Assessment Data Report of the Billfish Working Group

Statistics Working Group of ISC

July 2016

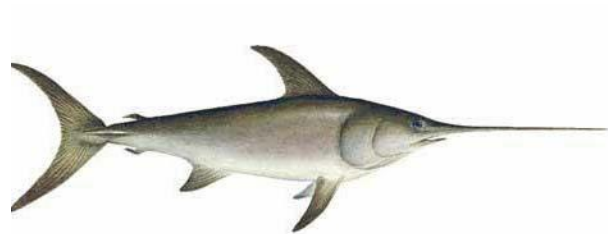# Assessment Data Report of the Billfish Working Group

27 April 2016

ISC Billfish Working Group

Chair: Jon Brodziak

Email: Jon.Brodziak@NOAA.GOV

Abstract – This report summarizes the data used in the 2016 stock assessment of the Pacific blue marlin (*Makaira nigricans*) stock conducted by the ISC Billfish Working Group. The summary consists of four tables that provide summaries of the history parameters (Table 1), catch data (Table 2), CPUE data (Table 3), and size composition data (Table 4) as well as a list of references.

Table 1. Key life history and stock-recruitment parameters used in the Pacific blue marlin population dynamics model. Boldface text indicates values that were updated because new information was available.

Parameter	Value	Comments	Source
Gender	2	Two genders model	ISC (2013)
Natural mortality (M)	Female: 0.42 (age 0) 0.37 (age 1) 0.32 (age 2) 0.27 (age 3) 0.22 (age 4+) Male: 0.42 (age 0) 0.37 (age 1+)	Age-specific natural mortality	Lee and Chang (2013)
Reference age (a1)	1	Fixed parameter	Refit from Chang et al. (2013); ISC (2013)
Maximum age (a2)	26	Fixed parameter	
Length at a1 (L1) (EFL cm)	Female: 144 Male: 144	Fixed parameter	Refit from Chang et al. (2013); ISC (2013)
Length at a2 (L2) (EFL cm)	Female: 304.18 Male: 226.0	Fixed parameter	Refit from Chang et al. (2013); ISC (2013)
Growth rate (K)	Female: 0.107 Male: 0.211	Fixed parameter	Refit from Chang et al. (2013); ISC (2013)
CV of L1 (CV=f(LAA))	Female: 0.14 Male: 0.14	Fixed parameter	Chang et al. (2013); ISC (2013)
CV of L2	Female: 0.15 Male: 0.1	Fixed parameter	Chang et al. (2013); ISC (2013)
Weight-at-length	Female: $W=1.844 \times 10^{-5}L^{2.956}$ Male:	Fixed parameter	Brodziak (2013)

	$W=1.37 \times 10^{-5}L^{2.975}$		
Length-at-50% Maturity (EFL cm)	179.76	Fixed parameter	Sun et al. (2009); Shimose et al. (2009)
Slope of maturity ogive	-0.2039	Fixed parameter	Sun et al. (2009); Shimose et al. (2009)
Fecundity	Proportional to spawning biomass	Fixed parameter	Sun et al. (2009)
Spawning season	2	Model structure	Sun et al. (2009)
Spawner-recruit relationship	Beverton-Holt	Model structure	Brodziak and Mangel (2011); **Brodziak et al. (2015)**
Spawner-recruit steepness (h)	0.87	Fixed parameter	Brodziak and Mangel (2011); **Brodziak et al. (2015)**
Recruitment variability (σ_R)	0.28; iteratively rescaled	Fixed parameter	Method from ISC (2013)
Initial age structure	5 yrs (1966-1970)	Estimated	ISC (2013)
Main recruitment deviations	1971-2013	Estimated	ISC (2013)
Bias adjustment	1971-2013	Fixed	ISC (2013)

Table 2. Fishery codes, acronyms, fishing fleets, catch time series, total catch (1971-2014, mt) and data sources by fleet used in the stock assessment of Pacific blue marlin by fishing fleets and gears: DWLL is distant water longline; OSLL is offshore longline; COLL is coastal and other longline; DRIFT is high seas large-mesh driftnet and coastal driftnet; LL is longline; GN is gillnet; HAR is harpoon; PS is purse seine.

Fishery Code	Acronym	Fishing Fleets in Fishery	Catch Time Series	Total Catch (mt)	Source
F1	JPNEarlyLL	Japanese DWLL & OSLL	1971-1993	210,395	Ijima and Shiozaki (2016)
F2	JPNLateLL	Japanese DWLL & OSLL	1994-2014	80,614	Ijima and Shiozaki (2016)
F3	JPNCLL	Japanese COLL	1971-2014	44,476	Ijima and Shiozaki (2016)
F4	JPNDRIFT	Japanese DRIFT	1972-2014	11,937	Ijima and Shiozaki (2016)
F5	JPNBait	Japanese bait fishing	1971-2014	8,127	Ijima and Shiozaki (2016)
F6	JPNOth	Japanese other gears	1971-2014	5,063	Ijima and Shiozaki (2016)
F7	HWLL	United States (Hawaii) LL	1971-2014	14,273	Ito (2016)
F8	ASLL	United States (American Samoa) LL	1996-2014	2,285	Russell Ito, pers. comm., Jan 13, 2016
F9	HWOth	United States (Hawaii) troll & handline	1987-2014	7,245	Ito (2016)
F10	TWNLL	Taiwanese DWLL	1971-2014	25,150	Nan-Jay Su, pers. comm., Jan 13, 2016
F11	TWNOth	Taiwanese OSLL, COLL, GN & HAR	1971-2014	182,848	Nan-Jay Su, pers. comm., Jan 13, 2016
F12	OthLL	Various flags[1] LL	1971-2014	187,738	Chang et al. (2016); Tagami and Wang

					(2016)
F13	PYFLL	French Polynesian LL	1990-2014	6,297	Chang et al. (2016)
F14	EPOPS	Various flags[2] PS in IATTC region	1993-2014	3,765	Chang et al. (2016)
F15	WCPFCPS	Various flags[3] in WCPFC region	1971-2014	10,747	Chang et al. (2016)
F16	EPOOth	French Polynesian troll & handline, HAR	2006-2014	1,257	Chang et al. (2016)
ALL	ALL	All Fleets	1971-2014	802,217	

[1]Australia, Belize, China, Cook Islands, Costa Rica, Fiji, Indonesia, Kiribati, Korea, Marshall Islands, Mexico, Federated States of Micronesia, New Caledonia, Niue, New Zealand, Papua New Guinea, Philippines, Samoa, Senegal, Spain, Solomon Islands, Tonga, Tuvalu, Vanuatu, and Vietnam.

[2] Ecuador, Honduras, México, Nicaragua, Panamá, El Salvador, Spain, Venezuela, Vanuatu, and USA.

[3] Australia, China, Ecuador, Federated States of Micronesia, Indonesia, Kiribati, Marshall Islands, Mexico, New Zealand, Papua New Guinea, Philippines, Solomon Islands, El Salvador, Spain, Tuvalu, Vanuatu, Korea, Japan, and USA.

Table 3. Available standardized indices of catch-per-unit effort (CPUE) or relative abundance, for Pacific blue marlin. See Table 1 for fishery codes and acronyms.

Index	Fishery Acronym (Code)	Time Series	N	Used?	Source
S1	JPNEarlyLL (F1)	1975-1993	19	Y	Kanaiwa et al. (2013)
S2	JPNLateLL (F2)	1994-2014	21	Y	Kai et al. (2016)
S3	HWLL (F7)	1995-2014	20	N	Carvalho et al. (2016)
S4	TWNLL-Early (F10)	1971-1978	8	Y	Su et al. (2016)
S5	TWNLL-Middle (F10)	1979-1999	21	Y	Su et al. (2016)
S6	TNWLL-Late (F10)	2000-2014	15	Y	Su et al. (2016)

Table 4. Available length and weight composition data for Pacific blue marlin by fishery. See Table 1 for fishery acronyms and codes.

Reference Code	Fleet	Fishery Description	Unit	Bin	n	Time series	Source
JPNEarlyLL	F1	Japanese offshore and distant-water longline (early period)	cm	5	92	1971-1993	Ijima and Shiozaki (2016)
JPNLateLL	F2	Japanese offshore and distant-water longline (late period)	cm	5	84	1994-2014	Ijima and Shiozaki (2016)
JPNDRIFT	F4	High-sea large-mesh driftnet and coastal driftnet	kg	Proportional to length	19	1977-1989; 1993; 1998	Ijima and Shiozaki (2016)
HWLL	F7	Hawaiian longline	cm	5	70	1994-2014	Langseth and Fletcher (2016)
TWNLL	F10	Taiwanese distant-water longline	cm	5	23	2005-2010	ISC (2013)
OthLL	F12	Various flags longline	cm	10	83	1992-2014	Chang et al. (2016)
PYFLL	F13	French Polynesia longline	cm	10	52	1996-2014	Chang et al. (2016)
EPOPS	F14	Various flags purse seine	cm	5	95	1990-2014	Chang et al. (2016)

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