Annex 10

REPORT OF THE BILLFISH WORKING GROUP WORKSHOP

International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

20-28 April 2015
Yokohama, Japan

1.0 INTRODUCTION

An intercessional workshop of the Billfish Working Group (BILLWG) of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) was convened in Yokohama, Japan from 20-28 April, 2015. The goal of this workshop was to conduct the stock assessment update for the Western and Central North Pacific Ocean (WCNPO) striped marlin stock in 2015.

Kotaro Yokawa from the National Research Institute of Far Seas Fisheries welcomed participants from Chinese Taipei, Japan, and the United States of America (USA) (Attachment 1). Because of health reasons, Jon Brodziak who is chairman of the ISC BILLWG could not attend. Brian Langseth was appointed as interim Chairman for this meeting by Jon Brodziak. The Chairman noted that no representatives were present from Canada, China, Korea, Mexico, Inter-American Tropical Tuna Commission (IATTC), or the Secretariat of the Pacific Community (SPC).

2.0 ADOPTION OF AGENDA AND ASSIGNMENT OF RAPPORTEURS

The Chairman noted the efforts of the working group (WG) at this meeting would follow the scientific method with particular emphasis placed on empirical testing, open debate, documentation and reproducibility, reporting uncertainty, and peer review.

The meeting agenda was reviewed, revised, and adopted (Attachment 2). Discussions about assessment inputs were conducted during the first day only. Rapporteuring duties for the WG were assigned to Brian Langseth, Mikihiko Kai, Hiroaki Okamoto, Kotaro Yokawa, Chi-Lu Sun, and Yi-Jay Chang.

3.0 COMPUTING FACILITIES

Computing facilities included a website for distribution of working papers and other meeting documents and information, a Google drive matching information from the website, as well as a Wi-Fi wireless network access point to connect to the Internet.

4.0 NUMBERING OF WORKING PAPERS AND DISTRIBUTION POTENTIAL

Working papers were distributed and numbered (Attachment 3). All working papers were agreed to be posted on the ISC website where they will be available to the public upon finalization.

5.0 STATUS OF WORK ASSIGNMENTS

The assignments for this meeting that stemmed from the January 2015 ISC BILLWG workshop were as follows:

- Submit all catch, standardized catch-per-unit effort (CPUE), and size composition data in electronic format to the data coordinator Darryl Tagami by February 1, 2015.
- Submit final versions of working papers submitted during January 2015 workshop to Jon Brodziak by February 10, 2015.
- Prepare working papers for the BILLWG assessment workshop (this meeting).
- Seek clarification from the SPC about exclusion of Indonesia and Belize in provided catch data.

The Chairman reported that all assignments were completed, except the last one. An inquiry was made to the SPC during this meeting by the data coordinator, but no response was provided.

6.0 WCNPO STRIPED MARLIN ASSESSMENT MODELING

Three working papers, one on the topic of size composition data (section 6.1), and two on the topic of stock assessment (sections 6.2 and 6.3) were presented to the WG. The WG reviewed the working papers and discussed the presentations by Yi-Jay Chang and Chi-Lu Sun.

6.1 Graphical Presentation of the Striped Marlin (*Kajikia audax*) Size Composition Data to be Used in the 2015 Stock Assessment Update (ISC/15/BILLWG-2/01)
Presented by Yi-Jay Chang

This working paper (WP) presents graphical presentations of striped marlin *Kajikia audax* mean size data in the form of time series from ISC, WCPFC, and cooperating nations, which will be used in the 2015 ISC Billfish Working Group stock assessment update. This WP explores the consistency of the historical length frequency distributions during 1975-2010 between the 2011 assessment and the 2015 update assessment. Seeming discrepancies were identified, tabulated, and investigated to the extent possible. This WP conforms to ISC guidelines concerning use of best available scientific information by presenting the size data by years and quarters, categorized by fleets and gears.

<u>Discussion</u>

All major fleets updated their size data to 2013, while some other fleets had limited number of size data in the updated period. It was noted in the WP that size compositions provided for the 2015 stock assessment differed in some years prior to 2010 with size compositions from the 2011 stock assessment. Differences were in sample size or distributional shape. These differences were not discussed at the data workshop; comparisons with prior assessment size data and justification of differences between the two were not provided by reporting countries. The presenter requested and strongly recommended data-providing countries include sufficient metadata to elucidate fully any possible ambiguity regarding their data submissions. The WG discussed and agreed that comparisons between new and old data across similar years be done by data-providing countries as part of the data submitting process, and that any revision of historical data should be recorded in the systematic way through collaboration with the ISC Statistics WG.

The WG also discussed the relationship between size data and stock structure. The WG expressed concerns about the current area stratifications, and recommended that further research be performed to improve the areal stratification for future stock assessment and to better match striped marlin migrations patterns and spawning areas and periods.

The WG requested that the author clarify decisions about the size composition data used in the preliminary stock assessment working paper. The WG noted that the preliminary analyses used old data for Japanese size comps and added new data for 2010 onwards. The WG discussed that the newly provided Japanese data represented additional samples from longline fisheries and other fisheries and constituted best available information. Consequently, it was recommended and agreed by the WG to use all new Japanese size composition data, as provided at the January data workshop (ISC 2015). The WG noted that size data for the WCPO area fleet only included one new year in comparison to the last assessment. The WG also noted that the Korean size data, which in the last assessment had only one year of data, had low sample size and was uninformative. As a result, these data were not used.

6.2. Preliminary Stock Assessment Update for Striped Marlin (*Kajikia audax*) in the Western and Central North Pacific Ocean through 2013 (ISC/15/BILLWG-2/02)

Presented by Yi-Jay Chang

We present a preliminary update of the stock assessment of the Western and Central North Pacific Ocean striped marlin (*Kajikia audax*) stock conducted in 2011 by the ISC Billfish Working Group. The assessment update consisted of running a Stock Synthesis model with newly available catch, abundance index, and size composition data for 1975-2013. We used the same model structure and parameters as were used in the base case model from the 2011 stock assessment. The preliminary results indicated that biomass (age 1 and older) of the WCNPO striped marlin stock showed a long-term decline from 29,940 to 6,141 mt from 1975 to 2010 that was followed by an increase to around 8,800 mt for the last three years (2011-2013). Estimates of fishing mortality were stable, and fluctuated around 0.7 $year^{-1}$ over the last six years. Compared to maximum sustainable yield (MSY)-based reference points, the current spawning biomass (2013) was 48% below SSB_{MSY} and the current fishing mortality (average F for 2010-2013) was 19% above F_{MSY}. Consequently, the stock remained in an overfished state and overfishing was still occurring. The aim of this working paper is to provide the basic update assessment model and its results to the BILLWG. Further in-depth exploration of various data sets and different alternative model scenarios will be discussed at the 2015 BILLWG assessment meeting.

Discussion

Catch data

The working paper (WP2) showed differences in some years prior to 2010 between newly provided catch data for the 2015 assessment and in data from the 2011 assessment. The WG discussed the choices to update old catch data from the last assessment with the new catch data for only 2010-2013 for two of three Taiwanese fleets, the Hawaiian fleet, and other fleets in WCPO area. Concerns were raised by WG about the selection methods of best available data. These initial decisions were made because differences in these data were not available for full review at the January 2015 data workshop.

The WG recognized that historical catch series of Taiwanese fisheries were revised since the 2011 assessment and that some differences were observed between old and new time series. The WG discussed and agreed that the new Taiwanese time series workshop for the offshore longline fleet and coastal fisheries fleet provided at the data were more appropriate for the stock assessment than those used in the last assessment. The WG noted that the new data series provided a more accurate representation of total catch which included foreign-based offshore longline fleets and also corrected previous double counting of some coastal fisheries data. The third Taiwanese fleet (distant water longline) was also updated with new data to maintain consistency with other fleets.

The WG discussed differences among the Hawaiian catches and agreed that the use of only updated data from 2010-2013 provided the best available information due to possible misidentification of striped marlin as blue marlin, as discussed at the January 2015 data workshop (Ito 2015). The WG also noted that catches from the last assessment were generally greater than catches presented at the January data workshop.

The WG discussed the treatment of the catch data for Indonesia and Belize, which were not reported in the newly provided data for the category of other fleets operating in the WCPO area, as well as the catch data for China. Given that there was no new information provided at the data workshop, and no representation from the respective countries at this meeting, the WG agreed that updating new 2010-2013 catch data to the data time series from the last assessment, which included Indonesia and Belize, constituted the best approach. The WG discussed the issue of multiple catch series in 2010-2013 for the model's WCPO area fleet as reported by TASK I and TASK II data from the WCPFC and by an additional series for China submitted by China to the January data preparatory meeting. In the WP, the maximum of reported catch among all series was used. Given the precedent for using country-provided data if these were directly provided, and TASK I data over TASK II data, the WG agreed to use TASK I data for individual counties within the WCPO area fleet and the China data as directly provided by China. One sensitivity run was conducted using TASK I data for China and results were similar to those using the directly provided data. The WG discussed the lack of new information on Indonesia and Belize catch data and recommended that data from these countries be routinely be reported to improve future assessments.

The WG discussions about catch data strongly supported the WG recommendation that any revision of historical data used in the last assessment be explained in the systematic way by data-submitting countries at the BILLWG data workshop. Nonetheless, the time series of total annual catches of striped marlin to be used in the 2015 assessment was very similar to that used in the 2011 with some minor differences occurring after 2000 (Figure 6.1.).

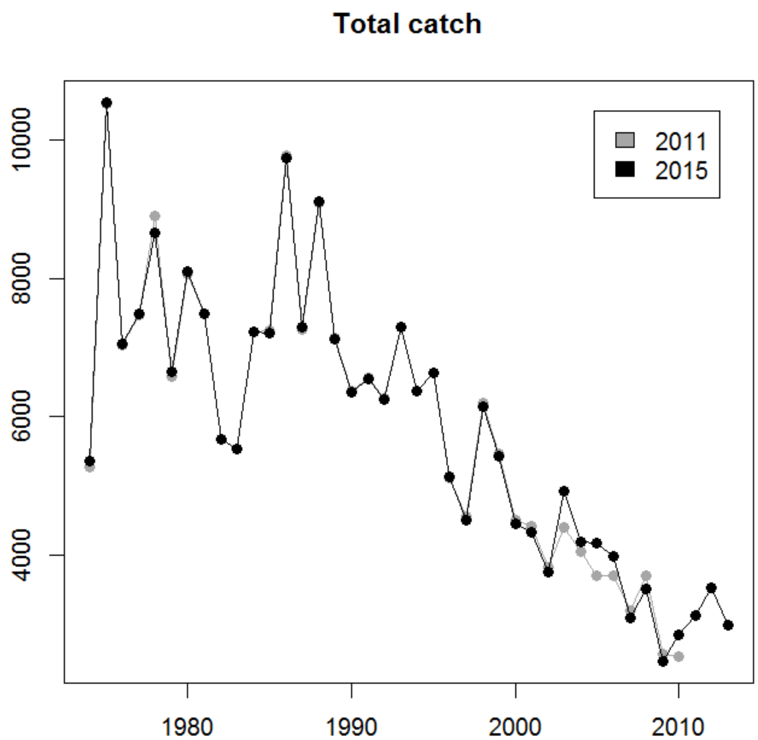

Figure 6.1: Total catch (mt) used in the previous 2011 assessment (gray) in comparison to total catch used for the current 2015 assessment (black).

Other inputs

There was no new information presented to the WG about the biology of the WCNPO striped marlin stock. The WG agreed to the use of the life history parameters from the previous 2011 assessment in the 2015 assessment update and also agreed to use the same fishery definitions and fishery selectivity assumptions

Model runs

The WG reran the model presented in the assessment WP2. Comparisons between the previous results in the WP2 and the new results were requested by the WG to better understand the possible influences of agreed upon changes in both catch and size composition data to the assessment results. It was determined that recommended improvements in the treatment of the catch data had little effect on model results, but that improvements in the treatment of the size composition data were influential. In particular, changes in the size composition data affected the scale of historical fishing mortality estimates, although estimates of stock status did not change (Figure 6.2). The new size composition data affected the estimates of fishery selectivity, especially for the Japanese fleets, and also affected estimates of stock age structure and recruitment. These findings support the recommendation by the WG to do further future research on striped marlin stock structure to better match fishery assumptions with the spatial information in the size composition data.

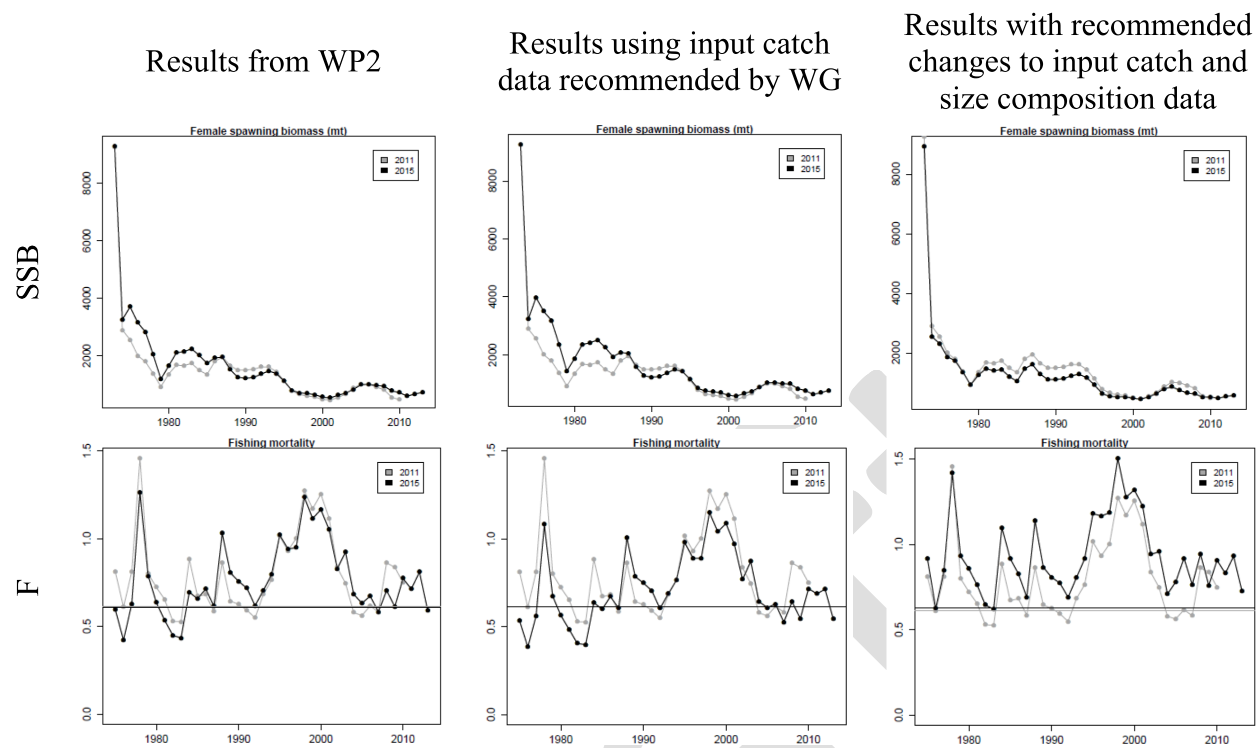

Figure 6.2: Female spawning stock biomass (SSB) and fishing mortality (F) estimates from the 2011 stock assessment (red line – 2011) compared to those for the 2015 assessment update (blue line – 2015) under three input data assumptions: WP2 model using original WP2 input data (first column), WP2 model using input catch data recommended by WG (second column), and WP2 model using input catch and size composition data recommended by WG (third column). Horizontal lines in fishing mortality plots (second row) show estimates of F_{MSY}.

In what follows below, all of the model results incorporate the recommendations of the WG about the input catch and size composition data (Figure 6.2, third column).

Model diagnostics

The WG reviewed model diagnostics including residuals plots, fits to CPUE indices, and likelihood profiles. The WG discussed the choice of a data weighting method, particularly for size composition data. This was done because the method used in WP2 (i.e., Francis 2011, Table A1, Method TA1.8) differed slightly from that used in the previous stock assessment (i.e., Francis 2011, Table A1, Method TA1.1). The weighting method used in the last assessment emphasized a preference for fitting the relative abundance indices in comparison to fitting size compositions (Francis 2011). However, this weighting method does not account for correlations within the size composition data. The WG noted that the TA1.8 weighting method proposed for this assessment in WP2 reflected a preference to fitting abundance indices, accounted for correlations within size composition data, and was preferred in Francis (2011) to the TA1.1 method used in the last assessment.

The WG compared the model diagnostics and fits using the two weighting methods. The comparison showed that model fits were generally similar. Likelihood profiles of total, size data, and CPUE likelihood components as a function of log-scale unfished recruitment (logR0) were constructed. The WG noted a spike in the total likelihood component near the model estimate of logR0, which was recognized to be caused by a spike in the size composition component for the Japanese distant water longline (fleet F1). The shapes of the likelihood profiles for CPUE were acceptable under both weighting methods but a slight improvement was observed using the new weighting method. The WG also noted that, despite this improvement, there was some misfitting of size composition data near the best estimate of logR0. To alleviate this, the WG suggested the exploration of a model that down weighted the size data from fleet F1 in order to reduce the effect of the misfit. Further exploration using the new weighting method with down weighted fleet F1 data showed that using the new weighting method with down weighting of fleet F1 was superior to the previous weighting method, particularly for CPUE likelihood (Figure 6.3).

Overall, the WG noted that:
(1) model fits were similar across weighting methods with and without down weighting fleet F1;
(2) the shape of the likelihood profiles improved using the new weighting method with a down weighted fleet F1; and
(3) in general, the new weighting method was preferred to the old method because it better accounts for correlation within composition data (Francis 2011).

As a result, the WG agreed to use the new weighting method (TA1.8 in Francis (2011)) and a down-weighted size composition likelihood component of fleet F1 for the base case model. The WG agreed to use the previous weighting method (TA1.1 in Francis (2011)) as a sensitivity run to determine how model outcomes were affected by this assumption.

6.3. Stock Assessment of Striped Marlin (*Kajikia audax*) in the Western and Central North Pacific Ocean Using an Age-structured Model: Updated to 2013 (ISC/15/BILLWG-2/03)

Presented by Chi-Li Sun

Based on the two-stock scenario for striped marlin population structure, an age-structured population dynamics model was fitted to catch, catch-rate, and length-frequency data for the WCNPO stock of striped marlin to examine the current status of this population. Catch-rate and length-frequency data of striped marlin for Japanese, Taiwanese, and Hawaiian fisheries in the North Pacific Ocean were included in the analyses. Results indicate that the current spawning stock biomass in 2013 has increased to near the MSY level but still remains below SSB_{MSY}, and that the current fishing mortality in 2013 has decreased to below the level needed to maintain MSY since 2010.

Discussion

This working paper used a subset of the total data available used in the previous working paper (i.e., ISC/15/BILLWG-2/02). Given that the modeling platform for this assessment was Stock Synthesis (SS3), the WG focused its discussion on the SS3 model.

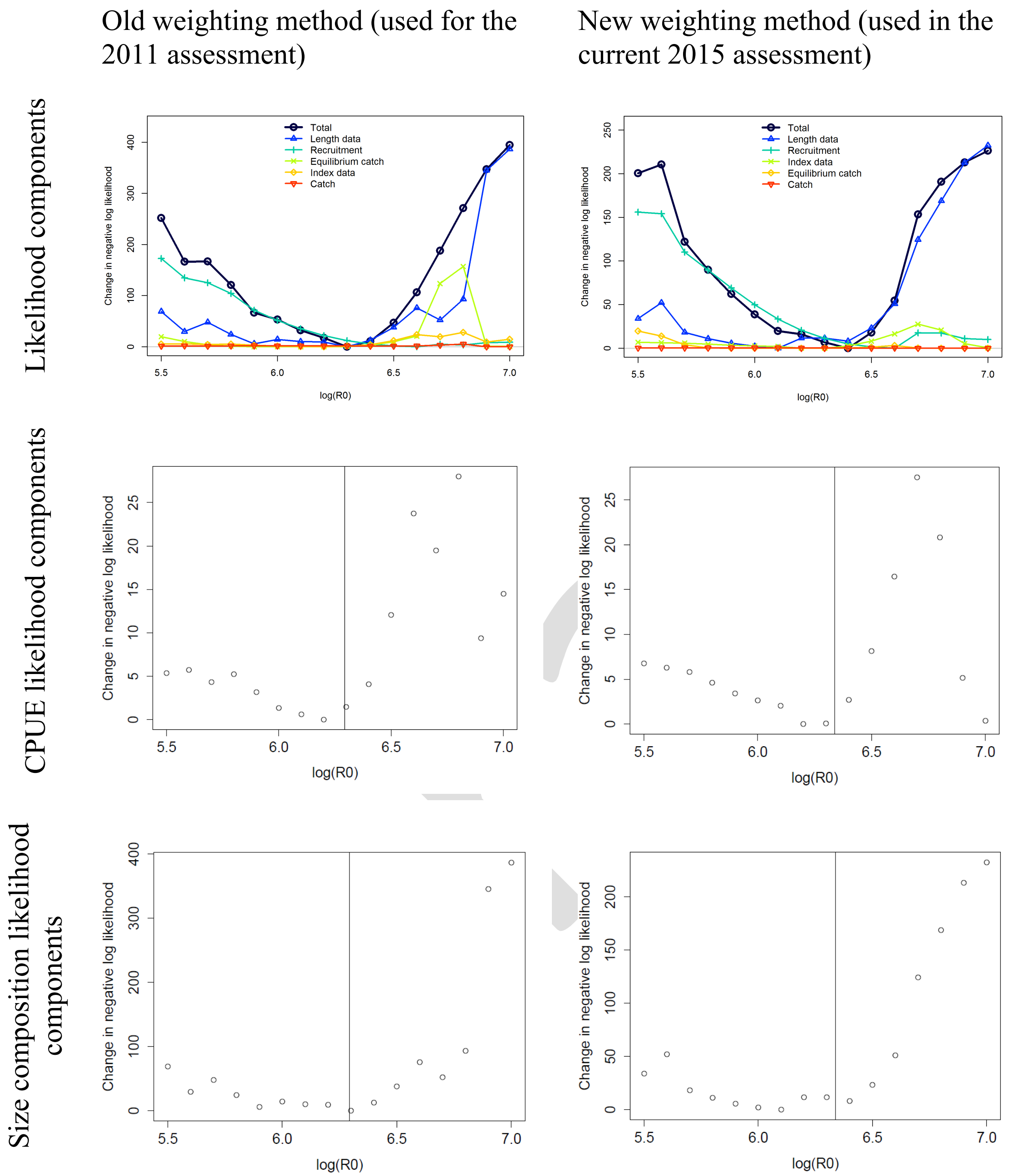

Figure 6.3: Results of likelihood profile plots on logR0 for each likelihood component (first row) of the assessment model using the weighting method used in last assessment model (first column) and the recommended weighting method used for this assessment model (second column). The likelihood component for abundance indices (second row) and size composition data (third row) were rescaled. logR0 values are on x-axis, and relative change in negative log-likelihood is on y-axis.

7.0. ADOPTION OF THE BASE CASE ASSESSMENT MODEL FOR WESTERN AND CENTRAL NORTH PACIFIC STRIPED MARLIN

The WG adopted a base case assessment model for the Western and Central North Pacific Ocean striped marlin. The structure, input data, and assumptions for the base case model were updated from the tables in the associated BILLWG working papers and this information was summarized (Tables 7.1, 7.2, 7.3, 7.4, 7.5).

Table 7.1. Descriptions of fisheries included in the base-case model for the stock assessment update including fishing countries, gear types, catch units (biomass (B) or numbers (#)), and reference sources for catch data.

Fishery number	Reference Code	Fishing Countries	Units	Source
F1	JPN_DWLL_A1	Japan	#	Yokawa et al. (2015)
F2	JPN_DWLL_A2	Japan	#	Yokawa et al. (2015)
F3	JPN_DWLL_A3	Japan	#	Yokawa et al. (2015)
F4	JPN_CLL	Japan	B	Yokawa et al. (2015)
F5	JPN_DRIFT	Japan	B	Yokawa et al. (2015)
F6	JPN_OLL	Japan	B	Yokawa et al. (2015)
F7	JPN_SQUID	Japan	B	Yokawa et al. (2015)
F8	JPN_BAIT	Japan	B	Yokawa et al. (2015)
F9	JPN_NET	Japan	B	Yokawa et al. (2015)
F10	JPN_TRAP	Japan	B	Yokawa et al. (2015)
F11	JPN_OTHER_Q12	Japan	B	Yokawa et al. (2015)
F12	JPN_OTHER_Q34	Japan	B	Yokawa et al. (2015)
F13	TWN_LL	Taiwan	B	Su et al. (2015a)
F14	TWN_OSLL	Taiwan	B	Su et al. (2015a)
F15	TWN_CF	Taiwan	B	Su et al. (2015a)
F16	HW_LL	USA	B	Ito (2015)
F17	WCPO_OTHER	See working paper text for full list	B	Yau and Chang (2015); Tagami and Wang (2015)
F18	KOR_LL	Korea	B	Sang Chul Yoon, pers. comm., Jan 6, 2015

Table 7.2. Descriptions of standardized relative abundance indices (catch-per-unit-effort, CPUE) for striped marlin from the Western and Central North Pacific Ocean used in the stock assessment update including whether the index was used in the base case, sample size (n), years of coverage, and reference source. For all indices, catch was in numbers.

Reference Code	Used	Fishery Description	*n*	Time series	Source
S2_JPN_DWLL1_A1	Yes	Japanese offshore and distant-water longline area 1	12	1975-1986	Kanaiwa et al. (2015)
S3_JPN_DWLL2_A1	Yes		13	1987-1999	Kanaiwa et al. (2015)
S4_JPN_DWLL3_A1	Yes		14	2000-2013	Kanaiwa et al. (2015)
S6_JPN_DWLL1_A2	Yes	Japanese offshore and distant-water longline area 2	12	1975-1986	Kanaiwa et al. (2015)
S7_JPN_DWLL2_A2	Yes		13	1987-1999	Kanaiwa et al. (2015)
S5_JPN_DWLL3_A2	Yes		14	2000-2013	Kanaiwa et al. (2015)
S8_JPN_DWLL1_A3	Yes	Japanese offshore and distant-water longline area 3	12	1975-1986	Kanaiwa et al. (2015)
S9_JPN_DWLL2_A3	Yes		13	1987-1999	Kanaiwa et al. (2015)
S10_JPN_DWLL3_A3	Yes		14	2000-2013	Kanaiwa et al. (2015)
S11_JPN_CLL	Yes	Japanese coastal longline	20	1994-2013	Oshimo et al. (2015)
S12_JPN_DRIFT1	No	Japanese high-sea large-mesh driftnet	17	1977-1993	Yokawa (2005)
S13_JPN_DRIFT2	No	Japanese coastal driftnet	11	2001-2002; 2004-2011; 2013	Yokawa and Shiozaki (2015)
S14_TWN_LL1	No	Taiwanese distant-water longline	16	1975-1984, 1987, 1989-1993	Sun et al. (2011c)
S15_TWN_LL2	Yes	Taiwanese distant-water longline	19	1995-2013	Sun et al. (2015)
S16_HW_LL	Yes	Hawaiian longline	18	1996-2013	Walsh and Chang (2015)

Table 7.3. Description of size composition data (eye-fork lengths, EFL, cm) for striped marlin from the Western and Central North Pacific Ocean used in the stock assessment update, including number of observations (n), years of coverage, and reference sources.

Reference Code	Fishery Description	*n*	Time series	Source
L_JPN_DWLL_A1	Japanese offshore and distant-water longline in area1	71	1975-1990 1992-2000 2002; 2004; 2006; 2011; 2012	Yokawa et al. (2015)
L_JPN_DWLL_A2	Japanese offshore and distant-water longline in area2	152	1975-2013	Yokawa et al. (2015)
L_JPN_DWLL_A3	Japanese offshore and distant-water longline in area3	154	1975-2013	Yokawa et al. (2015)
L_JPN_CLL	Japanese coastal longline	109	1986-2013	Yokawa et al. (2015)
L_JPN_DRIFT	Japanese high-sea large-mesh driftnet and coastal driftnet	46	1980-1983; 1991; 2000; 2004-2013	Yokawa et al. (2015)
L_JPN_OTHER_Q12	Japanese harpoon and trolling in quarters 1 and 2	47	1976-1997; 2000; 2006-2008; 2010	Yokawa et al. (2015)
L_JPN_OTHER_Q34	Japanese harpoon and trolling in quarters 3 and 4	26	1977-1979; 1982-1990; 1992-1993; 1995; 2007-2011	Yokawa et al. (2015)
L_TWN_LL	Taiwanese distant-water longline	29	2006-2013	Su et al. (2015)
L_HW_LL	Hawaii longline	77	1994-2013	Eric Fletcher, pers. comm., Jan 13, 2015
L_WCPO_OTHER	Miscellaneous longline	54	1993-2010	Yau and Chang (2015)

Table 7.4. Key life history parameters and model structures for striped marlin from the Western and Central North Pacific Ocean used in the stock assessment update including values, pertinent comments, and references.

Parameter	**Value**	**Comments**	**Source**
Gender	1	Female only	ISC(2012)
Natural mortality	0.54 (age 0) 0.47 (age 1) 0.43 (age 2) 0.40 (age 3) 0.38 (age 4-15)	Age-specific natural mortality	Piner and Lee (2011)
Reference age (a1)	0.3	Fixed parameter	Refit from Sun et al. (2011a); ISC(2012)
Maximum age (a2)	15	Fixed parameter	
Length at a1 (L1)	104	Fixed parameter	Refit from Sun et al. (2011a); ISC(2012)
Length at a2 (L2)	214	Fixed parameter	Refit from Sun et al. (2011a); ISC(2012)
Growth rate (K)	0.24	Fixed parameter	Refit from Sun et al. (2011a); ISC(2012)
CV of L1 (CV=f(LAA))	0.14	Fixed parameter	ISC (2012)
CV of L2	0.08	Fixed parameter	ISC (2012)
Weight-at-length	$W=4.68e\text{-}006 \times L^{3.16}$	Fixed parameter	Sun et al. (2011a)
Size-at-50% Maturity	177	Fixed parameter	Sun et al. (2011b)
Slope of maturity ogive	-0.064	Fixed parameter	Sun et al. (2011b)
Fecundity	Proportional to spawning biomass	Fixed parameter	Sun et al. (2011b)
Spawning season	2	Model structure	Sun et al. (2011b)
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)
Log of Recruitment at virgin biomass $\ln(R_0)$	6.31642	Estimated	ISC (2012)
Recruitment variability (σ_R)	0.6	Fixed parameter	ISC (2012)
Initial age structure	5 yrs	Estimated	ISC (2012)
Main recruitment deviations	1975-2008	Estimated	ISC (2012)

Table 7.5. Fishery-specific selectivity assumptions for striped marlin from the Western and Central North Pacific Ocean. The selectivity curves for fisheries lacking size composition data were assumed to be the same as (i.e., mirror fishery) closely related fisheries or fisheries operating in the same area.

Fishery Number	Reference Code	Selectivity Assumption	Mirror Fishery
F1	JPN_DWLL_A1	Double-normal	
F2	JPN_DWLL_A2	Double-normal for 1975-1986; 1987-1999; 2000-2013	
F3	JPN_DWLL_A3	Double-normal for 1975-1986; 1987-1999; 2000-2013	
F4	JPN_CLL	Double-normal	
F5	JPN_DRIFT	Logistic	
F6	JPN_OLL	Double-normal	F4
F7	JPN_SQUID	Logistic	F5
F8	JPN_BAIT	Double-normal	F4
F9	JPN_NET	Double-normal	F4
F10	JPN_TRAP	Double-normal	F4
F11	JPN_OTHER_Q12	Logistic	
F12	JPN_OTHER_Q34	Double-normal	
F13	TWN_LL	Double-normal	
F14	TWN_OSLL	Double-normal	F13
F15	TWN_CF	Double-normal	F13
F16	HW_LL	Double-normal	
F17	WCPO_OTHER	Double-normal	
F18	KOR_LL	Double-normal	F2

7.1. Base Case Assessment Model

The WG noted that the base case stock assessment model was fit using the Stock Synthesis (Version 3.24f) software. Information to parameterize the biology and life history of the species (Table 7.4) was taken from ISC BILLWG working papers as previously agreed. Growth was modeled with a von Bertalanffy growth curve, recruitment was modeled with a Beverton-Holt stock-recruit curve and the natural mortality rate was age-specific. The base case model structure allowed for the estimation of domed-shaped selectivity patterns for all fisheries except the Japanese driftnet and other-early fishery; fishery selectivity patterns for these two fisheries were assumed to be asymptotic (Table 7.5). Fishery selectivity patterns were also allowed to vary in time for the Japanese distant water longline fleet. Variances for likelihood components were rescaled following methods described in Francis (2011) and in particular, accounted for correlation among size composition data (Table 7.6) and used iterative reweighting. The dynamics of the base case model started in 1975. It was assumed that the combined fisheries were in equilibrium in 1975 with an assumed equilibrium catch of 5,000 mt. There were 5 initial recruitment deviations estimated prior to the start of model dynamics and these deviations were used to initialize the population age structure in 1975. The base case model was to the length composition data and CPUE indices. The base case model results were summarized (Figures 7.1, 7.2 and 7.3) along with the associated likelihood components (see Figure 6.3 – second column).

Table 7.6. Likelihood component data variances used in the stock assessment. N indicates the

number of observations. q is the analytical solution of the catchability coefficient. Inputted and model expected variances (Input CV and RMSE for indices; and mean_input_N and mean_effN for size compositions) are given where input variances reflect a single iterative re-scaling of estimates, as is the standard deviation of normalized residuals (SDNR) and their Chi-squares values.

Fleet	n	q	Input CV	RMSE	SDNR	Chi-squares
Svey2_JPN_DWLL1	12	6.25E-06	0.33	0.32	1.01	1.34
Svey3_JPN_DWLL1	13	1.04E-05	0.36	0.45	1.26	1.32
Svey4_JPN_DWLL1	14	1.17E-05	0.76	0.62	0.72	1.31
Svey5_JPN_DWLL2	14	4.89E-05	0.39	0.60	1.57	1.31
Svey6_JPN_DWLL2	12	1.85E-05	0.55	0.49	0.93	1.34
Svey7_JPN_DWLL2	13	5.37E-05	0.27	0.61	2.38	1.32
Svey8_JPN_DWLL3	12	0.000398	0.30	0.32	1.12	1.34
Svey9_JPN_DWLL3	13	0.000668	0.25	0.25	1.04	1.32
Svey10_JPN_DWLL3	14	0.000187	0.59	0.72	1.19	1.31
Svey11_JPN_CLL	20	0.00111	0.28	0.44	1.57	1.26
Svey12_JPN_DFT	17	0.001119	0.21	0.45	2.27	1.28
Svey13_JPN_DFT	11	0.024206	0.21	0.26	1.31	1.35
Svey14_TWN_EARLY	16	0.002961	0.61	0.57	0.97	1.29
Svey15_TWN_LATE	19	0.010202	0.20	0.16	0.81	1.27
Svey16_HWLL	18	0.006014	0.52	0.47	0.93	1.27

FleetName	Fleet	mean_input_N_2015	mean_effN_2015
JPN_DWLL1	1	1.03	12.85
JPN_DWLL2	2	41.12	35.13
JPN_DWLL3	3	17.46	42.21
JPN_CLL	4	26.68	51.13
JPN_DRIFT	5	25.41	92.61
JPN_OTHER_early	11	7.59	24.69
JPN_OTHER_late	12	4.18	18.53
TWN_LL	13	16.16	53.89
HW_LL	16	35.68	27.32
WCPO_OTHER	17	3.47	25.92
KOR_LL	18	1.77	7.53

Table 7.7. Table showing values from update base case model for 2007-2013, as well as 2009 value from last assessment (ISC, 2012). Mean, min, and max values are of 2007-2013.

	Last assessment	Current base case update assessment									
Year	2009	2007	2008	2009	2010	2011	2012	2013	Mean	Min	Max
Reported catch	2560	3084	3503	2468	2852	3125	3521	2984	3077	2468	3521
Population biomass	5335	6915	6773	6409	5156	7823	7349	6819	6749	5156	7823
SSB	1106	1192	1171	970	984	873	1013	1094	1043	873	1094
Relative SSB	0.41	0.42	0.42	0.34	0.35	0.31	0.36	0.39	0.37	0.31	0.39
Recruitment	349	240	242	63	496	155	224	352	253	63	496
F	0.84	0.82	0.99	0.80	0.96	0.89	0.97	0.76	0.89	0.76	0.97
Relative F	1.41	1.29	1.57	1.27	1.51	1.41	1.53	1.20	1.40	1.20	1.53
Exploitation	0.48	0.45	0.52	0.39	0.55	0.40	0.48	0.44	0.46	0.39	0.55
SPR	0.13	0.15	0.12	0.16	0.13	0.12	0.12	0.14	0.13	0.12	0.16

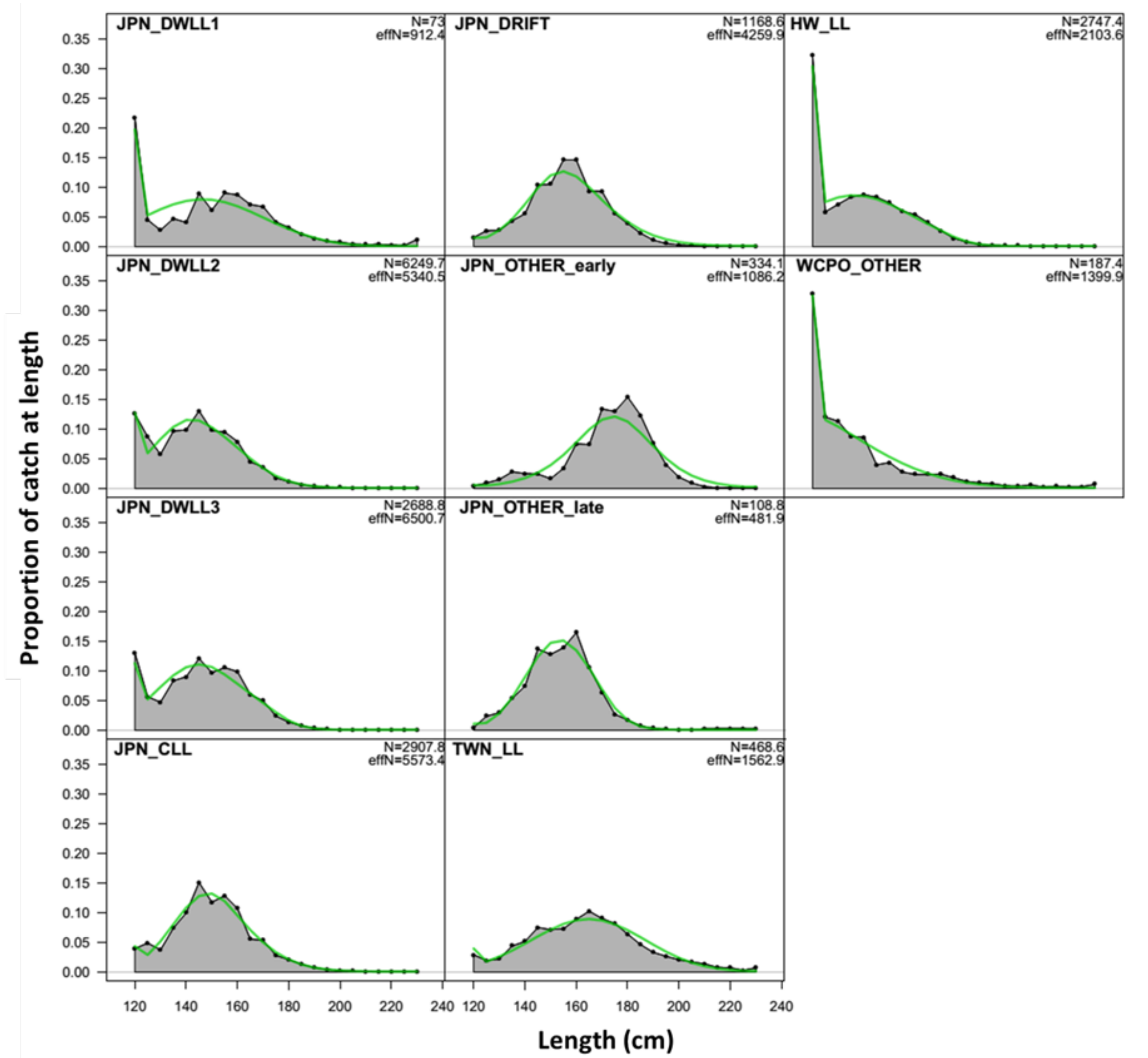

Figure 7.1. Aggregated (across season and years) fits to the size composition data by fishery for the base case model.

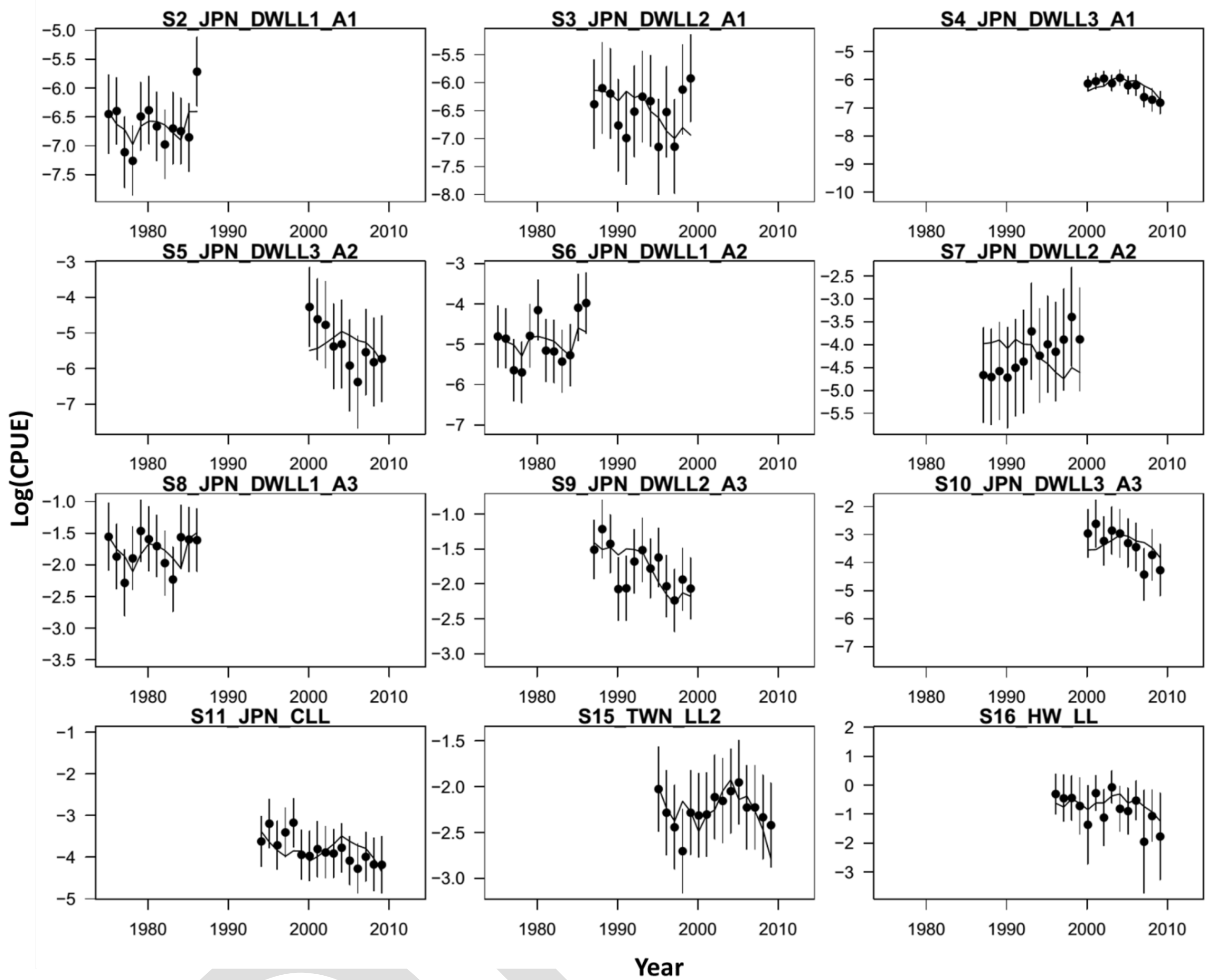

Figure 7.2. Observed (line) and predicted fishery (points) CPUE for the base case model. Vertical lines represent error bars around estimates.

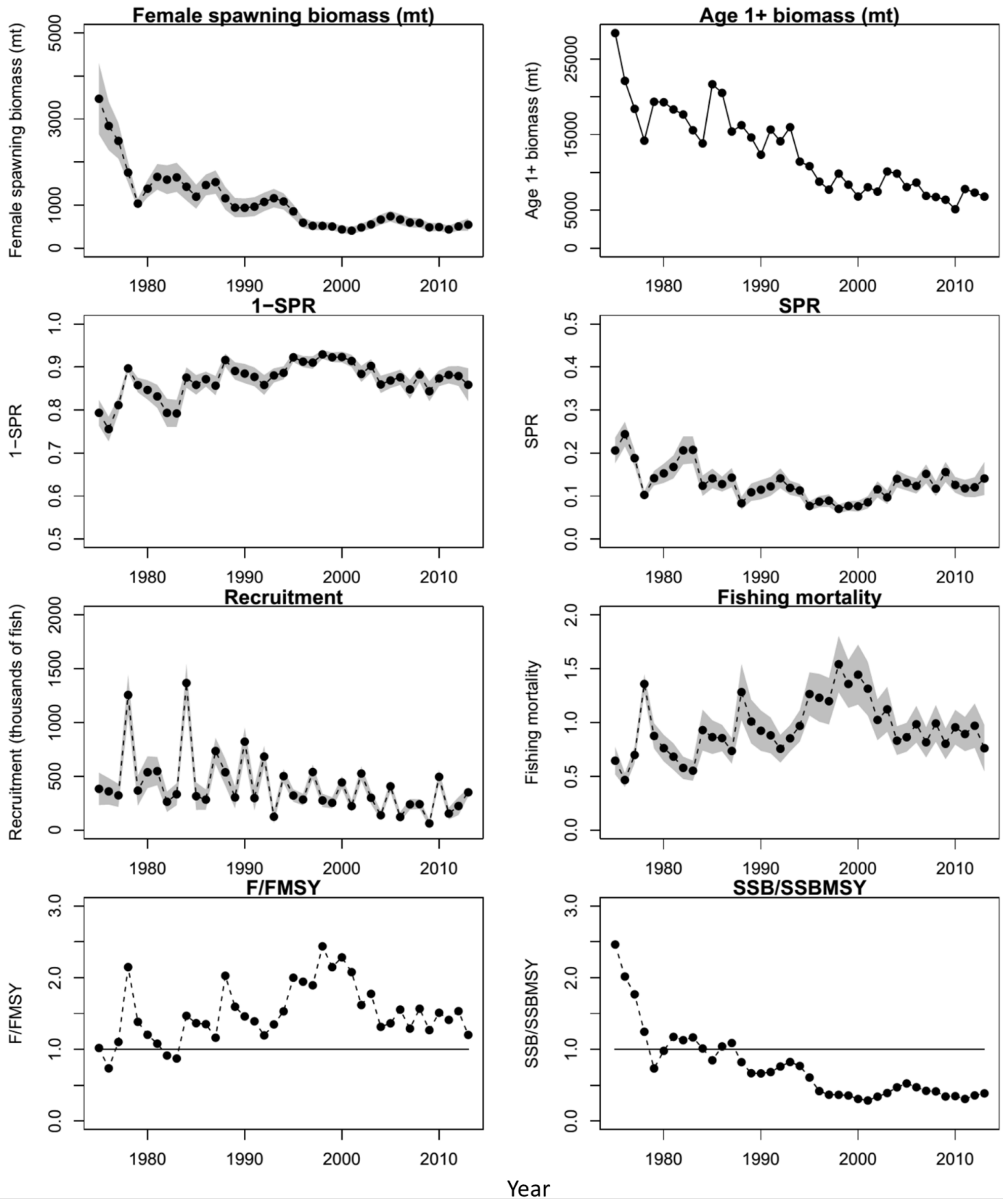

Figure 7.3. Maximum likelihood estimates of assessment outputs for the base case model including spawning biomass (SSB) age-1 and older biomass (Age 1+ biomass), one minus spawning potential ratio (1-SPR) and SPR, recruitment of age-0 fish (Recruitment), an average adult (ages 3-12) fishing mortality rate, average adult fishing mortality relative to F_{MSY} (F/F_{MSY}), and female spawning biomass relative to SSB at MSY (SSB/SSB_{MSY}). Solid circles are maximum likelihood estimates of the quantities of interest and the shaded regions are the approximate 95% confidence intervals for the point estimates.

7.2. Stock status

Results from the base case assessment model were used to determine trends in population biomass, female spawning stock biomass, and fishing mortality of the WCNPO striped marlin stock during 1975-2013. Estimates of population biomass (age-1 and older) showed a long-term decline (Figure 7.4). Population biomass averaged roughly 20,500 mt during 1975-1979 (46% of unfished biomass) and declined to 5,155 mt in 2010 and slightly increased to an average of 7,330 mt during 2011-2013 (16% of unfished biomass). Reported catches of WCNPO striped marlin also declined from an average of 8,172 mt during 1975-1979 to an average of 3,210 mt during 2011-2013 (Figure 7.4). Spawning stock biomass also exhibited a generally declining trend from 1975-1996 and stabilized afterwards (Figure 7.5). Estimates of SSB averaged roughly 4,642 mt during 1975-1979 (65% above SSB_{MSY} (2819 mt), the spawning stock biomass to produce MSY) and declined to an average of roughly 993 mt during 2011-2013 (65% below SSB_{MSY}). Fishing mortality rates fluctuated at or above F_{MSY}, the fishing mortality to produce MSY, during 1975-2013 (Figure 7.6). Estimates of annual fishing mortality averaged roughly F_{1975}-F_{1979} = 0.81 during 1975-1979 (29% above F_{MSY} =0.63) and averaged roughly F_{2011}-F_{2013} = 0.88 during 2011-2013 (40% above F_{MSY}). If the status of the WCNPO striped marlin stock was evaluated relative to MSY-based reference points using the average estimates during 2011-2013 to measure current status with the minimum stock size threshold set to be 50% of SSB_{MSY}, then the stock would currently be considered to be depleted and would currently be experiencing overfishing, as shown in the Kobe plot (Figure 7.7).

7.2.1. Comparison to the previous assessment

The base case model indicated that slight increases of SSB (Figure 7.5) and recruitment (Figure 7.3) occurred during 2011-2013. Yet in comparison to the 2011 results, the trajectory of relative spawning stock biomass was shifted more towards the upper left quadrant of the Kobe plot with higher depletion (Figure 7.7) than was estimated in the last assessment (ISC, 2012). One reason for this change was the updated size composition data for the Japanese offshore and distant-water longline fisheries (Figure 6.2) which comprise one of the largest fisheries that capture striped marlin. The changes in size composition data resulted in changes in fishery selectivity estimates and also affected recruitment estimates. The WG recommended that future work on this assessment include an exploration of the influence of size composition data (see section 8.3). Additional quantities of interest for the base case model and the previous 2011 assessment were also tabulated for comparison (Table 7.7).

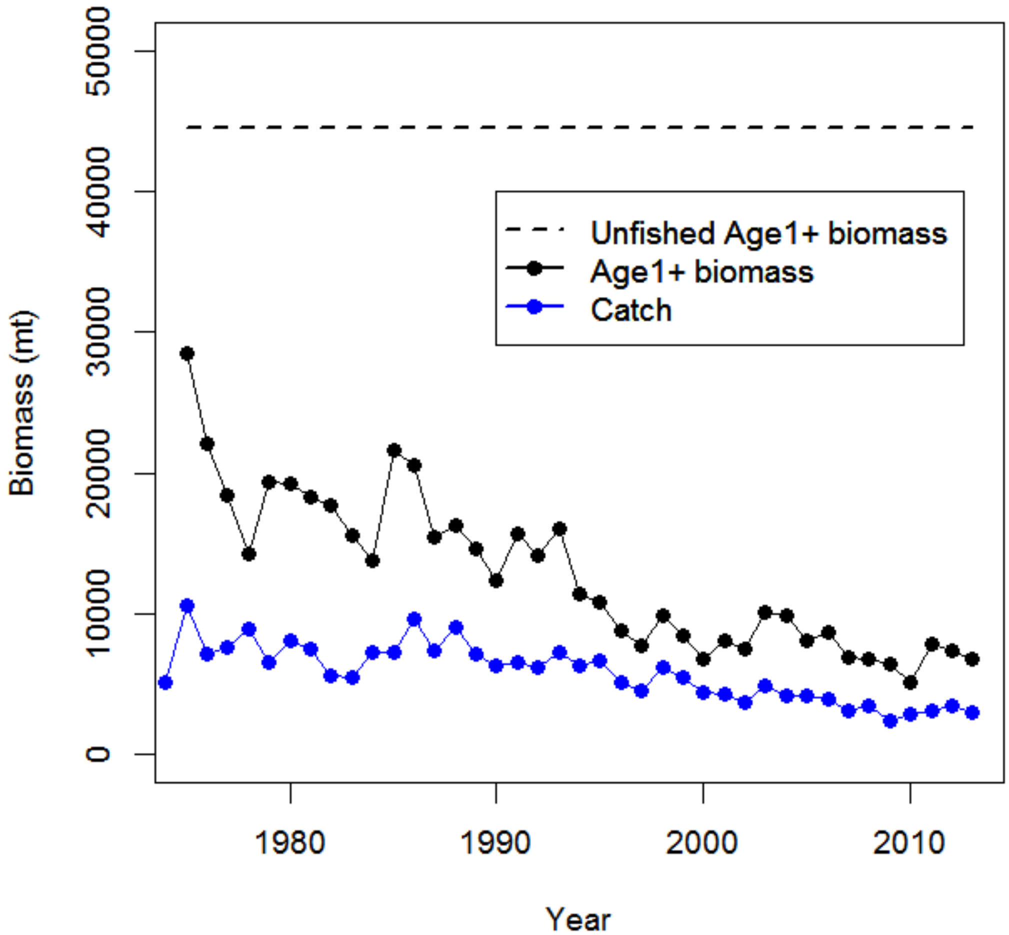

Figure 7.4. Trends in population biomasses (black) and catch (blue) of Western and Central North Pacific Ocean striped marlin (*Kajikia audax*) during 1975-2013.

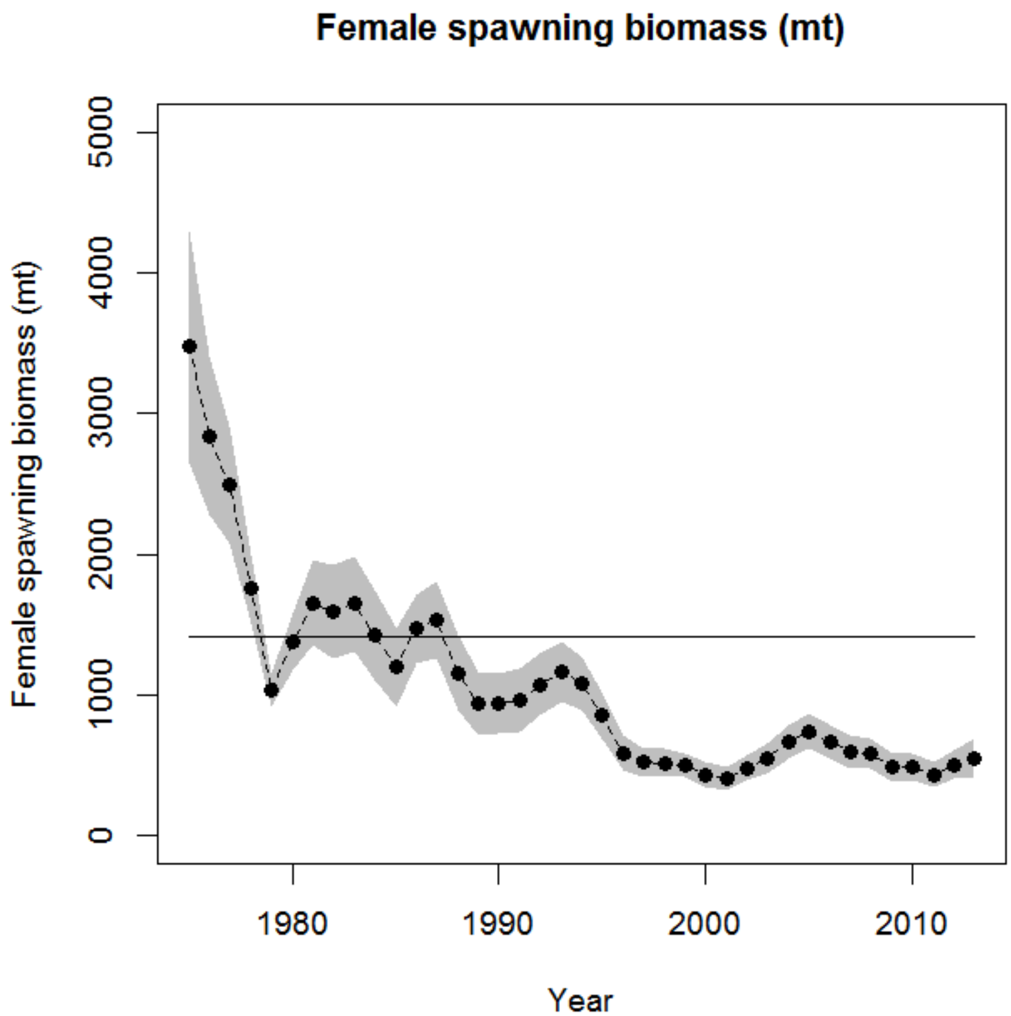

Figure 7.5. Trends in estimates of female spawning biomass of Western and Central North Pacific Ocean striped marlin (*Kajikia audax*) during 1975-2013 along with (mean ± 1.96×SD) confidence intervals.

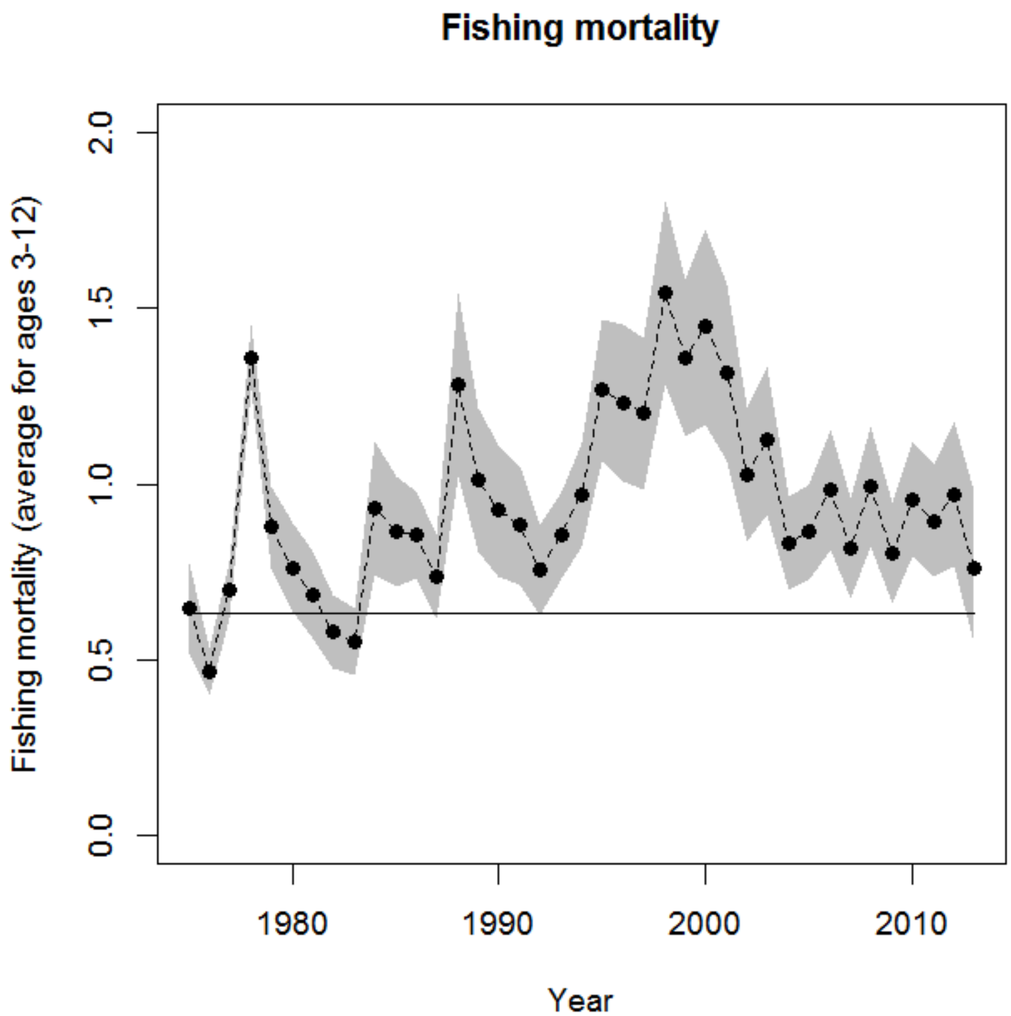

Figure 7.6. Trends in estimates of fishing mortality of Western and Central North Pacific Ocean striped marlin (*Kajikia audax*) during 1975-2011 along with (mean ± 1.96×SD) confidence intervals.

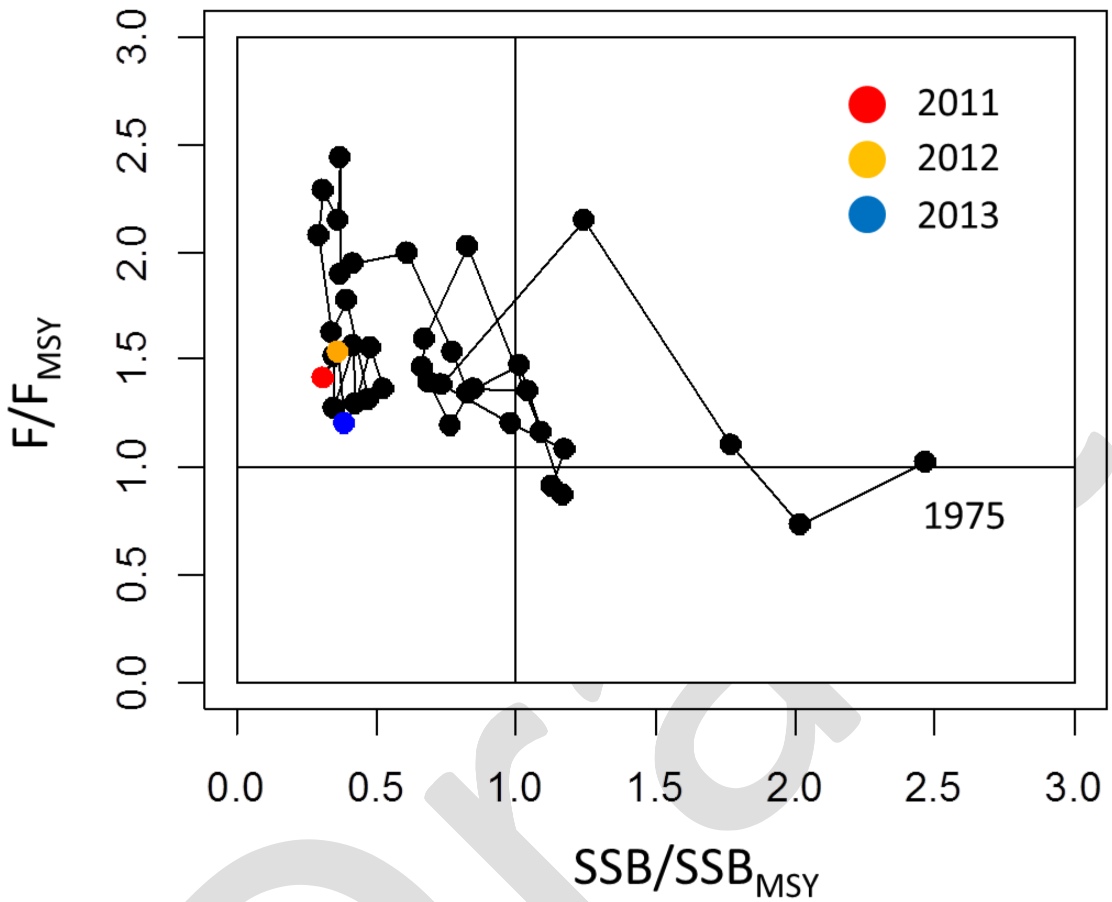

Figure 7.7. Kobe plot of the trends in estimates of relative fishing mortality and spawning biomass of WCNPO striped marlin (*Kajikia audax*) during 1975-2013.

Table 7.7. Additional quantities of interest from the current base case model during 2007-2013, as well as from the year 2009 values from the 2011 assessment (ISC, 2012). These included reported catch used in the assessment (mt), population biomass (biomass, ages 1 to 15+, mt), female spawning biomass (SSB, mt), relative SSB (SSB/SSB_{MSY}), recruitment (thousands), fishing mortality (F, y^{-1}), relative fishing mortality (F/F_{MSY}), exploitation rate, and spawning potential ratio (SPR). Reported mean, min, and max values are for the period 2007-2013.

	Last assessment	Current base case update assessment									
Year	2009	2007	2008	2009	2010	2011	2012	2013	Mean	Min	Max
Reported catch	2560	3084	3503	2468	2852	3125	3521	2984	3077	2468	3521
Biomass	5335	6915	6773	6409	5156	7823	7349	6819	6749	5156	7823
SSB	1106	1192	1171	970	984	873	1013	1094	1043	873	1094
Relative SSB	0.41	0.42	0.42	0.34	0.35	0.31	0.36	0.39	0.37	0.31	0.39
Recruitment	349	240	242	63	496	155	224	352	253	63	496
F	0.84	0.82	0.99	0.80	0.96	0.89	0.97	0.76	0.89	0.76	0.97
Relative F	1.41	1.29	1.57	1.27	1.51	1.41	1.53	1.20	1.40	1.20	1.53
Exploitation rate	0.48	0.45	0.52	0.39	0.55	0.40	0.48	0.44	0.46	0.39	0.55
SPR	0.13	0.15	0.12	0.16	0.13	0.12	0.12	0.14	0.13	0.12	0.16

7.3. Sensitivity runs

The WG developed a set of 10 sensitivity runs based on sensitivity analyses done in the last stock assessment and discussions at the January and April BILLWG meetings (Table 7.8).

Additional sensitivity runs from the last assessment (ISC, 2012) were discussed but were considered to be unimportant or not applicable. This included sensitivity runs comparing the results from the 2007 assessment (starting at 1952, using older estimates of life history parameters) to the 2011 assessment.

Table 7.8: Ten sensitivity runs conducted for the current base case assessment model.

Run	Type	Original value	Sensitivity value	Done in last assessment and if so values
1	CPUE fits	NA	Drop fits to poor fitting CPUE indices S5, S7, and S11	Yes – dropped S15 for one run; S4, S5, and S6 for another
2, 3	Steepness	0.87	0.75, 0.95	Yes – 0.65, 0.75, 0.85, 0.95
4, 5	Length at maximum reference age	214 cm	205 cm, 225 cm	Yes – 205 cm, 225 cm
6	CV in length at age of older fish	0.08	0.12	Yes - 0.12. Also discussed at data workshop
7, 8	Natural mortality	0.38 for adults (age 4) and scaled for younger fish	0.3, 0.05: values for adults (age 4), scaled for younger fish	Yes - 0.3, 0.05: for adults (age 4), scaled for younger fish
9	Catch for WCNPO area fleet	Included country provided china data, 2010-2013	TASK I data for China, 2010-2013	No
10	Reweighting	New weighting method TA1.8 in Francis (2011)	Old weighting method from 2011 assessment, i.e., TA1.1 in Francis (2011)	No

The WG discussed sensitivity runs suggested at the January data workshop but sufficient detail to perform these runs was lacking and they were not included. In particular, based on the January 2015 BILLWG meeting report (see page 14 in ISC, 2015), it was unclear whether the request was to model a separate Chinese fishery or not, and also whether to have a run for fixed versus estimated life history parameters. Setting the steepness value with a prior distribution was also suggested (see page 16 in ISC, 2015) but this run was reported as optional and was not conducted.

The WG requested that spawning stock biomass and spawning potential ratio, as provided in the 2011 assessment report (ISC, 2012) run be provided for each sensitivity run to empirically evaluate how sensitive the base case model configuration was to alternative model assumptions and configurations. This was done and the results were similar to those in the previous assessment (Table 7.9 and Figures 7.8 and 7.9).

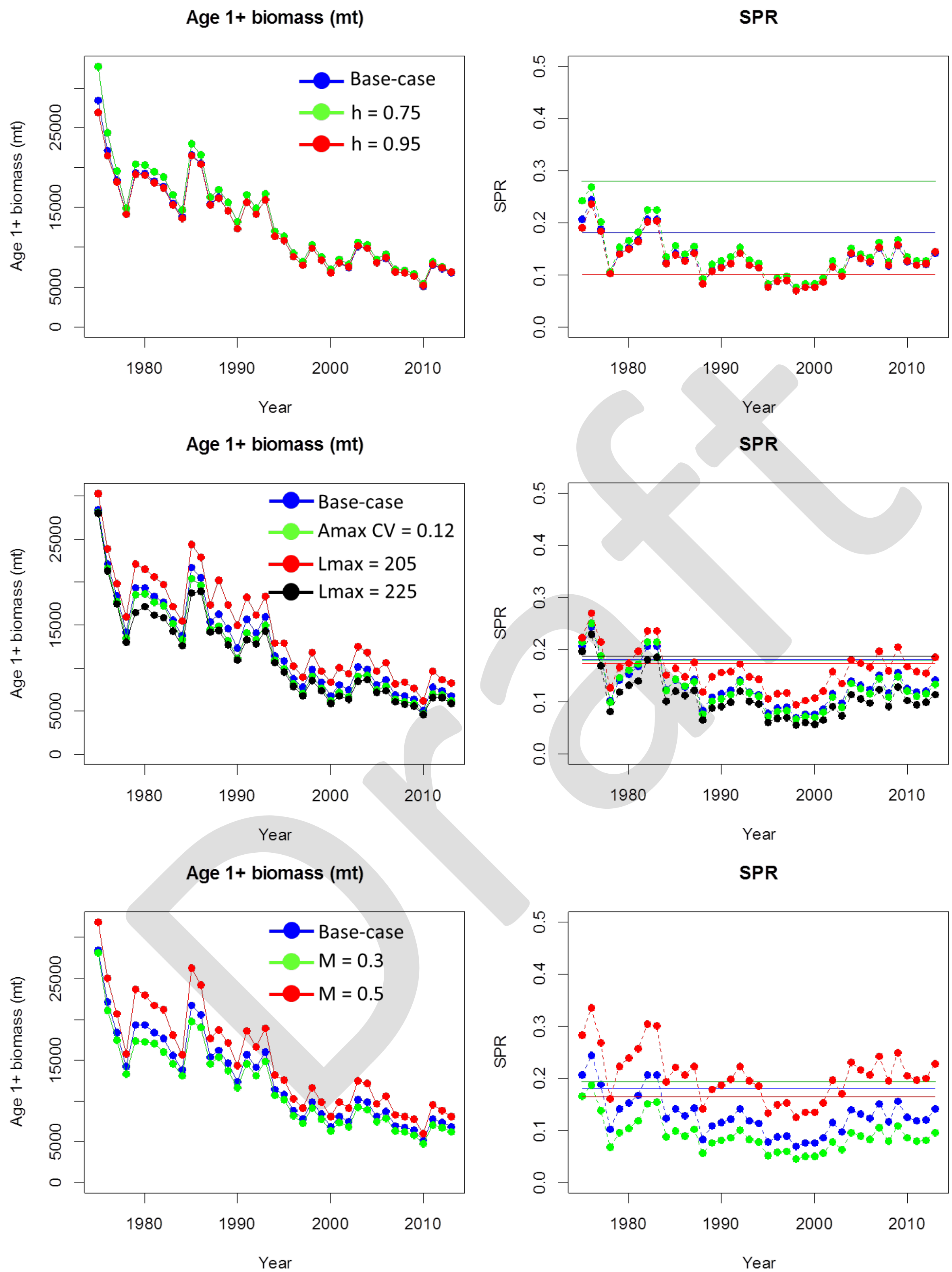

Figure 7.8: Results of sensitivity runs, point estimates of age 1+ biomass (first column) and SPR (second column) for steepness sensitivity runs (first row), growth sensitivity runs (CV and value of length at age max; second row), and natural mortality sensitivity runs (third row). Horizontal lines in SPR plots reflect F_{MSY} reference point.

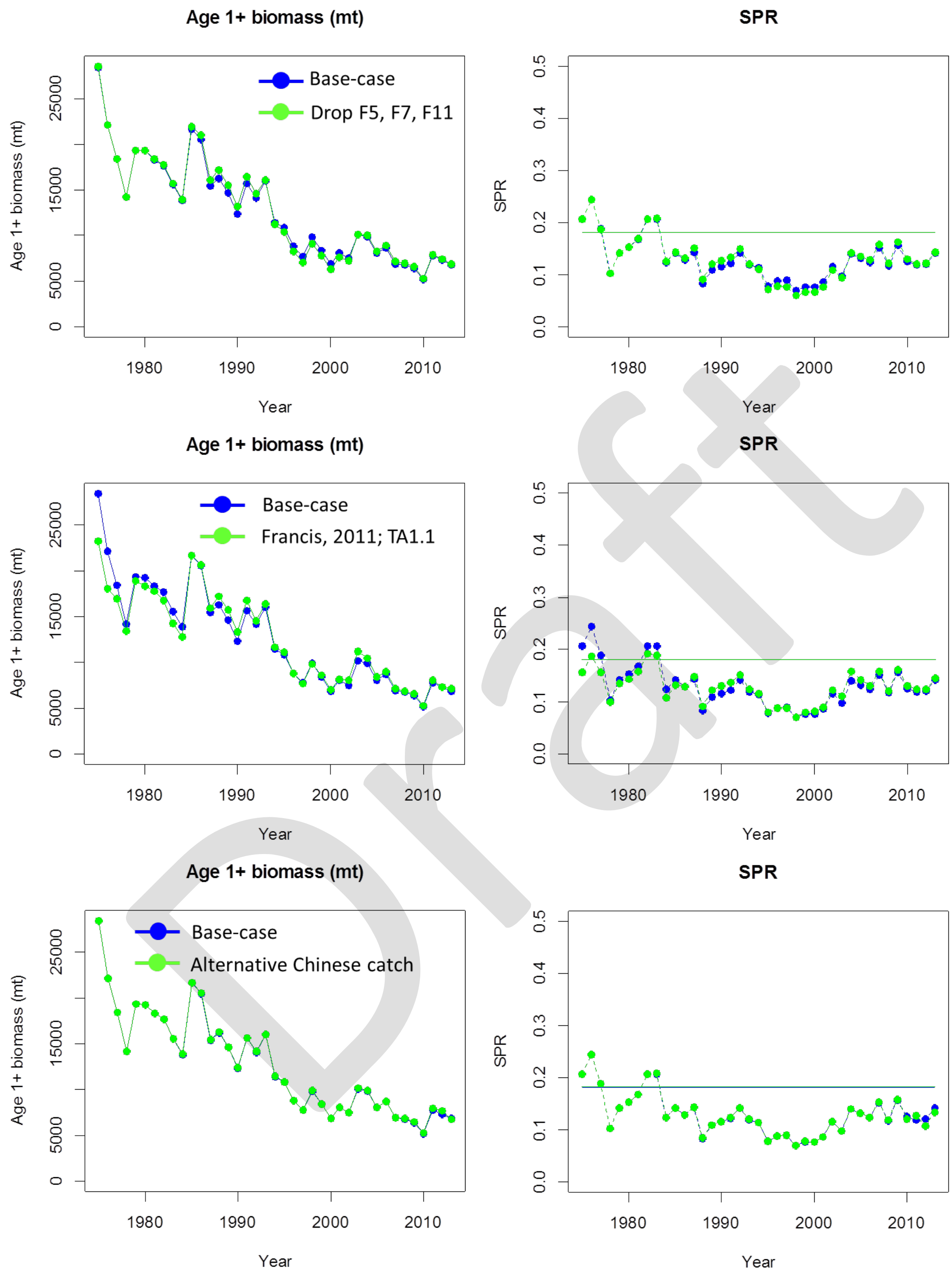

Figure 7.9: Results of sensitivity runs, point estimates of age 1+ biomass (first column) and SPR (second column) for excluding fits for some fleets (F5, F7, and F11; first row), alternative weighting approach from last assessment (second row), and alternative source for Chinese catch data (third row). Horizontal lines in the SPR panels show the F_{MSY} reference point.

Table 7.9: Age 1+ biomass and SPR estimates in 2013 along with comparisons to reference points and reference point ratios for each sensitivity run and the base case. Run number is from Table 7.8.

Run	Type	Age 1+ B	SSB	SSB_{MSY}	SSBratio	SPR	SPR_{MSY}	SPRratio
	Base case	6819	1094	2819	0.39	0.14	0.18	0.78
1	Drop F5,F7,F11	6880	1106	2826	0.39	0.14	0.18	0.79
2	h=0.75	6907	1160	5773	0.20	0.15	0.28	0.52
3	h=0.95	6966	1119	1386	0.81	0.14	0.10	1.44
4	Lmax=205	8323	1267	2141	0.59	0.19	0.17	1.06
5	Lmax=225_nc	5908	1041	3880	0.27	0.11	0.19	0.61
6	AmaxCV=0.12	6216	1053	2947	0.36	0.13	0.18	0.75
7	M=0.3	6204	1053	4793	0.22	0.10	0.19	0.50
8	M=0.5	8068	1234	1548	0.80	0.23	0.16	1.38
9	Use alternative Chinese catch	6805	1083	2844	0.38	0.13	0.18	0.74
10	Use old weighting method	7150	1129	2698	0.42	0.15	0.18	0.80

Summary of Sensitivity Analyses

The WG discussed that the base case model was sensitive to a few factors. These were: natural mortality rate, steepness, and values for length at maximum reference age (Figure 7.8). Natural mortality rate and steepness affected scale of biomass and SPR, and reference point values, as expected. Values for length at maximum reference age affected only scale of biomass and SPR. Overall, the WG concluded that the base case model appeared robust to alternative model configurations and assumptions.

7.4. Retrospective analysis

The WG requested that a retrospective analysis be done for the base case model and this request was completed during the meeting. The retrospective analysis for the base case model indicated that there was a moderate retrospective pattern of overestimating spawning biomass and underestimating fishing intensity, as indexed by the value of 1-SPR, in recent years (Figure 7.10)

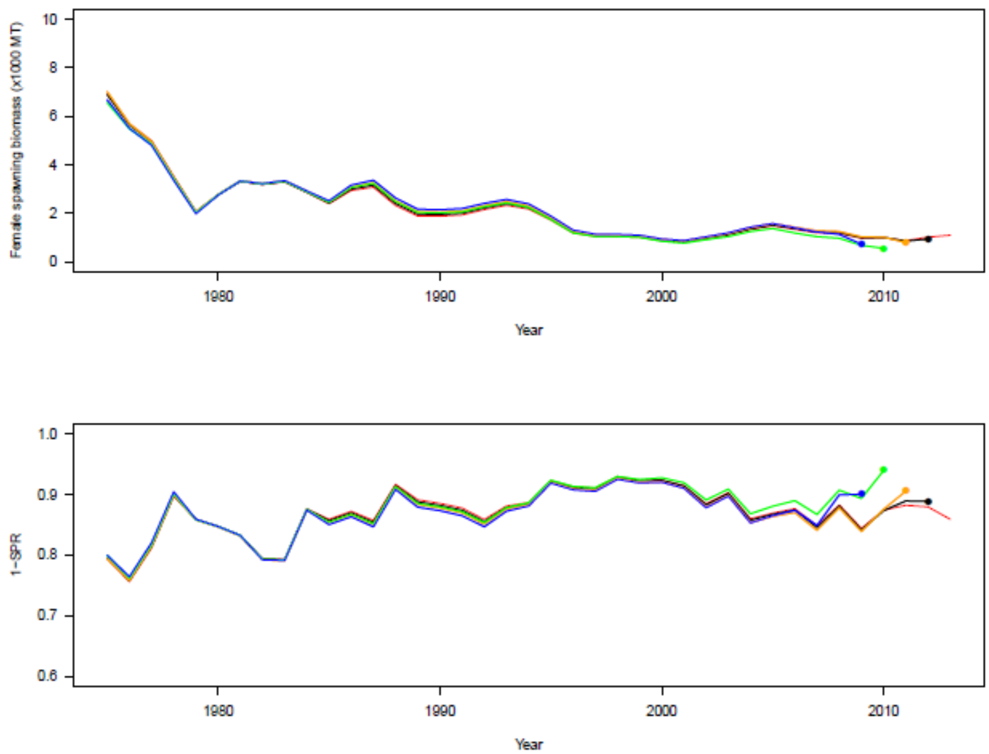

Figure 7.10. A five-year retrospective analysis of the base case for estimates of female spawning biomass (SSB, top panel) and fishing intensity index (1-SPR, bottom panel)

7.5. Projections

The WG discussed stock projection scenarios based on those used in the last assessment. The WG noted that there was some ambiguity about the periods of the fishing mortality for one scenario from last assessment because the CMM of WCPFC in 2010 (CMM 2010-01, 2010) mentioned that the reference years for harvest were 2000-2003 and that the fishing mortality reference was for 2003. However, reference years of 2001-2003 were used in the previous assessment. Overall, the WG agreed to use the same reference period for fishing mortality (2001-2003) to maintain consistency with the stock projections from the last stock assessment.

The WG also discussed the periods of the random sampling of the recruitment from the past. The WG agreed to use three scenarios: (1) a medium-term recruitment period (1994-2011); (2) a five-year period excluding the most recent 2 years (2007-2011), and (3) resampling from the stock recruitment relationship. The WG also discussed and agreed that stock projections would be conducted using the same fleet structure and seasonal treatment as used in the last assessment.

The WG discussed which software would be used for stock projections, Rebuilder (Punt 2010) or AGEPRO (Brodziak et al. 1998, available at: http://nft.nefsc.noaa.gov/Download.html). The WG agreed to use Rebuilder because it was used in the last assessment and no working paper or presentation on AGEPRO was presented at this meeting.

The WG agreed on a set of stock projection scenarios. A projection scenario matrix table for fishing mortality based projections was completed (Table 7.10) by filling in constant values of fishing mortality for the projections, where $F_{X\%}$ represents the fishing mortality to produce a spawning potential ratio of X%. These scenario values of F were: Average F during 2001-2003=$F_{10\%}$, Average F during 2010-2012=$F_{12\%}$, F_{MSY}=$F_{18.1\%}$, $F_{20\%}$, $F_{30\%}$, F=0).

Stock projections for alternative future constant catch values were also developed (Table 7.10). In this case, future constant catch scenarios were: 80% of 2010-2012 average catch = 2532.7 mt and 80% of 2000-2003 average catch = 3490.1 mt) similar to the catch scenarios used in last assessment. The WG discussed the use of the 80% value for setting the constant catch values. Although no reason was provided in last assessment for the use of 80%, the WG agreed to use it to maintain consistency. In addition to the 80% catch scenario, the WG recommended to conduct further catch scenarios (90% and 70% of recent catch) to provide managers further information on potential recovery scenarios for the stock and timing of changes for the stock. The agreed upon projection scenarios with detailed configurations were then summarized (Table 7.10).

The WG expressed its desire to be able to review the results of stock projections during the April 2015 BILLWG meeting. Given the heavy workload of the assessment analysts needed to update the base case model and to run sensitivities, as well as the lack of availability of input projection files from the last assessment, this was not possible. Thus, the WG agreed to have projection scenarios run after the April 2015 meeting, and be included in the stock assessment report (see work assignments section for dates). Some members of the WG expressed concern that it was possible that none of the scenarios would result in increased future spawning stock biomasses. If this were true, then the WG noted that it would be desirable to explore additional projection scenarios to provide managers with options for stock recovery.

Table 7.10. Detailed configuration of stock projection scenarios for the 2015 assessment along with comparisons to projections from the 2011 assessment.

Set up and structure	**Used for 2011 assessment**	**Used for 2015 assessment**
Start year July 1st	2010	2013
First two years with current exploitation level or catch	2010, 2011	2013, 2014
Average over which current exploitation or catch calculated	2007-2009	2010-2012
Projections begin July 1st	2012	2015
End year (8 years)	2017	2020
Metrics (2 of them)	SSB_{2017}/SSB_{2012} by percentile* Catch by year 2012-2017	SSB_{2020}/SSB_{2015} by percentile* Catch by year 2015-2020
Percentiles used across simulations	5, 25, median, 75, 95 over 4000 (40 times of 100 samples) simulations	5, 25, median, 75, 95 over 4000 (40 times of 100 samples) simulations
States of nature (3 of them)	Average recruitment 1994-2008 Average 2004-2008 Stock recruitment relationship	Average recruitment 1994-2011 Average 2007-2011 Stock recruitment relationship
Fishing Mortality Scenarios		
Constant F (6 levels)		
Average 2001-2003	$F_{12\%}$ 2001-2003	$F_{10\%}$ 2001-2003

Average recent	$F_{14\%}$ 2007-2009	$F_{12\%}$ 2010-2012
F_{MSY}	$F_{17.8\%}$	$F_{18.1\%}$
$F_{20\%}$	$F_{20\%}$	$F_{20\%}$
$F_{30\%}$	$F_{30\%}$	$F_{30\%}$
F=0 (no fishing)	F=0	F=0
Constant Catch Scenarios		
70% of recent average catches	Not done	2010-2012: 2216.2 mt
80% of recent average catches	2007-2009: 2,500 mt	2010-2012: 2532.7 mt
90% of recent average catches	Not done	2010-2012: 2849.4 mt
80% of catches for years from (CMM 2010-01)	2000-2003: 3,600 mt	2000-2003: 3490.1 mt

8.0. OTHER BUSINESS

The WG discussed other business, including future meetings, work assignments, and other items.

8.1. Future meetings

The next BILLWG meeting is scheduled for 13 July, 2015, on the Big Island of Hawaii, and is associated with the ISC plenary meeting, 15-20 July, 2015. The next intercessional meeting of the BILLWG will be decided at or before the next ISC plenary meeting. The Pacific Islands Fisheries Science Center offered to host this meeting in Honolulu.

8.2. Work assignments

The BILLWG members were assigned a number of tasks. These tasks include:

- Submit finalized copies of all working papers presented at this meeting to the BILLWG Chair, Jon Brodziak, by 20 May, 2015. To be done by working paper authors.

- Run the stock projection scenarios as agreed upon (Table 7.10) and distribute results to BILLWG by 29 May, 2015. WG agreed that set up files of projections would be shared among WG members by 29, May. To be done by assessment analysts.

- Draft the stock assessment report for submission for the ISC plenary meeting. It was discussed that the deadline for the final report was 15 June, 2015, and that a draft be circulated to the WG members by 1 June, 2015 for comment. To be done by Chair and assessment analysts.

Further requests and recommendations made by the WG include:

- Request that current fishery data be checked by data-providing countries for consistency with the previous assessment and that discrepancies be fully described, especially for assessment updates.

- Recommend that further investigations of the stock structure of striped marlin be conducted.

Additional requests were discussed, including:

- An additional request was made to establish a procedure for choosing an interim chair should one be needed again.

- Some concern was raised about lack of clarity in tasks required at assessment working group meetings. In particular, some WG members thought projections would be done while other WG members did not. It was suggested that objectives for future BILLWG meetings be clarified through close communication to minimize potential miscommunication.

8.3. Other Items

The WG discussed future meeting topics. Based on the past assessment schedule, a stock assessment update for Pacific blue marlin could potentially be the next assessment task. It was recognized that an assessment update for blue marlin would unlikely alter assessment conclusions. The WG discussed and preferred to focus on research for billfish species in 2015 in order to improve assessments. Research topics that were discussed included: (i) stock structure for swordfish; (ii) investigating the feasibility of assessments for sailfish or black marlin; and (iii) discussion about timelines for regular stock assessment (3 years or 5 years). Another topic was to explore striped marlin stock structure in relation to size composition data, as discussed at this meeting.

Additional recommendations for the next striped marlin assessment included:

- Explore the length bin structure used for small fish in the Stock Synthesis model noting that the current bin structure merges size data for fish smaller than 120cm EFL into the 120 cm bin.
- Explore changes in fishery selectivity by the gear configurations of fleets to account for changes in fishing practices by time and area.
- Explore fleet structure definitions that incorporate further consideration of size data when defining area structure.

9.0. ADJOURNMENT

The workshop was adjourned at 16:06 pm on 28 April, 2015. The WG Chairman for this meeting expressed his appreciation to all rapporteurs and participants for their contributions and cooperation in completing a successful meeting. The Chairman also expressed his appreciation for the diligent effort and hard work by Yi-Jay Chang to complete the stock assessment modeling work needed during the workshop. Lastly, the Chairman expressed his appreciation for the logistical support and hospitality of the local hosts, which was exceptional.

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Attachment 1. List of Participants

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Attachment 2. Agenda

INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC

BILLFISH WORKING GROUP (BILLWG)

INTERCESSIONAL WORKSHOP ANNOUNCEMENT
AND AGENDA

Meeting Site:	Queen's forum Queen's Tower B 7th floor (in Queens Square) 2-3-3 Minatomirai Nishi-ku Yokohama, Kanagawa, Japan http://www.qsy-tqc.jp/english/
Meeting Dates:	April 20-28, 2015
Goals:	Conduct the stock assessment of Western and Central North Pacific striped marlin in 2015
Attendance Deadline:	Please respond to Brian Langseth (Email: Brian.Langseth@noaa.gov) if you will be able to attend this meeting
Working paper deadline:	Submit working papers to Brian Langseth by **Tuesday April 14th**. Authors who miss the April 14 deadline must bring 20 hard copies to the meeting.
Local Contact:	Kotaro Yokawa National Research Institute of Far Seas Fisheries, JAPAN 5-7-1 Orido, Shimizu-ku, Shizuoka 424-8633, Japan Tel: +81-543-36-6016 Fax: +81-543-35-9642 Email: yokawa@affrc.go.jp
BILLWG Contact:	Brian Langseth NOAA Fisheries - PIFSC - Inouye Regional Center 1845 Wasp Boulevard - Building 176 NMFS/PIFSC/FRMD - Mail Room 2247 Honolulu, Hawaii 96818 USA Tel: (808) 725-5603 Email: Brian.Langseth@noaa.gov

AGENDA

April 20 (Monday), 930-1000 – Registration

April 20 (Monday), 1000-1700

1. Opening of Billfish Working Group (BILLWG) Workshop
    a. Welcoming Remarks
    b. Introductions
    c. Standard Meeting Protocols

2. Adoption of Agenda and Assignment of Rapporteurs

3. Computing Facilities
    a. Access
    b. Security Issues

4. Numbering Working Papers and Distribution Potential

5. Status of Work Assignments

6. Western and Central North Pacific Striped Marlin Stock Assessment Modeling
    a. Use of Life History Information
    b. Fishery Definitions and Selectivity Modeling
    c. Catch Time Series
    d. CPUE Time Series
    e. Size Compositions

April 21 (Tuesday), 930-1700

6. Assessment Modeling: Continued
    f. Model Runs
    g. Model Diagnostics
    h. Model Results
    i. Biological Reference Points
    j. Sensitivity Analyses
    k. Stock Projections

April 22 (Wednesday), 930-1700

6. Assessment Modeling: Continued
    f. Model Runs
    g. Model Diagnostics
    h. Model Results
    i. Biological Reference Points
    j. Sensitivity Analyses
    k. Stock Projections

April 23 (Thursday), 930-1700

6. Assessment Modeling: Continued
    f. Model Runs
    g. Model Diagnostics
    h. Model Results

i. Biological Reference Points
j. Sensitivity Analyses
k. Stock Projections

April 24 (Friday), 930-1700

6. Assessment Modeling: Continued
   f. Model Runs
   g. Model Diagnostics
   h. Model Results
   i. Biological Reference Points
   j. Sensitivity Analyses
   k. Stock Projections

April 25 (Saturday), 930-1500

6. Complete All Work

7. Adoption of Assessment Model for WCNPO Striped Marlin
   f. Model Runs
   g. Model Diagnostics
   h. Model Results
   i. Biological Reference Points
   j. Sensitivity Analyses
   k. Stock Projections

8. Other Business
   a. Future meetings
   b. Work assignments
   c. Other items

9. Rapporteurs Complete Report Sections

April 26 (Sunday), No meeting

April 27 (Monday), 930-1700

10. Complete Workshop Report and Circulate; WG reviews Report

April 28 (Tuesday), 930-1500

11. Clearing of report

12. Adjournment

Attachment 3. Working Papers

ISC/15/BILLWG-2/01	Graphical Presentation of the Striped Marlin (*Kajikia audax*) Size Composition Data to be Used in the 2015 stock assessment update. Yi-Jay Chang, Eric Fletcher, William Walsh, Jon Brodziak (yi-jay.chang@noaa.gov)
ISC/15/BILLWG-2/02	Preliminary Stock Assessment Update for Striped Marlin (*Kajikia audax*) in the Western and Central North Pacific Ocean through 2013. Yi-Jay Chang, Brian Langseth, Annie Yau, Jon Brodziak (yi-jay.chang@noaa.gov)
ISC/15/BILLWG-2/03	Stock Assessment of Striped Marlin (*Kajikia audax*) in the Western and Central North Pacific Ocean Using an Age-structured Model: Updated to 2013. Nan-Jay Su, Chi-Lu Sun, Su-Zan Yeh (nanjay@ntu.edu.tw)