FINAL

ISC/23/ANNEX/09

ANNEX 09

23rd Meeting of the
International Scientific Committee for Tuna
and Tuna-Like Species in the North Pacific Ocean
Kanazawa, Japan
July 12-17, 2023

REPORT OF THE BILLFISH WORKING GROUP WORKSHOP

July 2023

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ANNEX 09

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International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC)

28th - 30th November, 5th December 2022 (JST)
Hybrid Meeting

1. OPENING AND INTRODUCTION

1.1. Welcoming Remarks

Hirotaka Ijima, the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC) Billfish Working Group (WG) chair, opened the data preparatory meeting for Western Central North Pacific (WCNPO) swordfish. Scientists from Chinese Taipei, Japan, United States of America (USA), and the Inter-American Tropical Tuna Commission (IATTC) participated in the meeting. The participating scientists are listed in Attachment 1.

1.2. Introduction

The WG of ISC held a hybrid four-day meeting. The goals of the meeting were: i) agree on the data and the model configuration of Stock Synthesis 3 for the North Pacific Ocean (NPO) swordfish stock assessment and ii) discuss the request from the Western and Central Pacific Fisheries Commission Northern committee (NC).

1.3. Standard Meeting Protocols

The WG chair introduced protocols for the webinar meeting. This meeting was conducted in a hybrid format, with face-to-face meetings held at the Japan Fisheries Research and Education Agency, but also allowing participation via the internet. Microsoft Teams was used for this meeting, and the working papers on the agenda were presented and discussed.

2. ADOPTION OF AGENDA AND ASSIGNMENT OF RAPPORTEURS

Prior to the meeting, The WG adopted the draft agenda of the meeting (Attachment 2). The WG chair assigned the numbers for the working papers (WP) (Attachment 3) and the rapporteurs for the agenda items as follows:

Date	Item	WP	Rapporteur
28th Nov.	Abundance Indices	WP06, 07, 02	M Jusup, M Sculley
29th Nov.	Catch and length frequency data	WP05, 07, 04, 03, Presentation 1	H Koike, Michael Kinney
30th Nov.	Model configurations	WP01	J Brodziak, M Sculley

3. NUMBERING WORKING PAPERS AND DISTRIBUTION POTENTIAL

The WG agreed to post the finalized working papers on the ISC website and make them publicly available.

4. ABUNDANCE INDICES

CPUE Standardization for Pacific Swordfish (Xiphias gladius) caught by the Japanese longline fishery: A GLMM analysis using the R software package R-INLA. Haruko Koike (ISC/22/BILLWG-02/06)

We analyzed the logbooks recorded by the Japanese longline vessels to obtain the abundance index required for the Western and Central North Pacific Ocean (WCNPO) swordfish stock assessment. Considering the transition of Japanese longline fishing gear and the change of the logbook format, we separated the logbook into two time series (1976 to 1993 and 1994 to 2021). Using the R-INLA package, we constructed multiple GLMMs, including the spatiotemporal model with and without gear effect. We selected the best model using the information criteria WAIC and LOOCV. Model selection preferred spatiotemporal models without gear effect for both time series. Upon obtaining the spatiotemporally resolved standardized CPUE, we calculated the averages for each management area.

Discussion

The WG discussed the decision making during the development of the Japanese longline CPUE. It was clarified that the CPUE data were not separated into deep set and shallow set sectors because the number of shallow sets was very small, and fishermen target swordfish seasonally and by area. Therefore, the gear configuration is confounded with the spatial and temporal variation in effort. There was a suggestion that dividing the data into deep and shallow sets in the future may assist in the convergence of the model.

The WG discussed including hooks between floats (HBF) as a random effect in the spatio-temporal model. After additional information and figures were provided comparing the models with and without HBF, the WG suggested that the model with HBF should be used for the assessment, as it had the lowest WAIC. However, it was noted that there was not a large difference in the standardized CPUE between the two models, and that the variance of the HBF effect was very large, which increased the CV of the standardized CPUE. **The WG agreed to use the HBF as a random effect. However, it was believed that this would likely have a minimal impact on the assessment model.**

The apparent heteroscedasticity in the model residuals was also discussed. This was thought to be due to the aggregation of both deep (many zero catches) and shallow (mostly positive catches) sets. It was suggested that a simpler model like a GAMM be considered in the future if it is difficult to get the spatio-temporal models to converge, or to consider a targeting effect to better separate the deep and shallow sets. It was also suggested to bin HBF values and include as a fixed effect instead of as a random effect.

Catch, length data and standardized CPUE of swordfish caught by the Taiwanese fisheries in North Pacific Ocean. Jhen Hsu (ISC/22/BILLWG-02/07)

In this working paper, catch data and length composition of swordfish exploited by Taiwanese fisheries in the western central North Pacific Ocean (WCNPO) from 1959 – 2021 and 2004 – 2021 were summarized, respectively. In addition, catch rates of swordfish collected by Taiwanese distant-water tuna fishery data were standardized using a Vector-Autoregressive Spatio-Temporal

model with year, quarter, spatial, spatio-temporal, vessel, and HPB effects as explanatory variables. Results showed that the total catch was stable at around 1,800 mt after 2016, however, the catch of 2021 reached the lowest level over the recent 10 years. Size compositions of swordfish harvested by the Taiwanese distant-water longline fishery showed that the mean length was relatively stable around 165 cm LJFL during 2004 – 2021. Additionally, the standardized catch rate of the distant-water tuna longliner for the WCNPO swordfish has fluctuated overtime and recently increased from 2015 to 2021, except for 2019.

Discussion

The WG discussed whether the more complex standardization models were overfitting the data, even though they had the lowest AIC values. After considering the BIC values of each model and determining that the stepwise addition of each covariate did not substantially change the CPUE trend, the **WG agreed that the standardized CPUE proposed in this study was the best available.**

Standardization of Western and Central North Pacific Swordfish (Xiphias gladius) Catch Per Unit Effort in the Hawai'i Longline Fishery from 1995–2021. Erin Bohaboy (ISC/22/BILLWG-02/02)

The Western and Central North Pacific swordfish (*Xiphias gladius*) catch per unit effort for the Hawai'i-based longline fishery was standardized from the logbook dataset. The fishery was divided into the tuna-targeting deep-set sector and the swordfish-targeting shallow-set sector. Additionally, the shallow-set sector was standardized in two time periods: an early period (1995–2000) and a late period (2005–2021) because the shallow-set fishery was closed from 2001 to 2004, and regulations caused substantial changes in the fleet operations thereafter. Delta binomial-lognormal general additive models with random effects of fishing permit number as a proxy for vessel skill were evaluated for each sector and time-series. Spatial, temporal, environmental, and operational covariates were investigated for inclusion in the models following a forward stepwise approach based on Akaike Information Criteria and deviance explained selection criteria. The selected models explained between 34 and 49% of the deviance in the shallow-set sector and 31% of the deviance in the positive catches for the deep-set sector, but only 9% of the probability of presence/absence in the deep-set sector. Latitude and time of year were retained in all selected models, while time of day, moon phase, longitude, gear configuration (hooks per float), sea surface temperature, and bait type were also included in some models. The shallow-set standardized annual CPUE index displayed a general increasing trend from 1995–2000 and a decreasing trend from 2005– 2021, with marked peaks in abundance in 2006 and 2016. Deep-set standardized annual CPUE estimates were an order of magnitude smaller than the shallow-set fishery and peaked in 1995, 2004, and 2015. Standardized CPUE indices for both fishery sectors have decreased over the last several years of the time-series, from 2016–2021 in the shallow-set sector and 2015–2020 in the deep-set sector.

Discussion

There was some discussion how the fishery regulations changed over time in the Hawaii longline shallow set sector. These have included permanent area closures (MPA), partial year closures due to interactions with sea turtles, and gear changes to using monofilament branch lines and circle hooks. The WG also discussed why the 1995 point in the deep-set sector was anomalously high, likely because it is a partial year. It was discussed whether this year should be dropped from the assessment. It was also pointed out that the deep set CPUE index is provided as a recruitment index,

consistent with its usage in the 2018 assessment. This fishery targets bigeye tuna and catches swordfish incidentally, primarily age 0-1 fish.

5. CATCH AND LENGTH FREQUENCY DATA

Update Japanese catch and size statistics for the North Pacific swordfish stock assessment. Hirotaka Ijima (ISC/22/BILLWG-02/05)

This document compiles Japanese catch and size composition data for the North Pacific swordfish (*Xiphias gladius*) stock assessment. Fleet definitions for data compilation are based on new stock boundaries and previous stock assessments. The longline catch data source after 2008 has been updated using new 5° X 5° grid data. The Japanese yearbook after 2003 was also updated for available data on the Japanese government webpage. Changes in catch data due to these updates were minor. The longline size composition data were recompiled, removing the 5°X10° grid resolution data for 1998 and earlier. As a result, the sample size was reduced, and the distribution's shape was changed. The 5° X 10° resolution data must be excluded because it straddles different fleet areas. The shape of the swordfish size distribution caught by the Japanese longline fishery in Area 1 did not change when adding the size composition data after 2016.

Discussion

The WG asked for clarification as to what areas would be included in the sensitivity runs. The WG confirmed that the Japanese sensitivity-run-area catch would be included in the EPO area's catch.

A WG member noted that if the length composition data show changes related to seasonal movements, these data should be separated by season. The WG confirmed that there were no seasonal changes in the length data. While swordfish caught by the Japanese longline fishery tended to migrate seasonally in a north-to-south direction, body length did not show seasonal changes. A WG member suggested using a random forest approach to discern these length frequency patterns. The WG noted that this would be a helpful analysis but would probably need to await future evaluation.

The WG discussed how to treat the length composition data in the sensitivity run EPO area. It was noted that the length composition data from the EPO and the sensitivity run EPO areas had reasonable overlap in distribution prior to 1993. However, there are few length data in the EPO area after 1998, and so a comparison of the length data in the late period could not be made. **The WG agreed the length composition data from the sensitivity EPO area should be added to the EPO in the sensitivity analysis, and the selectivity could be estimated.**

A WG member asked if a CPUE time series for the Japanese drift net fishery was available as there was some interest in seeing if the recent CPUE increase seen in the longline would also be seen in a driftnet CPUE. It was commented that a CPUE time series for the Japanese drift net fishery was not currently available.

Catch, length data and standardized CPUE of swordfish caught by the Taiwanese fisheries in North Pacific Ocean. Yi-Jay Chang (ISC/22/BILLWG-02/07)

Discussion

The WG asked if a new fleet was needed for the EPO TWN catch data or if that catch will simply be added to the current TWN fleet. It was commented that there was likely very little TWN length information from the EPO area which would make defining a new fleet difficult. The WG suggested that IATTC size data could be used to define the size information of a TWN EPO fleet.

It was also mentioned that currently WCNPO and EPO data are combined in the TWN data; TWN will provide the catch data of both areas after the meeting.

U.S. swordfish fisheries in the Northern Pacific Ocean. Russell Ito (ISC/22/SWO-WG/04)

This working paper presents catch, effort and catch-per-unit-effort information on U.S. fisheries for swordfish in the North Pacific Ocean. The major gear types employed by U.S. fisheries were harpoon, drift gill net, and longline. The oldest of the fisheries was the California harpoon fishery which dates back to the early 1900's. The California drift gillnet fishery began in the early 1980's and was the dominant fishery for swordfish throughout that decade. The gillnet fishery was succeeded by the longline fishery in 1990. The longline fishery continues to be the largest U.S. fishery for swordfish in the North Pacific Ocean. This report summarizes historical trends and recent developments of effort, catch, and CPUE for each of these fisheries.

Discussion

The WG asked how the new stock boundary would affect US catch. It was answered that all US catch was within the old boundary (not in the EPO) so the new boundary will have no effect on the US catch.

The WG noted that the US longline and driftnet nominal CPUE trends were similar to the JPN longline nominal CPUE trend in that there was a large increase in CPUE in 2016-2018 and there was some interest in any possible explanation. Unfortunately, the US did not have any explanation for this sharp increase in CPUE and the subsequent decrease.

Swordfish (Xiphias gladius) Length Composition Data for the Hawaii Longline Fishery during 1994-2022. Jon Brodziak (ISC/23/BILLWG-01/03)

This working paper summarizes the available swordfish length composition data for swordfish caught in the Hawaii longline fishery. These data were prepared for submission to the November 2022 ISC Billfish Working Group data preparation meeting and application in the 2023 benchmark stock assessment of Western and Central North Pacific swordfish. Swordfish (*Xiphias gladius*) size frequency data were collected for the Hawaii-based longline fishery during 1994-2022 based on the current Pacific Islands Regional Observer Program (PIROP) data set. Length composition data were separated into shallow-set and deep-set longline sectors to account for differences in species targeting and operational characteristics by sector. The shallow-set longline sector targets swordfish while the deep-set sector typically targets big eye tuna and captures swordfish as bycatch. We evaluated annual and quarterly trends in observed mean lengths and calculated mean weights of swordfish and their variability. Summary length frequency tables showed the number of swordfish measured per 5-cm length bin by year, quarter, and fishery sector for stock assessment modeling. Empirical analyses showed that average size of swordfish captured in the shallow-set sector is consistently larger than in the deep-set sector. Quarterly mean lengths of swordfish in the shallow-set and deep-set sectors averaged 146 cm and 110 cm (eye-fork length) during 1994-2022 while calculated mean weights averaged 67.7 kg and 39.3 kg, respectively. Variability in the size of harvested swordfish was also lower for the shallow-set sector with coefficients of variation (CVs) for length and weight of 22% and 64% in comparison to CVs of 33% and 110% for the deep-set sector. Quarterly mean lengths were relatively stable across years for the shallow-set sector and were more variable for the deep-set sector with larger mean lengths observed in quarter 2. There was an increasing trend in mean lengths and weights of swordfish for both shallow- and deep-set sectors of the Hawaii longline fishery during 1994-2022. In particular, strong serial

correlations were observed for annual mean lengths ($\rho_{L,y}$) and weights ($\rho_{W,y}$) of swordfish in both the shallow- ($\rho_{L,y} = 0.70$ and $\rho_{W,y} = 0.71$) and the deep-set ($\rho_{L,y} = 0.65$ and $\rho_{W,y} = 0.65$) longline sectors. We note that the increasing trend in the size of harvested swordfish across the swordfish-targeting shallow-set and tuna-targeting deep-set sectors suggests that some biological aspects of the Hawaii longline fishery system have changed, especially in recent years.

Discussion

The WG asked about the change in the average size of catch from quarter to quarter in the deep-set sector, as the CPUE index from that fleet was recommended to be used as a recruitment index. The WG suggested that due to the larger sizes in quarter 1 and 2 that perhaps the length data from quarter 1 and 2 should be removed from the recruitment index. The WG noted that the size differences seen in quarters 1 and 2 would likely have little impact on the recruitment index since the data is consistently large for those quarters throughout the years. **The WG agreed that this was an interesting research question for future assessments.**

The WG asked if there was any explanation of the change in mean length in quarters 1 and 2 of the deep-set sector. The current hypothesis is that large reproductive adults migrate into the tuna targeting area of operations in quarters 1 and 2, and disperse out of the area in quarters 3 and 4. The WG noted that this pattern was also seen in the Japanese longline and that perhaps quarters 1 and 2 could be separated out from these two fisheries as there is information on migration in these quarters. **It was agreed that this would be a good research project and that perhaps a multiple comparison analysis (or something equivalent) could be used to investigate.**

Catch and length data from IATTC and WCPFC member countries. Hirotaka Ijima (Presentation 1)

This presentation summarized catch and size data from the IATTC and the WCPFC member countries according to the new stock boundaries. For the IATTC area, the yearbook and 5x5 grid public domain data were downloaded from the IATTC website. WCPFC yearbook was downloaded from their website, and SPC provided the 5x5 grid data. For size data, IATTC observer data were downloaded from the IATTC website. This presentation used the IATTC yearbook for the Mexican swordfish catch, as we have requested them to be provided but have not received a response. For the WCPFC, the previous stock assessment did not account for the non-longliners catch, and the Vietnamese catch was also added, resulting in a significant increase. However, the BILLWG needs to be used in the stock assessment because the Vietnamese catch should be in the South China Sea.

Discussion

The WG asked about whether or not to include the Vietnamese longline and drift net catches as they were mostly from the southwest corner of the WCNPO boundary (in the South China Sea). It was commented that the striped marlin assessment included Vietnamese longline and drift net catches, and for the purposes of maintaining consistency, their use in the swordfish assessment was considered appropriate. The WG noted that the treatment of these catches would be consistent with the WCNPO striped marlin assessment, in that a sensitivity analysis on the inclusion of the data will be run.

The WG noted that IATTC does not receive catch data from Mexico for its longline fishery, which could be a significant source of swordfish caught in the EPO area. The WG chair informed the WG that he had directly contacted the Mexican delegation but had not yet received a response.

The WG noted that Mexico's longline fleet is licensed as a shark fishery and it is therefore not required to report catches of tuna or tuna-like species, including swordfish, to the IATTC. The WG noted that Mexico provided catch data for the EPO area for the 2018 assessment, therefore some historical longline catch may still be available. **The WG agreed that more efforts should be made to gather the most recent swordfish catch and effort data directly from Mexico.**

6. MODEL CONFIGURATIONS

6.1. Stock boundary

Updates on the horizontal movements and stock affiliation of swordfish (Xiphias gladius) tagged in the eastern north Pacific (2002-2022). Chugey Sepulveda (ISC/22/BILLWG-02/01)

This work presented horizontal movement data from swordfish electronically tagged in the eastern north Pacific (ENP). The paper summarized the existing published data (n=181) and also presented recent findings from both archival and fin-mount Argos transmitter deployments off California. Point to point as well as multi-year, round-trip track data show large-scale movements from the foraging grounds off California towards putative spawning grounds both off the coast of Mexico and towards the Hawaii Islands. In general, horizontal movements ranged from the West Coast to the equator and out to 163°W. Track data showed that California swordfish used both ISC management units (EPO and WCNP). From archival tag deployments (n=212) there have been 31 individuals recaptured (15%) to date by both local and international fleets. Recapture and fin-mount data suggest that some individuals exhibit a high level of site fidelity to the Southern California foraging grounds. This work provides insight into the movement patterns of swordfish in the ENP and highlights new tag technology that can help document migration patterns and regional stock boundaries.

Discussion

A WG member asked how well these tags represent the stock structure of swordfish across the north Pacific as they believed there was evidence that swordfish are believed to be a single stock. It was explained that this study and the other tagging studies conducted in the northeastern Pacific Ocean show very little evidence of fish moving from the mainland US to areas west of Hawaii. It was explained that several fish retained tags for reasonably long periods (200+ days) that showed moving west to Hawaii from California tend to return to California, rather than continuing travelling west.

A WG noted that the movement tracks of tagged swordfish radiate out from the California coastline and cross the existing diagonal stock boundary 'step' used in previous ISC swordfish stock assessments. The WG member asked the presented whether they supported the change of the stock boundary to a horizontal line at 10 degrees N, and whether there was any evidence that fish from the northeastern Pacific may cross this new boundary or even cross the equator. It was explained that the tagging data now fairly conclusively show that swordfish movements did not adhere to the existing 'step' boundary. It was also explained that there has been very little evidence of tagged fish moving across the equator and so, the new stock assessment boundary at 10 N was believed to represent a more plausible representation of the stock boundary in the north Pacific.

6.2. Version of the Stock Synthesis 3

The WG discussed the version of Stock Synthesis 3. **The WG agreed to use the latest versions of Stock Synthesis and the diagnostic packages r4ss and ss3diags.**

6.3. Fleet definition and data sets

The WG discussed the fleet definition for the SS3 model (Table 1). The WG added one fleet (F5_JPN_EPO_OSDWLL) due to changes in the stock boundary. The additional catch for sensitivity runs will be added to F5_JPN_EPO_OSDWLL, F18_WCPFC, and F19_IATTC when assessing the North Pacific-wide stock assumption.

6.4. Biological parameters

The WG created the list of biological parameters (Table 2). It was noted that there were no new life history studies available for North Pacific swordfish. Therefore, the **WG agreed to adopt the same biological assumptions as in the 2018 stock assessment.** However, **the WG agreed that additional analyses would be conducted to update the values for the CVs in the growth curve.**

6.5. Future projection

WG agreed to use SS3 for simple deterministic future projections for this stock assessment using a multi-variate normal distribution (Table 3). To evaluate the conservation and management measures recommended in the WCPFC NC, the WG added the constant 2008-2010 fishing mortality scenario to the scenarios evaluated in 2018.

6.6. Sensitivity analysis

The WG agreed to make a final decision on the sensitivity runs to be conducted during the stock assessment. The WG summarized the tentative list of sensitivity runs (Table 4).

7. DATE OF THE STOCK ASSESSMENT MEETING

The WG discussed the flexible date of the swordfish stock assessment meeting. The WG will hold two modeling meetings before the stock assessment. The tentative date for the meeting is listed below:

Meeting	Date	Venue
Data submission	10th January 2023 (JST)	-
Modelers meeting 1	18th January 2023 (JST)	Webinar using Teams
Modelers meeting 2	1st March 2022 (JST)	Webinar using Teams
Stock assessment meeting	11th - 17th April 2023 (HST)	Hybrid meeting in Hawaii using Teams

8. REQUEST FROM WCPFC NORTHERN COMMITTEE

The WG discussed the following request from the WCPFC NC.

The NC requests that the ISC BILLWG conduct an analysis of how catch and effort for NPS varies spatially in the North Pacific, with the aim of estimating the proportion of catch and effort north and south of 20^{o}N in the Convention and including this information in the 2023 stock assessment for NPS.

The WG agreed to organize the swordfish catch and effort data and confirm them during the stock assessment. It was noted that it is necessary to make comparisons with the output of the stock assessment model because number-based catch data is used for some fleets in the stock assessment. The WG Chair will ask IATTC and WCPFC to provide catch-and-effort data.

9. CIRCULATE WORKSHOP REPORT

The WG Chair prepared a draft of the workshop report for the data preparation of the swordfish stock assessment and reviewed it with the WG members.

10. ADOPTION

The WG adjourned the data preparatory meeting of the North Pacific swordfish stock assessment at 11:40 am on 5th December 2022 (JTS). The WG Chair appreciated the participating scientists' collaboration in the stock assessment work.

11. REFERENCES

Kapur, M., Brodziak, J.K.T., Fletcher, E. and Yau, A., 2017. Summary of life history and stock assessment results for Pacific blue marlin, Western and Central North Pacific striped marlin, and North Pacific swordfish. ISC/17/BILLWG-1/01.

DeMartini, E.E., Uchiyama, J.H., Humphreys Jr, R.L., Sampaga, J.D. and Williams, H.A., 2007. Age and growth of swordfish (*Xiphias gladius*) caught by the Hawaii-based pelagic longline fishery. Fish. Bull. 105: pp 356–367.

DeMartini, E.E., Uchiyama, J.H. and Williams, H.A., 2000. Sexual maturity, sex ratio, and size composition of swordfish, Xiphias gladius, caught by the Hawaii-based pelagic longline fishery. *Fishery Bulletin*, *98*(3), pp.489-489.

Nishikawa, Y 1985. Average distribution of larvae of oceanic species of scom- broid fishes, 1956-1981. Far Seas Fisheries Research Laboratory. Series 12, 99 pp.

Brodziak, J., 2020. On the Probable Distribution of Stock-Recruitment Steepness for Western and Central North Pacific Swordfish. ISC/20/BILLWG-1/06.

Table 1. Fleet definition for the NPO swordfish stock assessment.

Fleet name	Catch	Size data	CPUE	Working paper No.
F1_JPN_WCNPO_OSDWLL_early_Area	Num	Y	Y	ISC/22/BILLWG-
F2_JPN_WCNPO_OSDWCOLL_late_Ar	Num	Y	Y	ISC/22/BILLWG-
F3_JPN_WCNPO_OSDWLL_early_Area	Num	Mirror to	Y	ISC/22/BILLWG-
F4_JPN_WCNPO_OSDWLL_late_Area2	Num	Mirror to	Y	ISC/22/BILLWG-
F5_JPN_EPO_OSDWLL[1]	Num	Y	N	ISC/22/BILLWG-
F6_JPN_WCNPO_OSDF	B	Mirror to	N	ISC/22/BILLWG-
F7_JPN_WCNPO_CODF	B	Y	N	ISC/22/BILLWG-
F8_JPN_WCNPO_Other_early	B	Mirror to	N	ISC/22/BILLWG-
F9_JPN_WCNPO_Other_late	B	Mirror to	N	ISC/22/BILLWG-
F10_TWN_WCNPO_DWLL_early	B	Mirror to	Y	ISC/22/BILLWG-
F11_TWN_WCNPO_DWLL_late	B	Y	Y	ISC/22/BILLWG-
F12_TWN_WCNPO_Other	B	Mirror to	N	ISC/22/BILLWG-
F13_US_WCNPO_LL_deep	B	Y	Y	ISC/22/BILLWG-02/04
F14_US_WCNPO_LL_shallow_early	B	Mirror to	Y	ISC/22/BILLWG-
F15_US_WCNPO_LL_shallow_late	B	Y	Y	ISC/22/BILLWG-02/04
F16_US_WCNPO_GN	B	Mirror to	N	ISC/22/BILLWG-
F17_US_WCNPO_Other	B	Mirror to	N	ISC/22/BILLWG-
F18_WCPFC[2]	B	Mirror to	N	Presentation 1
F19_IATTC[3]	B	Y	N	Presentation 1
S1_JPN_WCNPO_OSDWLL_early_Area	Num	Mirror to	-	ISC/22/BILLWG-
S2_JPN_WCNPO_OSDWCOLL_late_Ar	Num	Mirror to	-	ISC/22/BILLWG-
S3_JPN_WCNPO_OSDWLL_early_Area	Num	Mirror to	-	ISC/22/BILLWG-
S4_JPN_WCNPO_OSDWLL_late_Area2	Num	Mirror to	-	ISC/22/BILLWG-
S5_TWN_WCNPO_DWLL_early	Num	Mirror to	-	ISC/22/BILLWG-
S6_TWN_WCNPO_DWLL_late	Num	Mirror to	-	ISC/22/BILLWG-
S7_US_WCNPO_LL_deep	Num	Mirror to	-	ISC/22/BILLWG-
S8_US_WCNPO_LL_shallow_early	Num	Mirror to	-	ISC/22/BILLWG-
S9_US_WCNPO_LL_shallow_late	Num	Mirror to	-	ISC/22/BILLWG-

[1]Catch and length data will be added for the sensitivity analysis.

[2]Catch data will be added for the sensitivity analysis.

[3]Catch data will be added for the sensitivity analysis, including Taiwanese catch.

Table 2. Biological parameters for the NPO swordfish stock assessment models.

Parameter	Female	Male	Reference
Growth age for L1	1	1	-
Growth age for L2	15	15	-
Natural mortality	0.42 (0)	0.4 (0)	Kapur et al. 2017
	0.37 (1)	0.38 (1)	
	0.32 (2)	0.37 (2)	
	0.27 (3)	0.37 (3)	
	0.22 (4+)	0.37 (4)	
		0.37 (5)	
		0.36 (6+)	
L at Amin GP 1	97.7	99	DeMartini et al. 2007
L at Amax GP 1	226.3	206.4	DeMartini et al. 2007
VonBert K GP 1	0.246	0.271	DeMartini et al. 2007
CV young GP 1	0.1	0.1	
CV old GP 1	0.1	0.1	
Weight – length par 1	1.30E-05	1.30E-05	DeMartini et al. 2000
Weight – length par 2	3.07	3.07	DeMartini et al. 2000
50% maturity length	143.68	-	DeMartini et al. 2000
Mat slope	-0.1034	-	DeMartini et al. 2000
Fecundity	Proportional	-	
Spawning season	July	-	Nishikawa 1985
R0	Estimate	-	
Steepness	0.9	-	Brodziak 2020

Table 3. List of proposed future projection scenarios.

No	Management scenario	Years	Recruitment scenario
S1	Average fishing intensity during the 2019-2021 scenario ($F_{2019-2021}$= *F*XX%);	20	Deterministic
S2	F_{MSY} scenario (*F*XX%);	20	Deterministic
S3	F at level to produce 20% of unfished spawning biomass $F_{20\%SSB0}$ scenario (*F*= *F*XX%);	20	Deterministic
S4	High F scenario (F20%)	20	Deterministic
S5	Low F scenario (F50%)	20	Deterministic
S6	Average fishing intensity during 2008-2010 scenario ($F_{2008-2010}$= *F*XX%);	20	Deterministic

Table 4. List of tentative sensitivity runs.

RUN	NAME	DESCRIPTION
Alternative Life History Parameters: Natural Mortality		
1	base_case_highM	Alternative natural mortality rates are 10% lower than in the base case
2	base_case_lowM	Alternative natural mortality rates are 10% higher than in the base case
Alternative Life History Parameters: Stock-Recruitment Steepness		
3	base_case_h070	Alternative lower steepness with h=0.70
4	base_case_h081	Alternative lower steepness with h=0.81
5	base_case_h099	Alternative higher steepness with h=0.99
Alternative Life History Parameters: Growth Curves		
6	base_case_large_Amax	Alternative growth curve with a 10% larger maximum size for each sex.
7	base_case_Sun_Growth	Alternative growth curves using growth parameters from Sun et al. (2002)
Alternative Life History Parameters: Maturity Ogive		
8	base_case_high_L50	Alternative maturity ogives with L50 set 10% higher than base case
9	base_case_low_L50	Alternative maturity ogives with L50 set 10% lower than base case
10	base_case_Wang2003	Alternative maturity ogives with converted L50 from Wang et al. (2003)
Alternative catch assumption		
11	Drop_VNCN_catch	Drop the Vanuatu and Chinese catch
12	NP_all_catch	Use all catches in North Pacific Ocean

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APPENDIX 2. MEETING AGENDA.

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

BILLFISH WORKING GROUP (BILLWG)

DATAPREPARETORY MEETING OF WESTERN CENTORAL NORTH PACIFIC STRIPED MARLIN STOCK ASSESSMENT ANNOUNCEMENT and DRAFT AGENDA

Meeting Style:	Hybrid meeting using Microsoft Teams The WG chair will inform the link on the day before the meeting.
Meeting Dates:	November 28-30, 2022 10:00-17:00 (JST)
Meeting Venue:	Japan Fisheries Research and Education Agency. 2-12-4 Fukuura, Kanazawa-ku, Yokohama, Kanagawa, 236-8648, JAPAN
Meeting Goals:	To agree on the data and the model configuration of Stock Synthesis 3 for WCNPO swordfish stock. Discuss the request from WCPFC NC.
Meeting Attendance:	Please respond to Hirotaka Ijima if you plan on attending this meeting. (Email: ijima_hirotaka69@fra.go.jp)
Working Papers:	Submit working papers to Hirotaka Ijima by November 25th.
BILLWG Contact:	Hirotaka Ijima (Ph.D, ISC BILLWG Chair) Highly Migratory Resources Division, Fisheries Stock Assessment Center, Fisheries Resources Institute (FRI), Japan Fisheries Research and Education Agency. 2-12-4 Fukuura, Kanazawa-ku, Yokohama, Kanagawa, 236-8648, JAPAN E-mail: ijima_hirotaka69@fra.go.jp TEL: +81-543-36-6044

DRAFT AGENDA

November 28th (Monday), 10:00 - 17:00 (JST)

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. Numbering working papers and distribution potential
4. Abundance Indices
    a. Japanese longline CPUE
    b. Taiwanese longline CPUE
    c. US Hawaii longline CPUE

December 29th (Tuesday), 10:00 - 17:00 (JST)

5. Catch and length frequency data
    a. Japanese catch and length data
    b. Taiwanese catch and length data
    c. US catch and length data
    d. Other WCPFC and IATTC fleet data

December 30th (Wednesday), 10:00 - 17:00 (JST)

6. Model configurations
    a. Version of the Stock Synthesis 3
    b. Fleet definition and data set
    c. Biological parameters
    d. Future projection
    e. Sensitivity analysis
7. Date of the stock assessment meeting
8. Request from WCPFC Northern Committee
9. Other items

December 5th (Monday), 10:00 - 17:00 (JST)

10. Circulate workshop report
11. Adoption

APPENDIX 3. THE LIST OF WORKING PAPERS AND PRESENTATIONS.

ISC/22/BILLWG-02/01	Updates on the horizontal movements and stock affiliation of swordfish (*Xiphias gladius*) tagged in the eastern north Pacific (2002-2022). Chugey Sepulveda and Scott Aalbers.
ISC/22/BILLWG-02/02	Standardization of Western and Central North Pacific Swordfish (*Xiphias gladius*) Catch Per Unit Effort in the Hawai'i Longline Fishery from 1995–2021. Erin Bohaboy and Michelle Sculley
ISC/22/BILLWG-02/03	Swordfish (*Xiphias gladius*) Length Composition Data for the Hawaii Longline Fishery during 1994-2022. Jon Brodziak and Michelle Sculley
ISC/22/BILLWG-02/04	U.S. Swordfish fisheries in the North Pacific Ocean. Russell Y. Ito and Yuhong Gu.
ISC/22/BILLWG-02/05	Update Japanese catch and size statistics for the North Pacific swordfish stock assessment. Hirotaka Ijima
ISC/22/BILLWG-02/06	CPUE Standardization for Pacific Swordfish (*Xiphias gladius*) caught by the Japanese longline fishery: A GLMM analysis using the R software package R-INLA. Marko Jusup, Haruko Koike, and Hirotaka Ijima.
ISC/22/BILLWG-02/07	Catch, length data and standardized CPUE of swordfish caught by the Taiwanese fisheries in North Pacific Ocean. Jhen Hsu, Yi-Jay Chang
Presentation 1	Catch and length data from IATTC and WCPFC member countries. Hirotaka Ijima