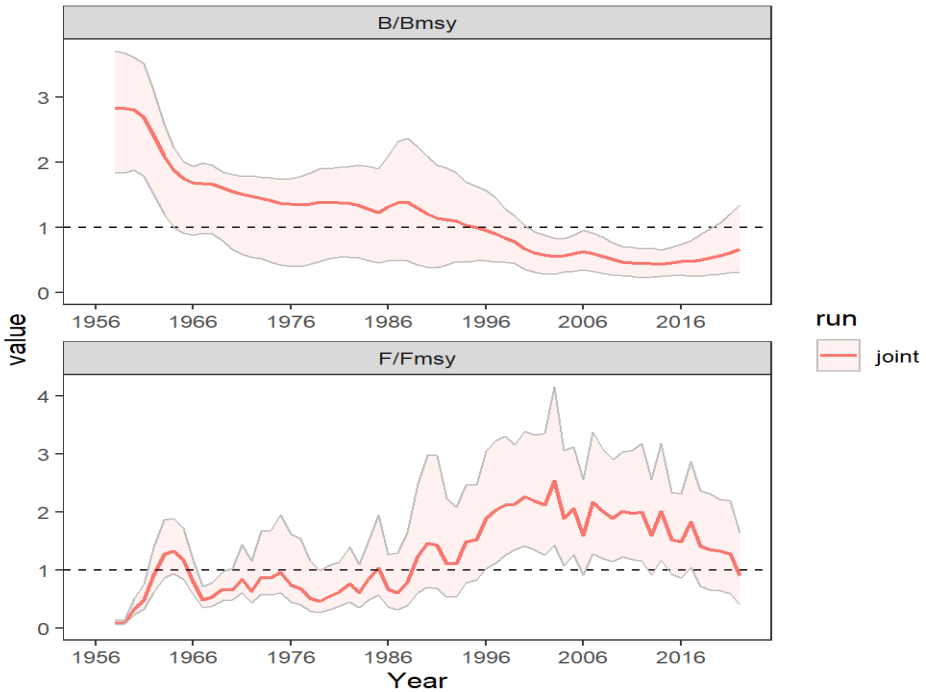
BUM-Figure 1. Geographic distribution of blue marlin total catches by decade (last decade only covers 3 years).



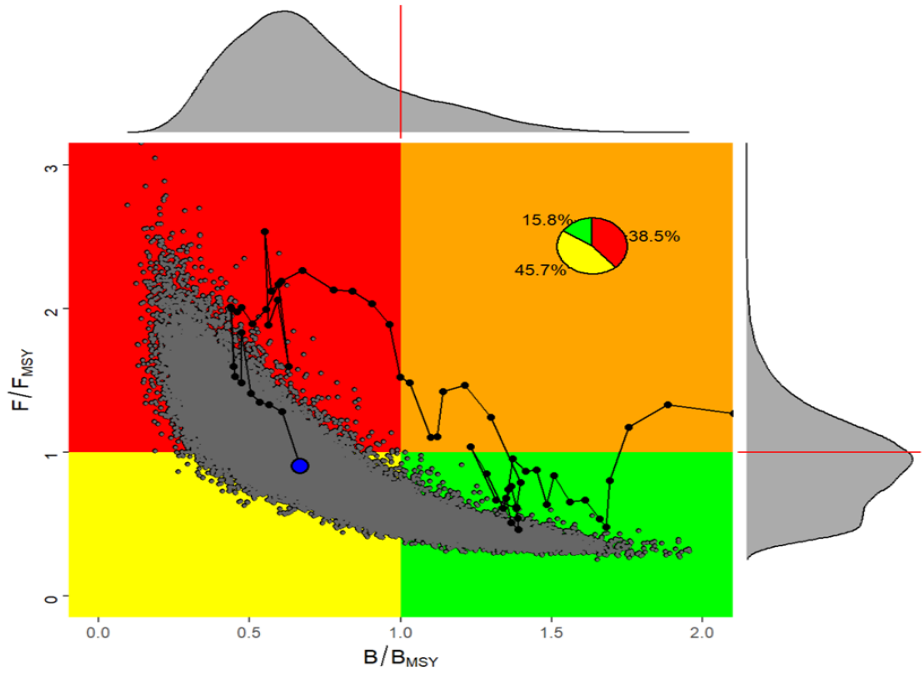
BUM-Figure 2. Atlantic blue marlin (*Makaira nigricans*) Task 1 catches (landings + dead discards) (t) by gear type between 1950 and 2023. The dotted red line indicates the landings limit for the stock.



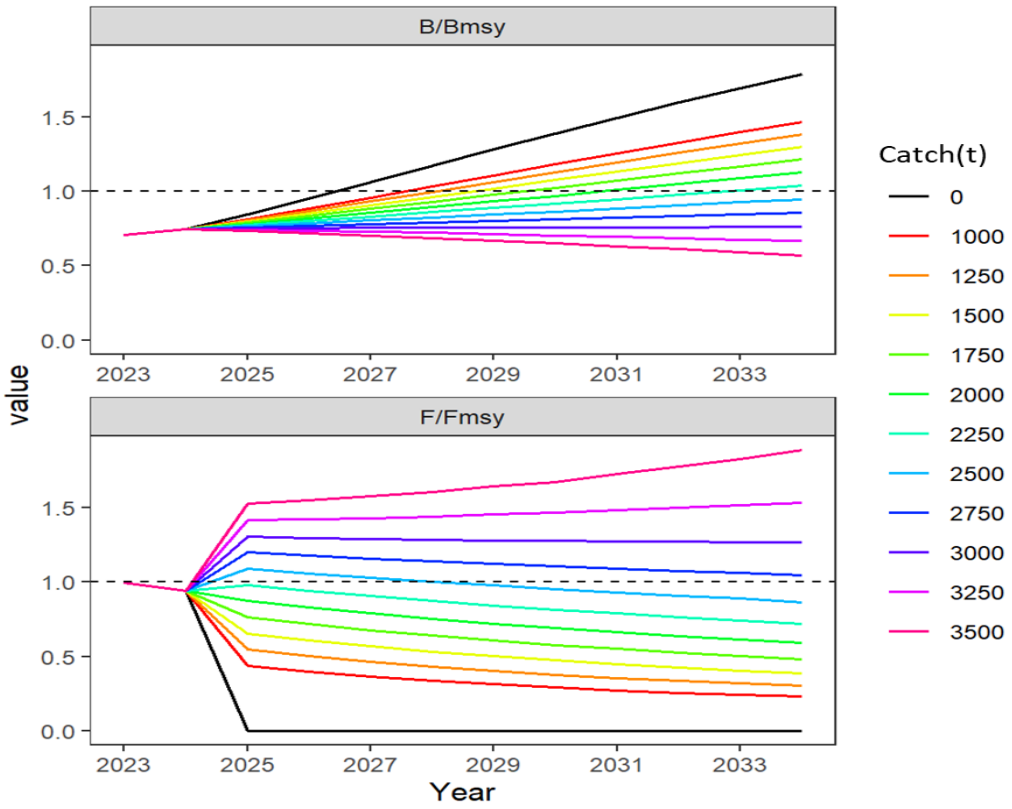
BUM-Figure 3. Plots of the indices of abundance used in the 2024 blue marlin stock assessment.



BUM-Figure 4. Annual trends of relative biomass (B/B_{MSY}) and fishing mortality (F/F_{MSY}) from the final combined grid model scenarios for Atlantic blue marlin. The dark line indicates the mean of all scenarios, and the shaded area the overall 95% confidence bounds of the results.



BUM-Figure 5. Combined Kobe plots for the final base cases of the Bayesian Surplus Production model and Stock Synthesis model for the Atlantic blue marlin.



BUM-Figure 6. Joint projection: Trends of projected relative stock biomass (upper panel, B/B_{MSY}) and fishing mortality (bottom panel, F/F_{MSY}) for Atlantic blue marlin under different fixed catch (landings plus dead discards) scenarios of 0–3,500 t, based upon the projections of both JABBA and Stock Synthesis grids. Each line represents the median of 80,000 iterations by projected year.