Annex 5

REPORT OF THE BILLFISH WORKING GROUP WORKSHOP

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

16-23 January 2013
Honolulu, Hawaii, USA

1.0 OPENING OF BILLFISH WORKING GROUP WORKSHOP

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 Honolulu, Hawaii, USA from 16-23 January 2013. The goals of this workshop were: (1) to complete data preparation for the Pacific blue marlin stock assessment including catch by quarter data, CPUE standardization, size frequency data, tagging data, and life history parameters, and (2) to finalize all Pacific blue marlin stock assessment data for a 2013 stock assessment.

Gerard DiNardo, ISC Chair, welcomed participants from Chinese Taipei, Japan, the United States of America (USA), and the Inter-American Tropical Tuna Commission (IATTC) (Attachment 1). The WG noted that no representatives from Canada, China, Mexico, Korea, or the Secretariat of the Pacific Community were present.

2.0 MEETING LOGISTICS

2.1 Standard Meeting Protocols

The BILLWG Chair Jon Brodziak noted that 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.

2.2 Computing Facilities

Computing facilities included a website for distribution of working papers, meeting documents, and other information, and also included a Wi-Fi wireless network access point to connect to the internet. The WG noted that the Wi-Fi connection was not consistent.

2.3 Adoption of Agenda

The meeting agenda was reviewed, revised, and adopted (Attachment 2). The final agenda included Hui-Hua Lee's presentation of additional information on striped marlin projection analyses.

2.4 Assignment of Rapporteurs

Rapporteuring duties were assigned to Yi-Jay Chang, Gerard DiNardo, Michael Hinton, Russell Ito, Lyn Katahira, Ai Kimoto, Joseph O'Malley, Nan-Jay Su, Chi-Lu Sun, Darryl Tagami, Lennon Thomas, William Walsh, and Kotaro Yokawa. Lennon Thomas and Lyn Katahira served as lead rapporteurs with overall responsibility for assembling the workshop report.

3.0 NUMBERING WORKING PAPERS AND DISTRIBUTION POTENTIAL

Working papers were distributed and numbered (Attachment 3).

It was noted that ISC/13/BILLWG-1/03 was withdrawn and that its contents were included in ISC/13/BILLWG-1/05. It was agreed that all working papers would be posted on the ISC website where they will be available to the public, contingent upon acceptable revisions.

4.0 STATUS OF WORK ASSIGNMENTS

The WG reviewed the status of work assignments from the April 2012 ISC BILLWG workshop. These were:

- Present complete working papers on blue marlin standardized CPUEs at the next intercessional BILLWG workshop. Approaches for standardizing CPUEs were discussed at the July 2012 meeting.

- Explore methods to estimate the natural mortality rate and steepness of blue marlin using empirical or model-based estimates.

- Given the lack of representative sex-specific size frequency data for blue marlin fisheries, develop a combined-sex von Bertalanffy growth curve.

- Obtain information on blue marlin reproductive ecology for use in the stock assessment from the published paper by Sun et al. (2009).

- Develop a standard protocol to select a representative length-weight relationship for the blue marlin stock assessment.

The BILLWG Chair reported that the CPUE standardization working papers will be completed and reviewed by 15 February 2013. The WG clarified that a combined-sex von Bertalanffy growth curve was not estimated, but that analyses of sex-specific growth curves were completed.

The BILLWG Chair was also assigned a number of tasks. These tasks included:

- Contact scientists from the IATTC, Japan, Southwest Fisheries Science Center and Pacific Islands Fisheries Science Center to summarize all available tagging data in the Pacific Ocean.
- Contact New Zealand to obtain recreational blue marlin fishery data.
- Contact the ISC webmaster to update billfish information on the ISC webpage.
- Coordinate future meeting dates with members using an online poll system.
- Contact the Statistics Working Group Chair, Ren-Fen Wu, about creating data codes for stock areas of striped marlin and swordfish.

The BILLWG Chair reported that these tasks were completed.

5.0 REVIEW OF RECENT FISHERIES

5.1 Review of recent developments and issues

The WG noted that MULTIFAN-CL, a spatially structured model, was used for the last stock assessment of Pacific blue marlin which was conducted in 2001 (Kleiber et al. 2003). It was also noted that the input data (1962-1999) used in the 2003 assessment were available on the BILLWG website for review. The WG also noted that two research papers regarding blue marlin assessment were published in recent years (Su et al. 2011; Su et al. 2012).

5.2 Future projections of the Western and Central North Pacific Striped Marlin Stock presented by Hui-Hua Lee (Information paper)

Stock projections were conducted to evaluate the impact of various levels of fishing intensity on future spawning stock biomass and catch based on the recent stock assessment of WCNPO striped marlin stock. The stochastic projections were implemented to incorporate variability in the estimates of terminal numbers at age in the stock assessment. This variability was propagated forward in future projections which also included uncertainty about the recruitment process to reflect the lack of knowledge about the future state of nature and ultimately, cast the results in a probabilistic analysis. Three recruitment (R) scenarios were evaluated: R randomly sampled from the 1994-2008 levels, R randomly sampled from the 2004-2008 levels, and random sampling from the spawner-recruit curve. Decision tables were used to show the results of alternative harvest rates on spawning stock biomass in the terminal projection year (2017) relative to 2012 under each recruitment scenario. The current harvest rate is likely to be unsustainable, especially if future recruitment follows the 2004-2008 scenario. Reductions in fishing pressure are projected to decrease the risk of future spawning biomass remaining below the level to produce maximum sustainable yield and would likely produce larger yields in 2017 relative to 2012 compared to the current harvest rate.

Discussion

It was noted that this research was requested at the WCPFC-NC8 meeting for presentation at WCPFC8 in December 2012 and that the presentation was completed by the ISC Chair. The ISC Chair commented that the WG may be requested to make further striped marlin projections. It was agreed that all ISC countries that harvest WCNPO striped marlin will provide WCNPO striped marlin catch data by gear through 2011 to the BILLWG Chair and that the WG will conduct updated projections as soon as practical.

The WG suggested several ways to display the information in the projection tables in a more efficient manner including box plots, density plots, and cumulative frequency distributions.

5.3 Feasibility of using Hawaii International Billfish Tournament data in blue marlin stock assessments presented by Joseph O'Malley (Presentation only)

Currently in Hawaii, there is no mechanism for recreational fishers who do not possess a State Commercial Marine License (CML) to report their catch. This study examined the potential of using the Hawaii International Billfish Tournament (HIBT) data as a source of information on recreationally-caught blue marlin.

Individual weight, vessel name, and the year and tournament day (1-5) of all blue marlin (*Makaira nigricans*) caught during the HIBT from 1959-2001 were acquired. Catch summaries (number of fish boated and number released) from 2002-2009 as well as the calendar date of some of the HIBT years were found in the Hawaii Fishing News. Upon examination, it was apparent that an unknown amount of the HIBT data may already be represented in the State of Hawaii Department of Aquatic Resource (HDAR) data. This is because the majority of vessels that participate in the HIBT are local charter vessels that are required to obtain a CML and hence report all their catch (including released fish) to the HDAR. Two different methods were used to determine the extent of the overlap of HIBT catch data with the HDAR catch data. The first approach was a direct comparison of HIBT data with the blue marlin catch data reported in HDAR and landed at Kona during the tournament. Further, the HDAR data were visually examined in an attempt to match specific fish caught during the HIBT by using date caught and fish weight. The second approach utilized a third data source, the Charter Desk, which represents a large majority of the charter fishing vessels in Kona and publishes daily catches. The Charter Desk published reports for blue marlin caught during the 2009 HIBT that were used to build a pseudo-HIBT data set which was then compared to the catch of blue marlin reported to HDAR on the same dates as HIBT.

Both methods found a substantial but undetermined amount of blue marlin that was caught during the HIBT and not reported to HDAR. Attempts to determine exactly which fish were reported were confounded by the nuances of each data set. Therefore, caution is advised when attempting to use HIBT data as a source of recreational catch information because of the undetermined amount of overlap with the HDAR data which would result in double-counting.

The following figures summarize the 1959-2001 data:

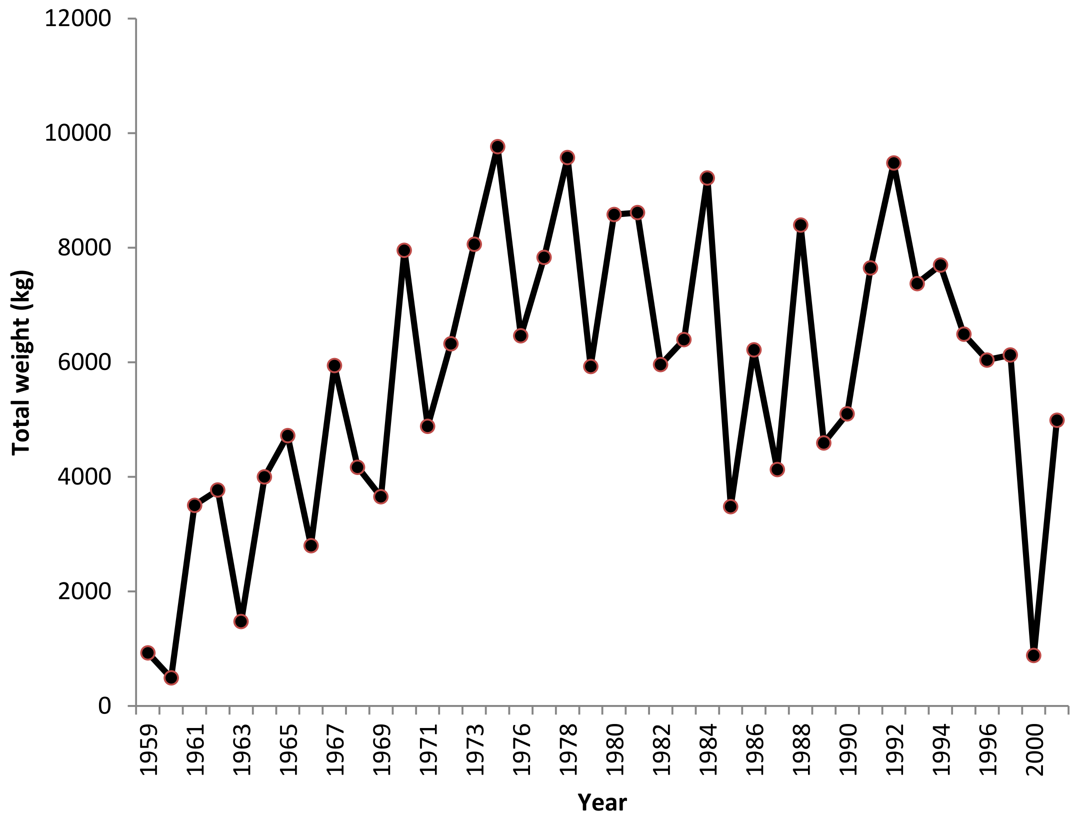

Figure 1. Total weight (kg) of blue marlin (*Makaira nigricans*) caught during the Hawaii International Billfish Tournament by year.

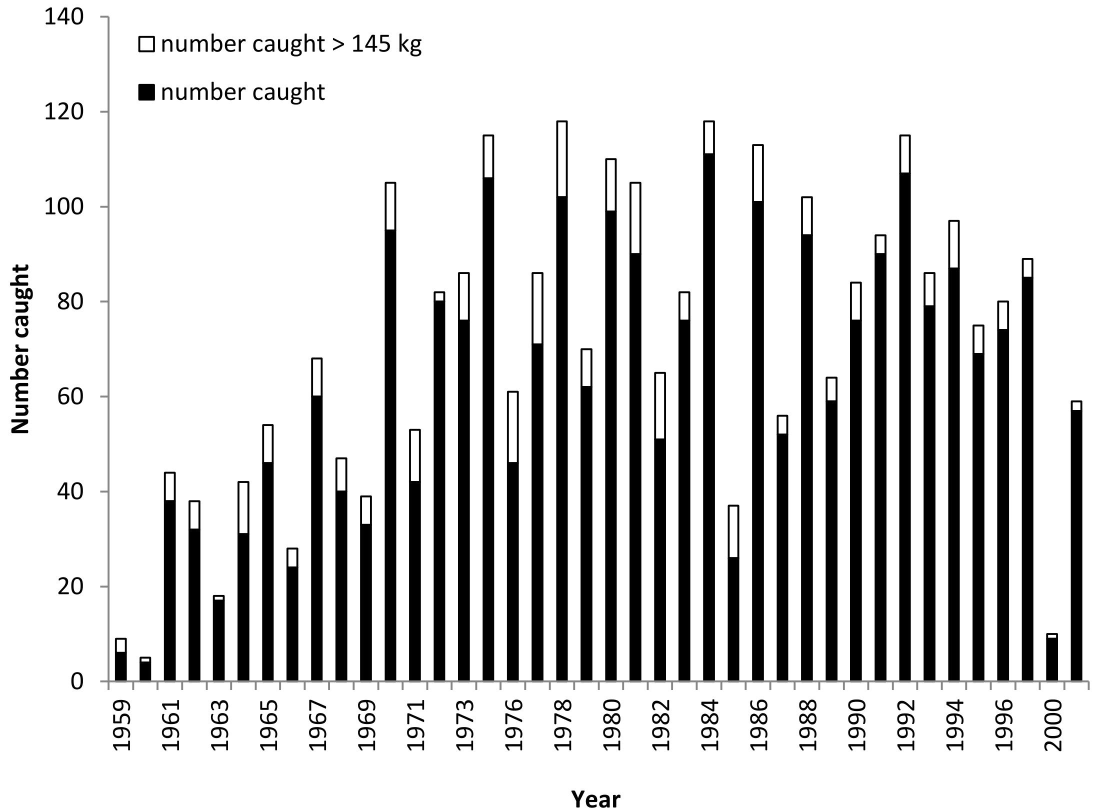

Figure 2. Total number of blue marlin (*Makaira nigricans*) (black bars) and the number of blue marlin greater than 145 kg (white bars) caught during the Hawaii International Billfish Tournament by year.

Discussion

The WG noted that the HIBT is a long history catch series (1959-2001) available for the assessment of Pacific blue marlin. However, HIBT catch data from 2002-present are not available. The WG noted that the catch data of blue marlin are available by year in total weight but there is no data on fishing effort or the number of the boats since the early years. However, the number of the boats is generally declining. The WG also noted that catches of blue marlin reported to HIBT were much larger than those reported to HDAR in the years examined. The WG requested that the HIBT data be made available.

5.4 Review of Information on BILLWG Web Page

It was noted that the BILLWG web page was online at the URL:
http://isc.ac.affrc.go.jp/working_groups/billfish.html

It was noted that the 2011 Striped Marlin Stock Assessment Report is posted on the ISC website and that the BILLWG web page is active and up to date. The WG also acknowledged the efforts of the ISC webmaster, Yumi Okochi, to complete the BILLWG web page. The BILLWG noted that historic working papers dating back to 1999 are now posted on the ISC website.

6.0 FISHERIES STATISTICS FOR PACIFIC BLUE MARLIN

6.1 U.S. Commercial Fisheries for Marlins in the North Pacific Ocean presented by Russell Ito (ISC/13/BILLWG-1/04)

This report summarized historical trends and recent developments for U.S. commercial fisheries taking marlins (Istiophoridae) in the North Pacific Ocean. At least five species of marlins are exploited commercially by U.S. fisheries in the North Pacific Ocean. These are striped marlin (*Kajikia audax*), blue marlin (*Makaira nigricans*), shortbill spearfish (*Tetrapterus angustirostris*), sailfish (*Istiophorus platypterus*), and black marlin (*Istiompax indica*). The first two species dominate the commercial landings by weight.

U.S. fisheries for marlins in the North Pacific Ocean can be categorized according to three distinct gear types: longline, troll, and handline. The largest is the longline fishery, which for the purposes of this report refers solely to the Hawaii-based longline fishery. This fishery takes marlins as incidental catch on sets targeting tuna or swordfish. Troll fisheries in Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands constitute the second largest category for marlins. These fisheries opportunistically target marlins on a seasonal basis. The Hawaii handline fishery represents the third category and has small incidental catches of marlins.

Discussion

The WG discussed temporal changes in the Hawaii longline shallow- and deep-set blue marlin catches because of management changes to reduce sea turtle interactions in 2000. The WG also discussed changes in Japanese hook depth and resulting catch, as well as blue marlin depth distribution. A graphical representation of the monthly hooks per float (HPF) in the Hawaii longline fishery was presented and showed that there was temporal consistency in the number of hooks per float for shallow sets but that HPF varied temporally for deep sets and showed a slight decline in recent years. The WG noted that increased monitoring and data collection would be needed to provide better information on gear configuration through time. The presenter indicated that such changes in gear configuration may be the cause for the recent increase of deep pelagic species in the catch composition. The species composition might also have changed over time due to natural variation in species abundances. The WG noted that the inclusion of information on gear configuration might improve the catch analysis, as well as including more information on the species composition for this fishery. It was also noted that nominal catch statistics for striped marlin appeared to increase in 2011, especially in juvenile striped marlins.

6.2 Catch History of Blue Marlin *Makaira nigricans* presented by William Walsh (ISC/13/BILLWG-1/13)

This working paper presents a catch history in numbers and metric tons for blue marlin *Makaira nigricans* in Hawaiian waters for 1948–2011. The data from 1948–1994, obtained primarily from Hawaii Division of Aquatic Resources records, are the same nominal values as were presented to the ISC BILLWG in 2012. An updated, corrected catch history for the Hawaii-based pelagic longline fleet from 1995–2011 is being generated using a zero-inflated negative binomial model.

This work is in progress and completed estimates in numbers and tonnage should be available to the ISC Billfish Working Group in February 2013.

Discussion

Discussions centered on changes in misidentifications of blue marlin from longline captains over time and on the use of observer, logbook, and auction data to correct misidentified catch. It was noted that the total marlin catches reported by observers and reported in logbooks generally agree. In 1999, the WG was informed that unusually large catches of spearfish may have resulted in more misidentifications. It was also noted that the longline logbook catch data were corrected with longline observer data and verified with auction sales data. Overall, nearly all of the marlins caught (>95%) were retained in the Hawaii longline fishery.

The WG discussed the CPUE of blue marlin for HI-based longline fleet during the early period of the fishery and observed that the higher variability in the early 1990s was, in part, due to lower observer coverage in 1994-1999.

6.3 Input Data of Blue Marlin Caught by Japanese Fisheries for the Stock Assessment in the Pacific Ocean presented by Ai Kimoto (ISC/13/BILLWG-1/06)

This report provides input data for the stock assessment on the amount and size of blue marlin caught by Japanese fisheries through 2011. The catch data by fishing gear was gathered from Japanese year book and logbook data between 1971 and 2011. There were several types of fishing gears that reported blue marlin catches. These were: Japanese offshore and distant-water longline, coastal longline, other longline, squid drift net, drift net, bait fishing, net fishing, trap net, and others, primarily harpoon. The size composition data were also updated from the April 2012 BILLWG meeting and were reported for several fisheries. Overall, most of the size composition data for blue marlin came from the distant-water longline fishery.

Discussion

The WG discussed the number of large female blue marlin observed (>400 EFL) in the Japanese distant water and offshore longline fisheries. It was noted that the fishing effort for Japanese longline fishery has declined since 1990 and that the fishing effort in the EPO also decreased. A map was provided to verify this change. The WG noted that it would be useful to have a relationship between whole weight and processed weight in order to convert the processed weight frequency data to length frequency data based on the length-weight relationship. and the converted length frequency data could then be used in the stock assessment of Pacific blue marlin. However, the WG noted that the relationship between whole weight and processed weight likely varied by fishery and that one relationship could not be consistently applied to all the Japanese fisheries.

The WG also discussed the time period when it was believed that the Pacific blue marlin stock was fully susceptible to Japanese longline fisheries across the entire Pacific. In the context of providing input data for the stock assessment, it was suggested that the Japanese fishery data for blue marlin be considered to start in 1971. However, the WG noted that assuming the fishery started in 1971 would not account for the impacts of fisheries that caught blue marlin since the 1950s.

After further work, a presentation was made showing new estimates of Japanese blue marlin catches in the Pacific Ocean from 1952-1970 that addressed the issue of blue marlin misidentification with black marlin. The WG agreed to use the new estimates of blue marlin catches from 1952 to 1970 from the blue marlin ratio expansion method.

6.4 Updated blue marlin catches in the North and South Pacific Ocean presented by Darryl Tagami (ISC/13/BILLWG-1/11)

This working paper presents catch summaries and distribution plots of blue marlin in the North Pacific and South Pacific from non-ISC member countries. The data was provided by the WCPFC for longline catches of blue marlin only. The purpose was to provide the ISC Billfish Working Group with billfish catch data that were not available in the ISC or ISC Working Groups data holdings. This was the first time the WCPFC blue marlin catch data has been made available to the ISC for stock assessment purposes.

Discussion

Clarification of exactly what data were presented was the initial focus of discussion. The WG was informed that the same WCPFC data used in past assessments (e.g., fishery data from the Philippines in Hinton 2001; Kleiber et al. 2003) was going to be used in this assessment, including length frequency data from WCPFC.

Later the presenter showed that the WCPFC also had purse seine catch data that included blue marlin. There was a brief discussion about the potential of misidentification of blue marlin and it was suggested that the majority of the reported marlin catch was likely to be blue marlin based on the spatial distribution of the purse seine catches. As a result, misidentifications of marlins should not be an issue and the WG agreed to include the WCPFC purse seine catch data in the blue marlin catch table.

6.5 Catch statistics, size composition, and CPUE standardizations for blue marlin *Makaira nigricans* in the Hawaii-based pelagic longline fishery in 1995-2011 presented by William Walsh (ISC/13/BILLWG-1/14)

This working paper presents catch statistics, catch maps, catch-per-unit-effort (CPUE) standardizations, and size composition data for blue marlin *Makaira nigricans* in the Hawaii-based pelagic longline fishery in 1995–2011 using data from the Pacific Islands Regional Observer Program (PIROP) in support of the stock assessment activities of the ISC Billfish Working Group (BILLWG). The largest fraction of the observed blue marlin catch (40.3%) was taken from 10°N to 20°N and 160°W to 180°W. The nominal blue marlin CPUE decreased by 69.9% from 1995 through 2011, reflecting an increase from 69.5% to 85.2% in zero catches and a decrease in positive catches from 30.5% to 14.8%. CPUE was standardized with five generalized linear models (GLMs) in which years, calendar quarters, fishery sectors, fishing regions, and bait types were significant factor variables and sea surface temperature (SST) and vessel length were significant continuous variables. The best fitting model, selected on the basis of its Akaike Information Criterion (AIC), was the zero-inflated negative binomial GLM (ZINB). Annual effect coefficients from all models were plotted as indices of relative abundance; downward trends early in the time series that reflected both a high level of observer effort in the shallow-set sector in 1995 and strong recruitment in 1997 were followed by rough stability since 2002. The ZINB was used to predict standardized CPUE under specified conditions (e.g., quarterly mean SST; mean vessel length; 1000 hooks). Most of these predicted trends appeared relatively constant. We conclude that the nominal fishery-wide decreases in catch rates in 1995–2011 reflect changes in observer coverage and effects of extrinsic factors, and that blue marlin population status in its core area of tropical waters has been roughly stable during that interval.

Discussion

The initial WG discussion centered mostly on the fit of the CPUE standardization model to the data. The WG noted that the analysis was done on a quarterly basis and that the standardized CPUE trend appeared to be relatively stable for the last 10 years.

It was suggested that including a year-area interaction effect in the CPUE standardization might improve the model fit. It was noted that the model already incorporated area effects and that while effort in the deep sector fishery had increased through time, effort in the shallow sector had not. The WG considered information on the temporal variability of SST for the Hawaii-based longline fishery and requested further clarification of why the blue marlin CPUE declined substantially in 1999.

Additional information on the variability of the SST data was presented and discussed. Further information was also presented on the 1999 CPUE decline including bootstrapped delta-lognormal GLM results, area information for the number of hooks per set, the proportion of zero catch and the blue marlin catch by area, bait-type over time, set-type composition over time, and the annual and monthly distribution of longline set annual SST by region. While there was no single cause for the 1999 CPUE decline, it appeared that the drop was in part due to lower observer sampling intensity, and also due to a shift in the overlap between the fishery and the blue marlin population. The WG also noted fewer data were available for the CPUE analysis prior to 2000.

6.6 Standardizing catch and effort data of the Taiwanese distant-water tuna longline fishery or blue marlin (*Makaira nigricans*) in the Pacific Ocean, 1967-2011 presented by Nan-Jay Su (ISC/13/BILLWG-1/09).

The catch and effort data for blue marlin in the Taiwanese distant-water tuna longline fishery in the Pacific Ocean were standardized using generalized additive models. Category II data (aggregated into 5º×5º grid) for 1967-2011 and those with hooks per basket (HPB) information for 1995-2011 were used for the standardization of CPUE in this study. Results showed that the standardized CPUE of blue marlin was generally stable over 1980-2000, but noticeably increased thereafter. The effect of HPB was statistically significant in the CPUE standardization. However, the CPUE trend with HPB information included in the model for 1995-2011 was similar to those without HPB included. The standardized CPUEs of blue marlin derived from this study could be used as basic input data for the assessment of the blue marlin stock.

Discussion

The WG discussed the change in the target species for the Taiwanese longline fleet from albacore at higher latitudes to bigeye tuna in lower latitudes in the 2000s. It was noted that the longline time series could be separated into 3 time periods (1967-1978, 1979-1999, 2000-2011) based on differences in fleet strategy. As a result, a further CPUE standardization analysis was requested. A discussion was also generated on the appropriateness of splitting or aggregating the data for analysis and additional analyses requested to determine the efficacy of the proposed time periods. The WG recognized that the result of the analyses for the separate time series produced more consistent and better fits to the data than treating the data as a single CPUE time series. The WG accepted the three-time period CPUE standardization analyses and recommended that these time series be considered for use in the stock assessment.

6.7 Standardization of abundance indices for blue marlin in the Pacific ocean by Japanese offshore and distance longline presented by Minoru Kanaiwa (ISC/13/BILLWG-1/05).

Standardized CPUE using a delta-lognormal two step model were provided for the earlier period (1975-1993) and the later period (1994-2010). The diagnostics for the binomial component (1st step) were problematic but were adequate for the lognormal component (2nd step). In the earlier period, the CPUE of blue marlin increased slightly and in the later period, CPUE decreased slightly. Confidence intervals for standardized CPUE will be estimated by bootstrap analysis and provided to the WG later.

Discussion

The working group requested more information on the residual patterns of the first step model including standardized residuals as well as information on the relationship between CPUE and reporting ratio. The WG noted that the first step residuals had a bimodal pattern. The WG also asked how much of the deviance was explained by the model and requested a more detailed rationale for splitting the data into two time periods (1975-1993 and 1994-2010). It was also questioned why catch data prior to 1975 was not used. The presenter noted that 1994 was the first year with a new logbook system and increasing use of monofilament gear, and that prior to 1975 all species of marlin caught by Japanese were recorded as blue marlin in catch and effort statistics.

Additional information on the first step residual patterns was reviewed by the WG. Additional information on the rationale for splitting the data in 1994 was also presented and accepted by the WG. The WG also made a request for a figure displaying how the spline fit the data. These plots were expected to be incorporated into the revised working paper.

The WG discussed several other issues on the CPUE standardization. The WG noted the degrees of freedom in the deviance table for splines were incorrect. The presenter responded the deviance table would be corrected in the revised working paper. It was also pointed out that only small numbers of outliers were apparent in the bimodal residual plots (the dominant mode accounted for over 99.9% of the data while the outliers accounted for less than 0.06% of total data). It was also explained that quadratic functions were used to replace the fitted splines and to facilitate computing of the Japanese standardized CPUE. The spatial coverage of the CPUE was also changed to be 30ºS to 30ºN to be consistent with the habitat-based standardization analysis. The WG also reviewed and accepted revised analysis of deviance tables and plots of the factor effects.

6.8 Habitat-based Standardization (HBS) of Japanese Longline Operational Level Data presented by Michael Hinton (ISC/13/BILLWG-1/05).

Standardization of Japanese longline data by habitat-based standardization (HBS) was presented for the period 1997 to 2011. This method had been used for the previous assessments (2001 and 2003) of blue marlin, however in this case detailed data on gear configuration by operation (set) was available for the gear model used in the standardization. In the HBS the gear model provides an estimate of the fishing depth of hooks on a longline based on lengths of the various components, e.g. float line length, of a longline. There were over 1,600 gear configurations in the operational data. A comparison of estimated hook depths to those depths used in the previous assessments indicated significant differences, with depths calculated from the operational data being more shallow than those developed using approximations for gear configuration components used in the previous assessments. The blue marlin distribution in habitat was estimated based on temperature of the mixed layer and depths of isotherms at temperatures of one to eight degrees less than mixed layer temperature. The trends in standardized and nominal catch-per-unit effort were presented. The analyses will be updated in the revised working paper to include additional operational data records and to include confidence intervals and diagnostics.

Discussion

There was a brief discussion about fishing gear. The WG questioned what the difference in the CPUE would be if the different gear models (2001 vs. 2013) were applied to the same data set. However, the WG also noted that the new gear configuration model was developed based on the best available information, which has improved the assumptions made for the old model. The presenter indicated that this analysis will be included in the revised working paper "*Standardization of Abundance Indices for Blue Marlin in Pacific Ocean by Japanese Offshore and Distance Longline*" (ISC/13/BILLWG-1/05). In particular, the HBS analysis covered the Japanese longline fishery from 1997-2011 and CPUE data for 1994 -1996 would be added in the revised working paper.

Additional analyses indicated that a GLM model was the most reliable method to standardize Japanese blue marlin CPUE for the early period (1975-1993) and that the habitat-based standardization was best for the late period (1994-2010). The WG discussed the need to include updated and corrected data in the later period CPUE standardization and the WG was assured that the final HBS analysis will be completed in the revised working paper. There were some concerns raised about whether or not CPUE estimates would change with expected HBS analyses and it was noted that these issues would be resolved as the WP was reviewed and finalized. The WG requested that estimates of the variability of HBS CPUE be provided.

6.9 A summary of blue marlin conventional tag recapture data from NMFS-SWFSC Cooperative Billfish Tagging Program in the Pacific Ocean presented by Jon Brodziak (ISC/13/BILLWG-1/08).

The ISC Billfish Group has identified tagging data as potentially useful to examine stock structure hypotheses and provide information on movements in support of stock-assessments. The NMFS Cooperative Billfish Tagging Program in the Pacific has been in operation since the 1960's but there was still limited information on the stock structure of highly migratory billfish, and movement data from tagging programs generally have not been included in stock assessments. The tagging data presented here show movements across the Pacific, including movement from the Northern Hemisphere to the Southern Hemisphere. However, the majority of recaptures occurred proximal to their initial tagging location.

Discussion

The WG suggested further analysis, such as looking at the distance moved and time-at-liberty relationship relative to fish size. It was also suggested that the data be examined at different times-at-liberty to attempt to detect annual patterns; it was noted that the month of recapture may indicate seasonal patterns in the movement of blue marlin and that the recaptures are likely highly dependent on recreational fishers rather than the commercial fleets which may explain the absence of tag recoveries north of Hawaii. This may have an impact on the perceived direction of travel because there are no recreational fisheries north of Hawaii. It would be helpful to know which fishery recaptured the fish. Preliminary pop-up satellite tagging information based on ten blue marlin tagged off Taiwan was displayed and discussed. Results from this research conducted under a joint FRI, PIFSC, and NTU collaborative project could be available in the near future. It was indicated that there was more pop-up satellite information from Hawaiian waters but that it was unlikely to be available in the near future, if at all.

7.0 REVIEW OF LIFE HISTORY PARAMETERS FOR PACIFIC BLUE MARLIN

7.1 Combining information on length-weight relationships for Pacific Blue Marlin presented by Jon Brodziak (ISC/13/BILLWG-1/01).

In this working paper, I provide a meta-analysis of the available studies in Sun et al. (2012) that provide standard information on the allometric model of weight as a function of length for female, male, and combined-sex blue marlin. The meta-analysis treats the parameters of the allometric model $BW = A * EFL^B$ relating body weight (BW , kg) to eye-fork length (EFL , cm) as effect sizes and combines this information to estimate the mean effect size using the random-effects model. Sample sizes of the available studies are used to weight the effect sizes under a simplifying assumption of homogeneous within-study variances and a rough approximation of the order of magnitude of the between-studies variance. Random effects meta-analysis results indicated that the effects for females were $A = 2.115*10^{-5}$ and $B = 2.932$. For males, the mean effects were $A = 1.614 * 10^{-5}$ and $B = 2.919$. The combined-sex results indicated that the mean effects were $A = 2.249 *10^{-6}$ and $B = 3.325$. The results of a fixed-effects meta-analysis were very similar to the random effects results. The results of the meta-analysis also indicated that there was sexual dimorphism in the length-weight relationship for Pacific blue marlin. This is consistent with the fact that the species exhibits sexual dimorphism in growth in size at age and suggests that there are important differences in the feeding behavior and ecology of female and male blue marlin. While females grow faster and achieve larger lengths at age than males, adult females also achieve greater weights at a given length, on average.

Discussion

The WG noted that annual variability in the length-weight relationship was likely. However, the length-weight relationship will be treated as fixed and constant through time for the assessment.

It was noted that a combined sex length-weight relationship may need to be used if there is not enough sex data available. The WG discussed another approach that could be used if no sex data is available that would include sex ratio information. One concern the WG has about using combined length-weight relationship is that females often go on large migrations while males stay close to the fishing grounds so the sex ratio of the catch would vary. Also, sex ratios changes by size class in other species.

Also the WG noted that there is more information on length-weight relationships that was not included in this analysis. The WG requested that the new information from Su et al. (2013) and Wang et al. (2006) be considered for the meta-analysis.

7.2 Age-structured natural mortality for Pacific blue marlin based on meta-analysis and ad hoc mortality models presented by Hui-Hua Lee (ISC/13/BILLWG-1/07).

Recent growth and reproduction studies revealed the sexual dimorphism for Pacific blue marlin. In this working paper, age- and sex-specific natural mortality estimates were derived based on a random effects meta-analysis to estimate adult M from a range of M estimators and apply an ad hoc mortality model to rescale juvenile M to account for size-dependent mortality processes. In the absence of a well-designed tagging study and good catch-at-age or catch-at-size data for each sex, natural mortality estimates for adults were derived from nine estimators based on life history and evolutionary-ecology theory. Estimates of uncertainty were also generated using a range of plausible biological and environmental factors based on the best available information. The adult M estimates derived from a random effects inverse variance weighting of each method were M=0.31 yr^{-1} (95% CI: 0.23-0.40) for females and M=0.35 yr^{-1} (95% CI: 0.27-0.44) for males. We compared Lorenzen's inverse-length model and Charnov's empirical relationship to rescale adult M for juveniles. Results indicated that Lorenzen's method provided a lower juvenile M than Charnov's relationship.

Discussion

The WG noted that, while the female and male adult mortality likely differed, there was no information to indicate that female and male juvenile mortality rates should differ. Juvenile mortality rates differed in the Charnov et al. (2013) analysis because that method estimates M based on growth parameters, which differ for males and females.

The WG discussed which method would be most appropriate for estimating M. One proposal was to include the juvenile growth rates from Shimose (unpublished data) into the analysis. The WG agreed that the best method for estimating M for this assessment would be to use the Lorenzen (1996) method. This method was chosen because it was used for the striped marlin assessment, there was less uncertainty associated with the parameters used in this method, and there was no discussion in Charnov et al. (2013) about how their method represented an improvement over the Lorenzen (1996) approach. When the Lorenzen (1996) method was used, male and female juvenile growth rates were similar, and the estimated M was consistent with values of M for other billfish.

A revised natural mortality schedule will be completed to incorporate revised length-weight relationship in meta-analysis provided by Brodziak (WP 01).

7.3 Sex-specific growth parameters and natural mortality rates of blue marlin (*Makaira nigricans*) in the northwest Pacific Ocean presented by Nan-Jay Su (ISC/13/BILLWG-1/10).

Blue marlin are sexually dimorphic in growth and other biological characteristics. We analyzed the sex-specific catch-at-length data for blue marlin, ranging between 100-311 cm in eye to fork length (EFL) for females and 100-236 cm EFL for males, collected from the Taiwanese offshore longline fishery in the northwest Pacific Ocean. Female blue marlin reach larger body sizes than males. Estimates of growth parameters and natural mortality rates of blue marlin differed between males and females. We suggest that growth parameters and natural mortality rates should be sex-specific when stock assessments for sexually dimorphic species such as blue marlin are conducted.

Discussion

It was noted that there is some variability in the length-weight relationships for females which is good because fish at tournaments of the same length vary in weight. The group was concerned that the EFL was too high at t_0. However, this may be possible as they are a very fast growing species. The study of Shimose (unpublished data) indicated that juveniles grow fast and this was consistent with a study of juvenile blue marlin growth in the Atlantic.

7.4 A Bayesian hierarchical meta-analysis of blue marlin (*Makaira nigricans*) growth in the Pacific Ocean presented by Yi-Jay Chang (ISC/13/BILLWG-1/02).

Growth characteristics of the Pacific blue marlin, *Makaira nigricans,* a highly migratory species of economic importance for commercial and recreational fisheries, are incompletely known and results of various ageing studies have been inconsistent across its geographical range. In this study, Bayesian hierarchical meta-analysis was used to describe variability in growth rates with age studies treated as a random effect. The Bayesian hierarchical model is found to fit the data better than the models with no hierarchical structure for ageing studies and/or a common observation error variance among ageing studies based on the deviance information criterion. The fitted growth curve indicated that the characteristic of rapid growth in juvenile fish. Moreover, between-sex growth differences are also described. The von Bertalanffy growth parameters estimated for the *M. nigricans* population and their standard errors (in parentheses) were: $L\infty = 284.67$ (33.02), K

= 0.18 (0.06), and t0 = -2.41 (0.01) for females and $L\infty$= 211.51 (16.85), K = 0.20 (0.06), and t0 = -3.51 (0.01) for males. We suggest that the posterior probability distributions of the hyperparameters from this analysis can provide plausible input for future implementation of population dynamics models when determining precautionary management decisions.

Discussion

The WG discussed that the growth curves presented may produce a biased prediction of blue marlin size at age 1 because they do not include juvenile growth information. The WG noted that including juvenile growth information may not be sufficient to fully explain the differences between the juvenile and adult growth rates. The WG also discussed that there was a possibility that the different studies used differing interpretations of annuli. If this were true, then some of the growth curves would have inconsistent measurements of size at age.

The WG recommended that the Bayesian hierarchical analysis presented be used to describe the variability in growth rate among various studies in order to determine a single growth curve. The WG requested that the study of Skillman and Yong (1976) be taken out of the analysis because that growth curve was based on a small sample size of larger fish. With Skillman and Yong (1976) data removed, the growth curves fit much better. However, there was still a lack of information on juvenile growth in the curve.

The juvenile growth information issue was resolved when the hierarchical Bayes homogeneous variance (HBHV) model was found to have a size at age 1 that was very close to the juvenile growth studies of Shimose (unpublished data) and Prince et al. (1991). The $L\infty$ from the HBHV model was higher, which is what the WG expected. The HBHV model was rerun with Skillman and Yong (1976) data removed and the estimate of the Brody growth coefficient K was reduced by roughly 50% which the WG noted was more consistent with the growth patterns of other billfish species. The WG agreed to use the results of the HBHV growth model for the blue marlin stock assessment.

7.5 Revised review of life history parameters for blue marlin *Makaira nigricans* presented by Lennon Thomas (ISC/13/BILLWG-1/12).

The intent of this working paper was to summarize available information on life history parameters for blue marlin (*Makaira nigricans*) for the January 16-23, 2013 ISC Billfish Working Group Intercessional Workshop in Honolulu, HI. This paper provided a tabulation of life history information in an accessible format and also identified where gaps in life history information exist. Information provided by Uchiyama and Humphreys (2007) and Sun et al. (2012) was included in the summaries as well as additional information found in both peer-reviewed articles and gray literature. As a result, the life history parameters presented in this review included length-length relationships, length-weight relationships, growth rates, mortality rates, fecundity, and proportion mature at size for Pacific blue marlin.

Discussion

The WG concluded that the Sun et al. (2009) and Shimose (2009) studies provided the best available scientific information on blue marlin length at maturity and the WG agreed that the Sun et al. (2009) maturity ogives will be used for the stock assessment.

8.0 FINALIZE SUMMARIES OF PACIFIC BLUE MARLIN FISHERY STATISTICS

The WG initially discussed the matter of what should be done with the Japanese CPUE series because, in the absence of a completed WP, any decision to recommend using this information was difficult. After consideration of the presentations on the standardization of Japanese CPUE, the WG agreed to use the GLM analysis from the mid-1970's until 1993 and the HBS CPUE from 1994-2011. For the GLM analysis, it was suggested that a comparison between a GLM and a generalized additive model (GAM) be considered in future standardization work. For the HBS method, the WG noted that the approach has improved in recent years because better operational data were available. For example, temperature at depth is now expected to be estimated with good accuracy.

The WG noted the requirements for all CPUE standardizations were based on the guidelines of ISC operational manual (ISC 2012). These were: fishery description, diagnostics and goodness of fit, model selection, data selection, fitting procedures, alternative model configurations, analysis of deviance tables, a comparison of nominal and standardized CPUE, characterization of uncertainty, and a comparison of the best-fitting model to nominal CPUE. These required components were expected to be included in finalized BILLWG working papers on CPUE standardization.

9.0 FINALIZE LIFE HISTORY PARAMETERS FOR PACIFIC BLUE MARLIN

9.1 Growth

The WG noted that a recent growth study by Shimose (unpublished data) based on daily otolith increments indicated that the growth rate of juvenile Pacific blue marlin was very rapid.. This result was consistent with the study in the Atlantic Ocean by Prince et al. (1991), which also used otolith microstructure counts. The WG noted that the meta-analysis of different growth studies by Chang et al. (WP 02) covered the range of sizes at age from age 1 to the oldest ages. The WG also found that Chang et al. (WP 02) HBHV model had a size at age 1 that had a CV within the range for the size of age 1 estimated by growth studies of Prince et al. (1991) and Shimose (unpublished data) and that the HBHV model results will be the best available scientific information on growth for the stock assessment.

The WG concurred that more research needs to be completed for juvenile growth rates in the future. The WG agreed to use the 0-1 age unpublished data from Shimose's study and agreed to use Chang et al. (WP 02) HBHV meta-analysis to estimate growth parameters for ages 1 to L_∞. Growth will be evaluated by the Hierarchical Bayesian model with homogeneous variance after deleting Skillman and Yong (1976) data. The estimated EFL at age 1 is approximately 143 cm.

9.2 Length-Weight Relationship

The WG discussed length-weight relationship models for Pacific blue marlin. The WG agreed to use the length-weight relation meta-analysis provided by Brodziak (WP 01) for the stock assessment model. However, the analysis will be redone to include the additional information from the Taiwanese offshore longline fishery (Su et al. 2013; Wang et al. 2006).

9.3 Maturity and Fecundity

The WG considered information on sexual maturity from Yonaguni Island and from the waters around Taiwan (Shimose et al. 2009; Sun et al. 2009) and noted that length at maturity may vary in other regions. The WG concluded that Sun et al. (2009) and Shimose et al. (2009) provided the best available scientific information on blue marlin maturity. With respect to length at maturity studies (length at 50% maturity), the WG observed from Sun et al. 2009 that the length at which male blue marlin mature is approximately knife-edged in males at 130 cm (EFL) and that 50% of females are mature at roughly 180 cm (EFL) (Sun et al. 2009).

9.4 Natural Mortality

The WG discussed the meta-analysis estimates of adult natural mortality by sex and found them to be useful. However, the WG was concerned about the differences in estimated mortality rates for males and females for age-0 to age-1 blue marlin. The apparent differences in mortality rates were based on differences between the estimated male and female growth curves. The WG agreed that it was more appropriate to use Shimose's unpublished data on juvenile growth for the estimation of juvenile M. The WG also suggested that a combined-sex mortality rate be estimated.

The WG decided that the Lorenzen (1996) method be used to scale juvenile M to adult M for the stock assessment because this method was used in the 2012 striped marlin assessment and because is the method was based on an empirical study in comparison to a theoretical studies. The Lorenzen method produces very similar estimates of male and female juvenile M. The WG acknowledged that the juvenile natural mortality rate should be higher than the adult rate, and the WG agreed to use the estimates of adult natural mortality from the meta-analysis for males and females. The WG also suggested that it would be useful and informative to do a combined-sex analysis.

9.5 Stock-Recruitment Relationship

The WG agreed that a steepness (h) value in the range of 0.8 to 0.9 was plausible for blue marlin. This range was similar to values of h that were considered or were used in other billfish stock assessments (Western and Central North Pacific swordfish assessment h = 0.90 (BILLWG 2009), Western and Central North Pacific striped marlin assessment h= 0.9 (Lee et al . (2012)).

9.6 Life History Parameter Summary Table

Parameter	**Method/value used for stock assessment**	**Additional Notes**
Growth	Juvenile: age-0 to age-1 growth from Shimose (2009, unpublished data). Adult: age-1 to maximum size at age from Chang et al. (WP 02).	
Length-weight relationship	Length-weight meta-analysis by Brodziak (WP 01).	Information from Su et al. (2013) and Wang et al. (2006) will be added to meta-analysis.
Maturity	Maturity ogives from Sun et al. (2009). Size at 50% maturity: Males = 130 cm EFL Females = 180 cm EFL	
Natural Mortality rate	Natural mortality meta-analysis by Lee and Change (WP 07) with Lorenzen (1996) to estimate scale of juvenile M.	Assumes that juvenile M is higher than adult M and scales with body mass.
Stock recruitment relationship	Steepness range of h=0.8 to 0.9 for central tendency of a prior distribution or as a point estimate.	Range of steepness that is consistent with the striped marlin and swordfish assessments.

10.0 WORK PLAN AND ASSIGNMENTS

10.1 Approaches and Assessment Models for Blue Marlin Assessment

The BILLWG discussed the use of several different types of stock assessment models to assess Pacific blue marlin. These included a Bayesian production model, the Stock Synthesis model, other age-structured models and a delay-difference model. For the age-structured models, the WG discussed the feasibility of a fitting a two-sex model to account for the differences in growth and migration by sex. The WG agreed to investigate this approach. However, the WG also suggested developing a combined-sex stock assessment model. The WG noted that a delay-difference model was used in the first blue marlin assessment in 2001. The WG also agreed that the Multifan-CL model, which was used for the 2003 assessment, will not be applied.

The BILLWG discussed the relative merits of using a combined-sex versus a two-sex stock structured assessment model. The WG noted that there would be approximation errors when using either type of model. The WG agreed to further examine the sex-specific catch and size composition data before making a decision on which approach to use. In this context, the WG also clarified that WCPFC blue marlin data included monthly combined-sex catch data and that these data were aggregated into 5ºx5º degree spatial blocks.

10.3 Definition of Working Groups for Assessment

The WG agreed that Hui-Hua Lee, Nan-Jay Su, Yi-Jay Chang, Michael Hinton, and a representative from Japan who will be determined prior to March 15, 2013 will form the structured modeling group which will conduct work on fitting a structured stock assessment model to the blue marlin data. The Bayesian production modeling group will include Minoru Kanaiwa, Joseph O'Malley, and Jon Brodziak. Other participants in these working groups are welcomed.

10.4 Update North Pacific Swordfish Assessment

The BILLWG is planning to update the North Pacific swordfish stock assessments.

10.4.1 Northern Committee Request

The WG reviewed the Northwestern Pacific Swordfish Reference Points request from the Northern Committee (Attachment F of WCPFC-NC8 Report). The BILLWG Chair will respond to the NC with help from the ISC Chair, as well as the group that will be working on the BSP and the WG's Data Manager, Darryl Tagami. The response from the BILLWG Chair will be reviewed by Plenary at ISC13 prior to submission to the NC. The BILLWG will present the results of the requested swordfish reference point research at NC9.

10.4.2 Updated Catch Information

The WG's Data Manager, Darryl Tagami, will work with other BILLWG members to update the swordfish catch by country and include WCPFC and IATTC data through 2011 (Table 2).

11.0 OTHER BUSINESS

11.1 Future Meetings

The next ISC Billfish Working Group Workshop is scheduled for 20-28 May 2013 at the National Research Institute of Far Seas Fisheries in Shimizu, Japan. The goal of this workshop will be to complete the Pacific blue marlin stock assessment and address requests from the WCPFC-NC. The BILLWG Chair thanked Japan for agreeing to host the next intercessional workshop.

Prior to ISC13 in Busan, Korea the BILLWG will meet informally from 15-16 July 2013 to prepare and summarize the blue marlin stock assessment for presentation to the ISC Plenary.

11.2 World Billfish Conference

It was reported that National Taiwan University (NTU), NOAA, and ISC will host the 5th International Billfish Symposium in Taipei, Taiwan from 4-8 November, 2013. The symposium will provide a forum for discussing various research topics, including life history, tagging, stock assessment modeling and management. The WG noted that a symposium website is currently under construction and that this site will provide detailed information about the event.

<u>Discussion</u>

It was noted that the symposium provides a unique opportunity for WG members to present their billfish research including stock assessments that have been completed by the ISC BILLWG, and all WG members are encouraged to attend. It was also pointed out that the symposium is a joint collaboration between NTU, NOAA, and ISC, and ISC Member Countries need to be aware of this. The ISC Chair indicated that this will be a discussion topic at ISC13.

11.3 Other Issues

The BILLWG Chair discussed standards for future stock assessment reports as described in the ISC operational manual (ISC 2012).

11.3.1 Working Paper Deadlines

The BILLWG Chair discussed the timeliness of working papers submitted at working group workshops. The BILLWG Chair understands that many of the WG members overlap with other ISC WGs such as the SHARKWG and that the workload is immense, however, the BILLWG should aim to submit all working papers at least one week prior to the start day of the meeting. From the next intercessional workshop being held in May 2013 in Shimizu, Japan onwards, the Chair noted that any working papers that are not submitted by the first day of the meeting will not be accepted and will need to be presented to the working group at the following intercessional workshop or withdrawn.

11.3.2 Scheduling Conflicts with other WG Meetings

The BILLWG also discussed the lack of resources in terms of human capital within the ISC. To help mitigate these effects, the BILLWG and SHARKWG, whose members overlap significantly, should work together to schedule meetings in order to minimize travel costs and to ensure that all necessary work is completed.

11.3.3 *Work Assignments*

- All working group papers from this meeting will be completed and provided to the BILLWG Chair by the 23-Feb-2013. The following tasks will be completed for working papers:
    - Data from Su et al. 2013 and Wang et al. 2006 will be added to the length-weight meta-analysis (Brodziak, ISC/13/BILLWG-1/01).
    - Confidence intervals for standardized CPUE of the Japanese offshore and distance longline will be provided Updated and corrected data in the late period CPUE

standardization and the final HBS analysis will be completed with estimates of variability of CPUE. (Kanaiwa and Hinton, ISC/13/BILLWG-1/05).

  - M will be estimated using methods from Lorenzen (1996) and the length-weight estimated in the meta-analysis by Brodziak will be used. A combined-sex estimate of M will also be made (Lee and Chang, ISC/13/BILLWG-1/07).

  - Purse seine data will be added to WCPFC catch tables (Tagami and Wang, ISC/13/BILLWG-1/11).

  - An updated corrected catch history for the Hawaii-based longline fleet from 1995-2011 will be generated using a zero inflated negative binomial model. Estimates in tonnage and numbers will be provided (Walsh, ISC/13/BILLWG-1/13).

- A relationship between whole weight and processed weight will be provided for the Japanese fishery data in order that processed weights may be converted to fish lengths (EFL, cm) for the stock assessment (Kimoto and Yokawa, ISC/13/BILLWG-1/06).

- In addition, catch information on the WCNPO swordfish stock through 2011 will be prepared and tabulated and additional stock projections will be conducted (Tagami).

- Information on North Pacific striped marlin catches by stock area through 2011 will be collected and tabulated at the next WG meeting (Tagami).

- Stock assessment models will be developed and fit to the Pacific blue marlin data by the structured and production modeling working groups and these models will be reviewed at the next intercessional meeting (Brodziak and Lee).

- The WG also recommended that additional analysis on tagging data be conducted by looking at the distance moved and time at liberty relationship relative to size and by looking at different times-at-liberty so annual patterns may be detected (Sippel et al., ISC/13/BILLWG-1/08).

12.0 ADJOURNMENT

The workshop was adjourned at 2:20 pm on 23 January 2013. The BILLWG Chair expressed his appreciation to the rapporteurs and to all of the participants for their contributions and cooperation in completing a successful meeting.

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Table 1. Pacific blue marlin catches (in metric tons) by fisheries 1948-2011. Blank (“ “) indicates no effort. Dash (“–“) indicates data not available. Zero (“0”) indicates a catch of less than 1 metric ton.

	Japan[7]								Mexico[1]			United States[5]									
												Hawaii[2]			California						
Year	Distant-water & Offshore Longline	Coastal & Other Longline	Squid Driftnet & Driftnet	Bait Fishing	Trapnet	Other[3]	Purse Seine[8]	Japan Total	Longline	Purse Seine	Mexico Total	Longline	Troll Landings	Handline Landings	Longline	Gill Net	Harpoon	Unknown[6]	Purse Seine[9]	US Total	**Total**
1948												80								80	80
1949												81								81	81
1950												123								123	123
1951		55	0	0	4	33		92				86								86	8,393
1952	8,167	63	-	0	11	66		8,307				83								83	9,368
1953	9,204	22	-	4	4	52		9,285				74								74	7,342
1954	7,194	33	0	4	0	37		7,268				102								102	8,287
1955	8,148	4	0	7	4	22		8,185				122								122	7,657
1956	7,483	4	0	26	0	22		7,535				84								84	11,744
1957	11,535	15	-	55	0	55		11,660				94								94	11,679
1958	11,522	23	-	5	1	33		11,584				67								67	11,556
1959	11,408	11	0	8	2	60		11,489				53								53	9,980
1960	9,852	10	0	9	1	55		9,927				40								40	16,017
1961	15,889	17	-	5	2	64		15,976				53								53	18,131
1962	18,009	29	0	15	3	24		18,078				48								48	19,337
1963	19,217	3	-	7	4	58		19,289				56								56	16,041
1964	15,838	2	-	29	4	112		15,985				38								38	12,869
1965	12,762	6	0	11	3	49		12,831				40								40	12,660
1966	12,466	37	-	2	5	109		12,620				37								37	10,904
1967	10,724	30	-	8	7	97		10,867				31								31	10,656
1968	10,548	30	-	2	3	42		10,625				32								32	11,206
1969	10,855	114	-	18	7	181		11,174				61								61	12,496
1970	12,225	161	-	7	6	36		12,435				79								79	12,514
1971	6,864	113	-	6	1	48	1	7,033				21								21	7,054
1972	8,493	211	8	7	2	50	1	8,772				1								1	8,773
1973	9,125	211	264	23	2	132	1	9,757				15								15	9,772
1974	8,073	182	226	61	4	47	1	8,594				35								35	8,629
1975	5,657	466	782	146	3	77	2	7,133				33								33	7,166
1976	7,145	429	572	200	3	315	2	8,666				60								60	8,726
1977	7,849	518	982	191	2	152	3	9,697				124								124	9,821
1978	8,794	828	870	197	3	390	4	11,084				194								194	11,279
1979	9,364	748	505	165	3	263	6	11,053				159								159	11,212
1980	10,387	686	854	138	2	113	5	12,185				174								174	12,359
1981	10,104	802	1,146	185	4	137	8	12,386				190						10	10	210	12,596

1 Catch data from IATTC website.
2 Longline data from Hawaii comes from logbooks. Troll and handline data come from, estimates of HDAR.
3 Other contains trolling, harpoon, and net fishing with the majority from harpoon fishing.
4 Offshore longline category includes some catches from harpoon and other fisheries but does not include catches unloaded in foreign ports.
5 Estimated round weight of retained catch. Does not include discards.
6 Unknown includes pole and line, purse seine, troll and troll/handline, half ring, and unspecified gears.
7 Catches between 2010 and 2011 are preliminary, and some catch data in 2011 by all fisheries except offshore and distant-water longline in Tohoku area were not included due to the data loss by the earthquake in 2011.
8 Data from WCPFC.
9 Data from WCPFC and IATTC.
10 Includes all other WPCFC and IATTC countries that have reported blue marlin catch.

Table 1. (Continued) Pacific blue marlin catches (in metric tons) by fisheries 1948-2011. Blank (“ “) indicates no effort. Dash (“–“) indicates data not available. Zero (“0”) indicates a catch of less than 1 metric ton.

	Japan[7]								Mexico[1]			United States[5]									
												Hawaii[2]			California						
Year	Distant-water & Offshore Longline	Coastal & Other Longline	Squid Driftnet & Driftnet	Bait Fishing	Trapnet	Other[3]	Purse Seine[8]	Japan Total	Longline	Purse Seine	Mexico Total	Longline	Troll Landings	Handline Landings	Longline	Gill Net	Harpoon	Unknown[6]	Purse Seine[9]	US Total	**Total**
1982	10,818	706	940	169	4	240	13	12,889			0	180							17	180	13,069
1983	9,786	1,035	916	227	12	423	16	12,415	8		8	143							32	143	12,565
1984	12,253	1,273	242	183	3	420	20	14,395			0	137							38	137	14,532
1985	9,352	1,021	401	298	14	331	19	11,436			0	136							25	136	11,573
1986	11,355	877	175	366	12	137	16	12,938	23		23	209							25	209	13,170
1987	11,700	1,495	252	281	6	113	16	13,863	55		55	240	253	8					27	500	14,418
1988	10,108	1,421	362	229	9	131	18	12,279	13		13	264	27	5					26	296	12,588
1989	8,748	1,231	295	389	8	115	19	10,804	0		0	477	319	6					31	803	11,606
1990	7,714	1,172	252	250	10	163	17	9,578			0	517	290	5					30	812	10,390
1991	8,336	1,307	177	169	15	50	17	10,070			0	535	340	6					46	881	10,951
1992	8,908	1,613	165	151	15	35	15	10,902			0	368	256	4					36	628	11,530
1993	9,465	2,037	144	187	11	77	17	11,937		21	21	467	306	5					46	778	12,736
1994	11,134	1,511	154	140	39	30	13	13,022	0	16	16	524	294	4					51	822	13,860
1995	9,317	1,787	140	171	23	43	15	11,495	0	11	11	569	310	5					51	884	12,390
1996	4,659	1,100	105	177	6	33	17	6,097	0	7	7	620	401	7					39	1,028	7,132
1997	6,145	952	75	233	12	22	13	7,452		26	26	656	369	9					43	1,035	8,512
1998	5,422	1,091	54	282	10	17	12	6,888		15	15	425	239	3					30	666	7,569
1999	4,088	1,091	76	170	5	6	11	5,447		12	12	458	288	5					20	750	6,210
2000	4,024	1,218	21	194	10	13	12	5,491	0	22	22	457	192	2					28	652	6,165
2001	4,062	1,163	159	136	6	8	11	5,545	0	7	7	541	276	2					24	819	6,371
2002	3,789	863	104	149	14	4	11	4,934		5	5	397	202	3					28	602	5,541
2003	3,708	981	36	175	13	4	12	4,929		12	12	435	177	2					19	614	5,556
2004	3,395	1,146	20	192	10	17	12	4,791	0	8	8	408	163	2					26	574	5,373
2005	2,886	986	36	192	7	11	41	4,159		15	15	440	179	3					28	621	4,795
2006	2,506	988	31	139	12	8	32	3,716		16	16	429	145	2					11	576	4,308
2007	2,165	1,105	75	159	19	13	51	3,586		14	14	339	119	1					15	459	4,060
2008	1,843	1,149	31	200	32	13	82	3,350		17	17	418	176	1					27	596	3,963
2009	1,927	1,095	57	157	17	14	46	3,313		17	17	469	165	1					86	635	3,965
2010	2,234	1,462	92	222	25	6	46	4,087		11	11	398	130	1					109	529	4,627
2011	1,889	956	97	234	22	15	94	3,307		15	15	322	193	2					99	517	3,839

[1] Catch data from IATTC website.
[2] Longline data from Hawaii comes from logbooks. Troll and handline data come from, estimates of HDAR.
[3] Other contains trolling, harpoon, and net fishing with the majority from harpoon fishing.
[4] Offshore longline category includes some catches from harpoon and other fisheries but does not include catches unloaded in foreign ports.
[5] Estimated round weight of retained catch. Does not include discards.
[6] Unknown includes pole and line, purse seine, troll and troll/handline, half ring, and unspecified gears.
[7] Catches between 2010 and 2011 are preliminary, and some catch data in 2011 by all fisheries except offshore and distant-water longline in Tohoku area were not included due to the data loss by the earthquake in 2011.
[8] Data from WCPFC.
[9] Data from WCPFC and IATTC.
[10] Includes all other WPCFC and IATTC countries that have reported blue marlin catch.

Table 1. (Continued) Pacific blue marlin catches (in metric tons) by fisheries 1948-2011. Blank (“ “) indicates no effort. Dash (“–“) indicates data not available. Zero (“0”) indicates a catch of less than 1 metric ton.

	Chinese Taipei[4]											Korea					Costa Rica[1]	Other[9,10]			
Year	Purse Seine[8]	Distant-water Longline	Offshore Longline	Offshore Gillnet	Offshore Others	Coastal Harpoon	Coastal Setnet	Coastal Gillnet & Other Net	Coastal Longline	Coastal Others	Chinese Taipei Total	Longline[1]	Longline [8]	Purse seine[8]	High-seas Drift Gillnet	Korea Total	Longline	Longline	Purse Seine	**Total**	**Grand Total**
1948																					80
1949																					81
1950																					123
1951																					8,393
1952			–																		9,368
1953			–																		7,342
1954			–																		8,287
1955			–																		7,657
1956			–																		11,744
1957			–																		11,679
1958			887								887									887	12,443
1959			781								781									781	10,761
1960			948								948									948	16,965
1961			703								703									703	18,834
1962			628								628									628	19,965
1963			691								691									691	16,732
1964		19	934								953									953	13,822
1965		40	1,016								1,056									1,056	13,716
1966		52	957								1,009									1,009	11,913
1967		113	898	–	167	–	–	317	–	–	1,495									1,495	12,151
1968		193	1,433	30	120	–	–	649	–	–	2,425									2,425	13,631
1969		160	1,230	58	103	–	–	465	–	–	2,016									2,016	14,512
1970		163	1,385	21	70	–	1	604	–	–	2,244							54	6	2,304	14,818
1971		104	1,331	13	118	–	–	473	–	–	2,039							60	7	2,106	9,160
1972		203	1,205	14	50	–	–	490	–	–	1,962							63	8	2,033	10,806
1973		225	1,650	12	265	–	–	275	–	–	2,427							75	13	2,515	12,287
1974		161	2,139	6	146	–	1	355	3	–	2,811							87	6	2,904	11,533
1975		148	2,628	3	207	–	–	421	–	–	3,407	21	29			50		89	5	3,551	10,717
1976		176	1,291	9	162	–	–	511	–	–	2,149	62	712			774		76	4	3,003	11,729
1977		145	1,175	11	110	–	–	391	–	–	1,832	77	546			623		107	6	2,568	12,389
1978		63	1,633	15	7	–	1	364	–	–	2,083	535	592			1,127		175	4	3,389	14,668
1979		422	1,626	19	164	–	3	362	–	–	2,596	130	1,188			1,318		201	7	4,122	15,334
1980		490	1,134	35	170	–	–	444	–	–	2,273	228	826	0		1,054		245	8	3,580	15,939
1981		463	1,813	35	69	–	–	313	1	–	2,694	528	953	1		1,482		314	12	4,502	17,098

[1] Catch data from IATTC website.
[2] Longline data from Hawaii comes from logbooks. Troll and handline data come from, estimates of HDAR.
[3] Other contains trolling, harpoon, and net fishing with the majority from harpoon fishing.
[4] Offshore longline category includes some catches from harpoon and other fisheries but does not include catches unloaded in foreign ports.
[5] Estimated round weight of retained catch. Does not include discards.
[6] Unknown includes pole and line, purse seine, troll and troll/handline, half ring, and unspecified gears.
[7] Catches between 2010 and 2011 are preliminary, and some catch data in 2011 by all fisheries except offshore and distant-water longline in Tohoku area were not included due to the data loss by the earthquake in 2011.
[8] Data from WCPFC.
[9] Data from WCPFC and IATTC.
[10] Includes all other WPCFC and IATTC countries that have reported blue marlin catch.

Table 1. (Continued) Pacific blue marlin catches (in metric tons) by fisheries 1948-2011. Blank (“ “) indicates no effort. Dash (“–“) indicates data not available. Zero (“0”) indicates a catch of less than 1 metric ton.

	Chinese Taipei[4]											Korea					Costa Rica[1]	Other[9,10]			
Year	Purse seine[8]	Distant-water Longline	Offshore Longline	Offshore Gillnet	Offshore Others	Coastal Harpoon	Coastal Setnet	Coastal Gillnet & Other Net	Coastal Longline	Coastal Others	Chinese Taipei Total	Longline[1]	Longline[8]	Purse Seine[8]	High-seas Drift Gillnet	Korea Total	Longline	Longline	Purse seine	**Total**	**Grand Total**
1982		304	2,129	7	120	–	–	306	–	–	2,866	315	890	1		1,206		507	12	4,591	17,660
1983	3	272	2,121	26	127	–	–	741	–	–	3,290	271	420	1		692		368	16	4,366	16,931
1984	9	382	1,789	22	111	–	–	960	–	–	3,273	455	848	2		1,305		286	18	4,882	19,414
1985	7	212	1,187	11	43	–	9	747	–	–	2,216	475	893	1		1,369		415	18	4,018	15,591
1986	6	184	1,723	90	107	–	4	839	–	–	2,953	742	791	2		1,535		459	19	4,966	18,136
1987	7	198	4,617	9	1	–	12	973	1	–	5,818	1287	2,329	4		3,620		1,278	23	10,739	25,157
1988	6	320	2,822	8	589	–	20	658	–	–	4,423	600	2,260	5		2,865		1,239	21	8,548	21,136
1989	11	445	2,644	13	8	1	10	640	–	1	3,773	267	1,685	6		1,958		827	25	6,583	18,189
1990	16	437	1,730	24	143	–	3	427	–	–	2,780	851	1,660	10		2,521		640	31	5,972	16,362
1991	26	720	2,152	48	152	2	4	338	–	–	3,442	1171	1,196	20		2,387	257	830	45	6,961	17,912
1992	44	122	3,771	34	110	6	25	432	2	–	4,546	1127	1,923	18		3,068	201	1,138	46	8,999	20,529
1993	41	449	3,876	38	81	3	44	400	–	1	4,933	813	1,768	15		2,596	292	1,497	108	9,426	22,162
1994	37	603	3,007	30	7	–	12	206	–	–	3,902	630	1,351	16		1,997	418	2,419	100	8,836	22,696
1995	41	326	3,820	33	5	3	15	895	–	–	5,138	770	2,507	14		3,291	344	2,492	108	11,373	23,763
1996	54	187	3,298	33	10	2	13	270	–	–	3,867	647	1,315	15		1,977	200	2,099	109	8,252	15,384
1997	54	104	3,625	44	–	4	5	194	38	–	4,068	1000	1,689	14		2,703	447	1,916	179	9,313	17,825
1998	60	209	3,603	58	–	1	8	91	–	1	4,031	840	3,575	16		4,431	378	1,852	198	10,890	18,459
1999	49	131	3,362	30	–	2	21	135	2	–	3,732	882	3,079	14		3,975	680	2,456	249	11,092	17,302
2000	53	114	7,737	40	2	0	24	186	–	–	8,156	733	2,324	17		3,074	606	2,742	190	14,768	20,933
2001	49	585	8,726	56	0	1	18	229	–	–	9,664	563	3,868	17		4,448	643	2,868	219	17,842	24,213
2002	52	495	8,685	52	6	11	13	32	–	–	9,346	211	3,845	18		4,074	662	3,261	301	17,644	23,185
2003	47	1,207	7,577	89	4	18	20	52	–	–	9,014	182	4,962	17		5,161	876	5,130	310	20,491	26,047
2004	44	1,456	6,420	84	5	9	14	36	–	4	8,072	1060	2,310	17		3,387	416	4,820	283	16,978	22,351
2005	77	1,506	7,403	55	16	10	8	48	–	–	9,123	399	4,120	66		4,585	820	3,994	892	19,414	24,209
2006	55	1,678	5,751	–	–	15	12	30	–	–	7,541		3,301	55		3,356	536	4,857	655	16,945	21,253
2007	47	1,271	5,121	6	0	11	3	20	–	–	6,479	262	1,693	83		2,038	596	4,688	822	14,623	18,683
2008	67	910	5,481	1	1	15	10	15	–	–	6,500	53	1,966	38		2,057	332	4,705	527	14,121	18,084
2009	56	1,338	4,756	3	1	9	9	9	–	–	6,181	438	2,453	62		2,953	304	4,141	581	14,160	18,125
2010	44	1,490	5,694	5	0	22	5	15	–	1	7,276	494	1,595	48		2,137		3,929	652	13,994	18,621
2011	38	1,331	5,065	2	8	16	3	17	–	–	6,480	48	1,415	44		1,507		3,750	785	12,522	16,361

[1] Catch data from IATTC website.
[2] Longline data from Hawaii comes from logbooks. Troll and handline data come from, estimates of HDAR.
[3] Other contains trolling, harpoon, and net fishing with the majority from harpoon fishing.
[4] Offshore longline category includes some catches from harpoon and other fisheries but does not include catches unloaded in foreign ports.
[5] Estimated round weight of retained catch. Does not include discards.
[6] Unknown includes pole and line, purse seine, troll and troll/handline, half ring, and unspecified gears.
[7] Catches between 2010 and 2011 are preliminary, and some catch data in 2011 by all fisheries except offshore and distant-water longline in Tohoku area were not included due to the data loss by the earthquake in 2011.
[8] Data from WCPFC.
[9] Data from WCPFC and IATTC.
[10] Includes all other WPCFC and IATTC countries that have reported blue marlin catch.

Table 2. North Pacific striped marlin catches (in metric tons) by fisheries, 1951-2011. Blank (“ “) indicates no effort. Dash (“–“) indicates data not available. Zero (“0”) indicates a catch of less than 1 metric ton.

	Japan							Mexico			United States					Costa Rica	
Year	Distant-water and Offshore Longline	Coastal Longline	Other Longline	Small Mesh Gillnet	Large Mesh Gillnet	Other[3]	Japan Total	Longline	Sport[2]	Mexico Total	Longline	Troll	Handline	Sport[2]	US Total	Sport	**WCPFC non-ISC Countries[4]**
1951	2,494	-	673	-	0	1,281	4,447										
1952	2,901	-	722	-	0	1,564	5,187							23	23		
1953	2,138	-	47	-	0	954	3,139							5	5		
1954	3,068	-	52	-	0	1,088	4,208							16	16		
1955	3,082	-	28	-	0	1,038	4,149							5	5		
1956	3,729	-	59	-	0	1,996	5,785							34	34		
1957	3,189	-	119	-	0	2,459	5,766							42	42		
1958	4,106	-	277	-	3	2,914	7,301							59	59		
1959	4,152	-	156	-	2	3,191	7,501							65	65		
1960	3,862	-	101	-	4	1,937	5,905							30	30		
1961	4,420	-	169	-	2	1,797	6,388							24	24		
1962	5,739	-	110	-	8	1,912	7,770							5	5		
1963	6,135	-	62	-	17	1,910	8,124							68	68		
1964	14,304	-	42	-	2	2,344	16,691							58	58		
1965	11,602	-	19	0	1	2,794	14,416							23	23		
1966	8,419	-	112	0	2	1,570	10,103							36	36		
1967	11,698	-	127	0	3	1,551	13,379							49	49		
1968	15,913	-	230	0	0	1,043	17,186							51	51		
1969	8,544	600	3	0	3	2,668	11,818							30	30		
1970	12,996	690	181	0	3	1,032	14,902							18	18		11
1971	10,965	667	259	0	10	2,042	13,943							17	17		12
1972	7,006	837	145	0	243	993	9,224							21	21		13
1973	6,357	632	118	0	3,265	702	11,074							9	9		15
1974	6,700	327	49	0	3,112	775	10,963							55	55		17
1975	5,281	286	38	0	6,534	686	12,825							27	27		18
1976	5,136	244	34	0	3,561	585	9,560							31	31		15
1977	3,019	256	15	0	4,424	547	8,261							41	41		21
1978	3,957	243	27	0	5,593	546	10,366							37	37		21
1979	5,561	366	21	0	2,532	526	9,006							36	36		26
1980	6,378	607	5	0	3,467	536	10,993							33	33		32
1981	4,106	259	12	0	3,866	542	8,785							60	60		43

[1]Provisional data. Japan catch between 2010 and 2011 are preliminary, and some catch data in 2011 by all fisheries except offshore and distant-water longline in Tohoku area were not included due to the data loss by the earthquake in 2011.

[2] Estimated from catch in number of fish.

[3] Contains bait fishing, net fishing, trapnet, trolling, harpoon, etc.

[4] Contains catches reported to the WCPFC by the Philippines, Indonesia, China, Vanuatru, Federated States of Micronesia, and Belize, totaled with the estimated unreported catch by the Philippines, Indonesia, Vanuatu, Federated States of Micronesia, and Belize.

Table 2. (Continued) Striped marlin catches (in metric tons) by fisheries, 1951-2011. Blank (" ") indicates no effort. Dash ("–") indicates data not available. Zero ("0") indicates a catch of less than 1 metric ton.

	Japan							Mexico			United States					Costa Rica	
Year	Distant-water and Offshore Longline	Coastal Longline	Other Longline	Small Mesh Gillnet	Large Mesh Gillnet	Other[3]	Japan Total	Longline	Sport[2]	Mexico Total	Longline	Troll	Handline	Sport[2]	US Total	Sport	WCPFC non-ISC Countries[4]
1982	5,383	270	13	0	2,351	656	8,673							41	41		61
1983	3,722	320	10	22	1,845	827	6,746							39	39		59
1984	3,506	386	9	76	2,257	719	6,952							36	36		36
1985	3,897	711	24	40	2,323	733	7,728					18		42	60		51
1986	6,402	901	33	48	3,536	577	11,497	-				19		19	38		62
1987	7,538	1,187	6	32	1,856	513	11,132	-			272	30	1	28	331		137
1988	6,271	752	7	54	2,157	668	9,909	-			504	54		30	588		129
1989	4,740	1,081	13	102	1,562	537	8,035	-			612	24	0	52	688		101
1990	2,368	1,125	3	19	1,926	545	5,986	-	181	181	538	27	0	23	588		50
1991	2,845	1,197	3	27	1,302	507	5,881	-	75	75	663	41	0	12	716	106	61
1992	2,955	1,247	10	35	1,169	303	5,719	-	142	142	459	38	1	25	523	281	66
1993	3,476	1,723	1	-	828	708	6,736	-	159	159	471	68	1	11	551	438	60
1994	2,911	1,284	1	-	1,443	383	6,022	-	179	179	326	35	0	17	378	521	72
1995	3,494	1,840	3	-	970	283	6,590	-	190	190	543	52	0	14	609	153	68
1996	1,951	1,836	4	-	703	152	4,646	-	237	237	418	54	1	20	493	122	73
1997	2,120	1,400	3	-	813	163	4,499	-	193	193	352	38	1	21	412	138	55
1998	1,784	1,975	2	-	1,092	304	5,157	-	345	345	378	26	0	23	427	144	69
1999	1,608	1,551	4	-	1,126	184	4,473	-	266	266	364	28	1	12	405	166	68
2000	1,152	1,109	8	-	1,062	297	3,628	-	312	312	200	14	1	10	225	97	41
2001	985	1,326	11	-	1,077	237	3,636	-	237	237	351	42	2	-	395	151	50
2002	764	796	5	-	1,264	290	3,119	-	305	305	226	30	0	-	256	76	88
2003	1,013	842	3	-	1,064	203	3,124	-	322	322	552	29	0	-	581	79	105
2004	699	1,000	2	-	1,339	92	3,132	-	-	0	376	34	1	-	411	19[1]	137
2005	562	668	1	-	1,214	98	2,543	-	-	0	511	20	0	-	531	-[1]	66
2006	623	538	1	-	1,190	95	2,447	-	-	-	611	21	0	-	632	-	42
2007	306	860	5	-	970	79	2,220	-	-	-	276	13	0	-	289	-	31
2008	390	609	10	-	1,302	97	2,408	-	-	-	426	14	0	-	440	-	154
2009	166	621	21	-	821	90	1,719	-	-	-	256	10	0	-	266	-	41[1]
2010	187[1]	820[1]	42[1]	-[1]	899[1]	82[1]	2,030[1]	-	-	-	158[1]	19[1]	0[1]	-	177[1]	-	16[1]
2011	321[1]	732[1]	55[1]	-[1]	333[1]	88[1]	1,529[1]	-	-	-	294[1]	19[1]	0[1]	-	313[1]	-	-

[1]Provisional data. Japan catch between 2010 and 2011 are preliminary, and some catch data in 2011 by all fisheries except offshore and distant-water longline in Tohoku area were not included due to the data loss by the earthquake in 2011.

[2] Estimated from catch in number of fish.

[3] Contains bait fishing, net fishing, trapnet, trolling, harpoon, etc.

[4] Contains catches reported to the WCPFC by the Philippines, Indonesia, China, Vanuatru, Federated States of Micronesia, and Belize, totaled with the estimated unreported catch by the Philippines, Indonesia, Vanuatu, Federated States of Micronesia, and Belize.

Table 2. (Continued) North Pacific striped marlin catches (in metric tons) by fisheries, 1951-2011. Blank (“ “) indicates no effort. Dash (“–“) indicates data not available. Zero (“0”) indicates a catch of less than 1 metric ton.

Year	Chinese Taipei[2]												Korea			Grand Total
	Distant-water Longline	High-seas Drift Gillnet	Offshore Longline	Offshore Gillnet	Offshore Others	Coastal Harpoon	Coastal Setnet	Gillnet & Other net	Coastal Longline	Coastal Others	Other	Chinese Taipei Total	Longline	High-seas Drift Gillnet	Korea Total	
1951														-		4,447
1952												-	-	-	-	5,210
1953												-	-	-	-	3,144
1954												-	-	-	-	4,224
1955												-	-	-	-	4,154
1956												-	-	-	-	5,819
1957												-	-	-	-	5,808
1958			543								387	930	-	-	-	8,290
1959			391								354	745	-	-	-	8,311
1960			398								350	748	-	-	-	6,683
1961			306								342	648	-	-	-	7,060
1962			332								211	543	-	-	-	8,318
1963			560								199	759	-	-	-	8,951
1964			392								175	567	-	-	-	17,316
1965			355								157	512	-	-	-	14,951
1966			370								180	550	-	-	-	10,689
1967	2		385								204	591	-	-	-	14,019
1968	1		332								208	541	-	-	-	17,778
1969	2		571								192	765	-	-	-	12,613
1970	0		495								189	684	-	-	-	15,615
1971	0		449								135	584	0	-	0	14,556
1972	9		380								126	515	0	-	0	9,773
1973	1		568								139	708	0	-	0	11,806
1974	24		650								118	792	0	-	0	11,827
1975	64		732								96	892	0	-	0	13,761
1976	32		347								140	519	0	-	0	10,125
1977	17		524								219	760	43	-	43	9,126
1978	0		618								78	696	28	-	28	11,149
1979	26		432								122	580	-	-	-	9,648
1980	61		223								132	416	37	-	37	11,512
1981	17		491								95	603	-	-	-	9,490

[1]Provisional data. Japan catch between 2010 and 2011 are preliminary, and some catch data in 2011 by all fisheries except offshore and distant-water longline in Tohoku area were not included due to the data loss by the earthquake in 2011.

[2] Estimated from catch in number of fish.

[3] Contains bait fishing, net fishing, trapnet, trolling, harpoon, etc.

[4] Contains catches reported to the WCPFC by the Philippines, Indonesia, China, Vanuatru, Federated States of Micronesia, and Belize, totaled with the estimated unreported catch by the Philippines, Indonesia, Vanuatu, Federated States of Micronesia, and Belize.

Table 2. (Continued) North Pacific striped marlin catches (in metric tons) by fisheries, 1951-2011. Blank (“ “) indicates no effort. Dash (“–“) indicates data not available. Zero (“0”) indicates a catch of less than 1 metric ton.

Year	Chinese Taipei[2]												Korea			
	Distant-water Longline	High-seas Drift Gillnet	Offshore Longline	Offshore Gillnet	Offshore Others	Coastal Harpoon	Coastal Setnet	Gillnet & Other net	Coastal Longline	Coastal Others	Other	Chinese Taipei Total	Longline	High-seas Drift Gillnet	Korea Total	Grand Total
1982	7		397								138	542	39	-	39	9,356
1983	-		555								214	769	19	-	19	7,632
1984	-		965								330	1,295	23	-	23	8,342
1985	-		513								181	694	16	-	16	8,550
1986	-		179								148	327	61	-	61	11,985
1987	31		383								151	565	1	-	1	12,166
1988	7		457								169	633	11	-	11	11,270
1989	8		184								157	349	26	-	26	9,199
1990	2		137								256	395	315	-	315	7,515
1991	36		254								286	576	141	-	141	7,556
1992	1		219								197	417	318	-	318	7,466
1993	5		221								142	368	388	-	388	8,700
1994	1		137								196	334	1,045	-	1045	8,552
1995	27		83								82	192	307	-	307	8,109
1996	26		162	8	6	30	3	-	-	-		235	429	-	429	6,236
1997	59		290	9	-	33	3	-	2	-		396	1,017	-	1017	6,710
1998	90		205	15	-	19	6	1	9	-		345	635	-	635	7,122
1999	66		128	7	-	26	5	1	3	-		236	433	-	433	6,047
2000	153		161	17	1	29	6	1	1	-		369	537	-	537	5,209
2001	121		129	16	-	30	5	-	-	-		301	254	-	254	5,024
2002	251		226	14	-	6	8	1	-	-		506	188	-	188	4,539
2003	241		681	26	0	11	5	1	0	0		965	206	-	206	5,382
2004	261		261	8	1	7	5	2	0	1		546	75	-	75	4,320
2005	199		584	1	1	5	9	8	-	8		815	141	-	141	4,096
2006	204		537	0	0	117	-	30	-	-		888	56	-	56	4,065
2007	102		199	-	-	141	-	29	-	-		471	28	-	28	3,039
2008	78		192	-	1	168	-	43	-	1		483	-	-	56 [5]	3,541
2009	37		225	0	-	92	-	46	-	-		400	-	-	44 [5]	2,470 [1]
2010	53[1]		200 [1]	1[1]	3 [1]	131[1]	-	41[1]	-	-		429[1]	-	-	30 [5]	2,682 [1]
2011	74[1]		269 [1]	-	4[1]	95[1]	1[1]	27[1]	-	-		470[1]	-	-	-	-

[1]Provisional data. Japan catch between 2010 and 2011 are preliminary, and some catch data in 2011 by all fisheries except offshore and distant-water longline in Tohoku area were not included due to the data loss by the earthquake in 2011.

[2] Estimated from catch in number of fish.

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Table 3. Swordfish catches (in metric tons) by fisheries, 1951-2011. Blank (" ") indicates no effort. Dash ("–") indicates data not available. Zero ("0") indicates a catch of less than 1 metric ton.

	Japan							Mexico	United States[5]					
									Hawaii	California				
Year	Distant-water and Offshore Longline	Coastal and Other Longline	Squid Driftnet and Driftnet	Bait Fishing	Trapnet	Other[3]	Japan Total	All Gears	Longline	Longline	Gill Net	Harpoon	Unknown[6]	US Total
1951	7,246	115	10	88	78	4,142	11,678	-	-	-	-	-	-	-
1952	8,890	152	0	6	68	2,575	11,691	-	-	-	-	-	-	-
1953	10,796	77	0	20	21	1,494	12,408	-	-	-	-	-	-	-
1954	12,563	96	0	104	18	829	13,610	-	-	-	-	-	-	-
1955	13,064	29	0	119	37	862	14,111	-	-	-	-	-	-	-
1956	14,596	10	0	66	31	782	15,486	-	-	-	-	-	-	-
1957	14,268	37	0	59	18	869	15,251	-	-	-	-	-	-	-
1958	18,525	42	0	46	31	1,091	19,734	-	-	-	-	-	-	-
1959	17,236	66	0	34	31	901	18,267	-	-	-	-	-	-	-
1960	20,058	51	1	23	67	1,199	21,400	-	-	-	-	-	-	-
1961	19,715	51	2	19	15	1,346	21,147	-	-	-	-	-	-	-
1962	10,607	78	0	26	15	1,390	12,115	-	-	-	-	-	-	-
1963	10,322	98	0	43	17	763	11,244	-	-	-	-	-	-	-
1964	7,669	91	4	40	16	1,032	8,852	-	-	-	-	-	-	-
1965	8,742	119	0	26	14	2,090	10,991	-	-	-	-	-	-	-
1966	9,866	113	0	41	11	1,732	11,763	-	-	-	-	-	-	-
1967	10,883	184	0	33	12	896	12,008	-	-	-	-	-	-	-
1968	9,810	236	0	41	14	1,548	11,649	-	-	-	-	-	-	-
1969	9,416	296	0	42	11	1,571	11,336	-	-	-	-	-	-	-
1970	7,324	427	0	36	9	1,751	9,547	-	5	-	-	612	10	627
1971	7,037	350	1	17	37	504	7,946	-	1	-	-	99	3	103
1972	6,796	531	55	20	1	284	7,687	2	0	-	-	171	4	175
1973	7,123	414	720	27	23	123	8,430	4	0	-	-	399	4	403
1974	5,983	654	1,304	27	16	192	8,176	6	0	-	-	406	22	428
1975	7,031	620	2,672	58	18	207	10,606	-	0	-	-	557	13	570
1976	8,054	750	3,488	170	14	325	12,801	-	0	-	-	42	13	55
1977	8,383	880	2,344	71	7	203	11,888	-	17	-	-	318	19	354
1978	8,001	1,031	2,475	110	22	131	11,770	-	9	-	-	1,699	13	1,721
1979	8,602	1,038	983	45	15	165	10,848	7	7	-	-	329	57	393
1980	6,005	849	1,746	29	15	399	9,043	380	5	-	160	566	62	793
1981	7,039	727	1,848	58	9	132	9,813	1,575	3	0	473	271	2	749

[1] Catch data are currently unavailable for Republic of Korea, Philippines, and some other countries catching swordfish in the North Pacific.

[2] Catches by gear for 1952-1970 were estimated roughly using FAO statistics and other data. Catches for 1971-2002 are more reliably estimated.

[3] Contains trolling and harpoon but majority of catch obtained by harpoon.

[4] For 1952-1970 "Other" refers to catches by net fishing and various unspecified gears.

[5] Offshore longline category includes some catches from harpoon and other fisheries but does not include catches unloaded in foreign ports.

[6] Estimated round weight of retained catch. Does not include discards.

[7] Unknown includes pole and line, purse seine, troll and troll/handline, half ring, and unspecified gears.

[8] Preliminary catch. Japan catch data in 2011 by all fisheries except offshore and distant-water longline in Tohoku area were not included due to the data loss by the earthquake in 2011.

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Table 3. (Continued) Swordfish catches (in metric tons) by fisheries, 1951-2011. Blank (" ") indicates no effort. Dash ("–") indicates data not available. Zero ("0") indicates a catch of less than 1 metric ton.

	Japan							Mexico	United States[5]					
									Hawaii	California				
Year	Distant-water and Offshore Longline	Coastal and Other Longline	Squid Driftnet and Driftnet	Bait Fishing	Trapnet	Other[3]	Japan Total	All Gears	Longline	Longline	Gill Net	Harpoon	Unknown[6]	US Total
1982	6,064	874	1,257	58	7	196	8,457	1,365	5	0	945	156	10	1,116
1983	7,692	999	1,033	30	9	168	9,931	120	5	0	1,693	58	7	1,763
1984	7,177	1,177	1,053	98	13	117	9,635	47	3	12	2,647	104	75	2,841
1985	9,335	999	1,133	69	10	191	11,737	18	2	0	2,990	305	104	3,401
1986	8,721	1,037	1,264	47	9	123	11,201	422	2	0	2,069	291	109	2,471
1987	9,495	860	1,051	45	11	87	11,549	550	24	0	1,529	235	31	1,819
1988	8,574	678	1,234	19	8	173	10,686	613	24	0	1,376	198	64	1,662
1989	6,690	752	1,596	21	10	362	9,431	690	218	0	1,243	62	56	1,579
1990	5,833	690	1,074	13	4	128	7,742	2,650	2,436	0	1,131	64	43	3,674
1991	4,809	807	498	20	5	153	6,292	861	4,508	27	944	20	44	5,543
1992	7,234	1,181	887	16	6	381	9,705	1,160	5,700	62	1,356	75	47	7,240
1993	8,298	1,394	292	43	4	310	10,341	812	5,909	27	1,412	168	161	7,677
1994	7,366	1,357	421	37	4	308	9,493	581	3,176	631	792	157	24	4,780
1995	6,422	1,387	561	34	7	423	8,834	437	2,713	268	771	97	29	3,878
1996	6,916	1,067	428	45	4	597	9,057	439	2,502	346	761	81	15	3,705
1997	7,002	1,214	365	62	5	346	8,994	2,365	2,881	512	708	84	11	4,196
1998	6,233	1,190	471	68	2	476	8,440	3,603	3,263	418	931	48	19	4,679
1999	5,557	1,049	724	47	5	416	7,798	1,136	3,100	1,229	606	81	27	5,043
2000	6,180	1,121	808	49	5	497	8,660	2,216	2,949	1,885	646	90	9	5,579
2001	6,932	908	732	30	15	230	8,847	780	220	1,749	375	52	5	2,401
2002	6,230	965	1,164	29	11	201	8,600	465	204	1,320	302	90	3	1,919
2003	5,376	1,063	1,198	28	4	149	7,818	671	147	1,812	216	107	0	2,282
2004	5,395	1,509	1,062	30	4	229	8,229	270	213	898	169	62	37	1,379
2005	5,359	1,294	956	337	3	187	8,137	235	1,622		220	76	0	1,918
2006	6,181	1,507	796	342	5	245	9,076	347	1,211		444	71	2	1,728
2007	6,109	2,016	829	367	2	123	9,446	383	1,735		484	58	0	2,277
2008	4,402	1,787	648	349	3	173	7,363	84	1,980		280	33	1	2,294
2009	4,400	1,602	682	249	3	239	7,175	-	1,813		172	34	1	2,020
2010	4,240	1,131	483	230	8	110	6,201	-	1,654		33	22	4	1,713
2011	3,018	768	189	233	2	10	4,221	-	1,602	-	108	24	89	1,823

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Table 3. (Continued) Swordfish catches (in metric tons) by fisheries, 1951-2011. Blank (" ") indicates no effort. Dash ("–") indicates data not available. Zero ("0") indicates a catch of less than 1 metric ton.

	Chinese Taipei[5]											Korea			
Year	Distant-water Longline	Offshore Longline	Offshore Gillnet	Offshore Others	Coastal Harpoon	Coastal Setnet	Coastal Gillnet & Other Net	Coastal Longline	Coastal Others	Other	Chinese Taipei Total	Longline	High-seas Drift Gillnet	Korea Total	**Grand Total**
1951												-	-	-	11,678
1952	-	-									-	-	-	-	11,691
1953	-	-									-	-	-	-	12,408
1954	-	-									-	-	-	-	13,610
1955	-	-									-	-	-	-	14,111
1956	-	-									-	-	-	-	15,486
1957	-	-									-	-	-	-	15,251
1958	-	-									-	-	-	-	19,734
1959	-	427								91	518	-	-	-	18,785
1960	-	520								127	647	-	-	-	22,047
1961	-	318								73	391	-	-	-	21,538
1962	-	494								62	556	-	-	-	12,671
1963	-	343								18	361	-	-	-	11,605
1964	-	358								10	368	-	-	-	9,220
1965	-	331								27	358	-	-	-	11,349
1966	-	489								31	520	-	-	-	12,283
1967	-	646								35	681	-	-	-	12,689
1968	-	763								12	775	-	-	-	12,424
1969	0	843								7	850	-	-	-	12,186
1970	-	904								5	909	-	-	-	11,083
1971	-	992								3	995	0	-	0	9,044
1972	-	862								11	873	0	-	0	8,737
1973	-	860								119	979	0	-	0	9,816
1974	1	880								136	1,017	0	-	0	9,627
1975	29	899								153	1,081	0	-	0	12,257
1976	23	613								194	830	0	-	0	13,686
1977	36	542								141	719	219	-	219	13,180
1978	-	546								12	558	68	-	68	14,117
1979	7	661								33	701	-	-	-	11,949
1980	10	603								76	689	64	-	64	10,969
1981	2	656								25	683	-	-	-	12,820

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	Chinese Taipei[5]											Korea			
Year	**Distant-water Longline**	**Offshore Longline**	**Offshore Gillnet**	**Offshore Others**	**Coastal Harpoon**	**Coastal Setnet**	**Coastal Gillnet & Other Net**	**Coastal Longline**	**Coastal Others**	**Other**	**Chinese Taipei Total**	**Longline**	**High-seas Drift Gillnet**	**Korea Total**	**Grand Total**
1982	1	855								49	905	48	-	48	11,890
1983	0	783								166	949	11	-	11	12,774
1984	-	733								264	997	48	-	48	13,568
1985	-	566								259	825	24	-	24	16,005
1986	-	456								211	667	9	-	9	14,770
1987	3	1,328								190	1,521	44	-	44	15,483
1988	-	777								263	1,040	27	-	27	14,028
1989	50	1,491								38	1,579	40	-	40	13,319
1990	143	1,309								154	1,606	61	-	61	15,733
1991	40	1,390								180	1,610	5	-	5	14,311
1992	21	1,473								243	1,737	8	-	8	19,850
1993	54	1,174								310	1,538	15	-	15	20,383
1994	-	1,155								219	1,374	66	-	66	16,294
1995	50	1,135								225	1,410	10	-	10	14,569
1996	9	701	2	-	19	10	-	-	-		741	15	-	15	13,957
1997	15	1,358	1	1	27	8	-	24	-		1,434	100	-	100	17,089
1998	20	1,178	8	-	17	15	1	-	-		1,239	153	-	153	18,114
1999	70	1,385	4	-	51	5	1	-	-		1,516	132	-	132	15,625
2000	325	1,531	5	-	74	5	1	1	-		1,942	202	-	202	18,599
2001	1,039	1,691	17	-	64	8	1	1	-		2,821	438	-	438	15,287
2002	1,633	1,557	7	1	1	16	1	1	-		3,217	439	-	439	14,640
2003	1,084	2,196	3	-	-	8	-	-	-		3,291	381	-	381	14,443
2004	884	1,828	5	-	-	7	1	-	3		2,728	410	-	410	13,016
2005	437	1,813	1	-	-	5	2	-	18		2,276	434	-	434	12,999
2006	-	-	-	-	-	-	-	-	-	-	-	477	-	477	11,629
2007	-	-	-	-	-	-	-	-	-	-	-	452	-	452	12,558
2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,733
2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,141
2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,713
2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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[3] Contrains trolling and harpoon but majority of catch obtained by harpoon.

[4] For 1952-1970 "Other" refers to catches by net fishing and various unspecified gears.

[5] Offshore longline category includes some catches from harpoon and other fisheries but does not include catches unloaded in foreign ports.

[6] Estimated round weight of retained catch. Does not include discards.

[7] Unknown includes pole and line, purse seine, troll and troll/handline, half ring, and unspecified gears.

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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 AGENDA

Meeting Site:	NOAA Fisheries Honolulu Service Center at Pier 38 1139 North Nimitz Highway, Suite 220 Honolulu, HI 96817, USA
Meeting Dates:	16-23 January 2013
Goals:	The BILLWG is holding an intercessional meeting to complete data preparation for the Pacific blue marlin stock assessment including catch by quarter data, CPUE standardization, size frequency data, tagging data, and life history parameters. The goal is to finalize all Pacific blue marlin stock assessment data for a 2013 stock assessment at this meeting.

AGENDA

January 16 (Wednesday), 9:15-10:00 – Registration and Opening of Meeting

1. Opening of Billfish Working Group (BILLWG) Workshop
    a. Welcome and Opening of Meeting
    b. Introductions
    c. Group Photo

January 16 (Wednesday), 10:30-17:00

2. Meeting Logistics
    a. Standard Meeting Protocols
    b. Computing Facilities
    c. Adoption of Agenda
    d. Assignment of Rapporteurs

3. Numbering Working Papers and Distribution Potential

4. Status of Work Assignments

5. Review of Recent Fisheries
    a. Review of Recent Developments and Issues
    b. Review of Availability of 2011-2012 Fishery Data

c. Review of Information on BILLWG Web Page: http://isc.ac.affrc.go.jp/working_groups/billfish.html
d. Review and Discussion of projections for Western and Central Pacific Striped Marlin

6. Fisheries Statistics for Pacific Blue Marlin, as Time Permits
    a. Fishery Data and Definitions
        i. ISC Countries
        ii. Non-ISC Sources
    b. Pacific Blue Marlin Catch by Fishery
        i. ISC Countries
        ii. Non-ISC Sources
    c. Standardized CPUE by Fishery
        i. ISC Countries
        ii. Non-ISC Sources
    d. Other Biological Information

January 17 (Thursday), 9:30-17:00

6. Fisheries Statistics for Pacific Blue Marlin
    a. Fishery Data and Definitions
    b. Blue Marlin Catch by Fishery
    c. Standardized CPUE by Fishery
    d. Size Composition by Fishery
    e. Other Biological Information
        i. Sex Ratios
        ii. Tagging

7. Review Life History Parameters for Pacific Blue Marlin, as Time Permits
    a. Growth
    b. Length-Weight Relationship
    c. Maturity and Fecundity
    d. Natural Mortality Rate
    e. Stock-Recruitment Relationship

January 18 (Friday), 9:30-17:00

7. Review Life History Parameters for Pacific Blue Marlin
    a. Growth
    b. Length-Weight Relationship
    c. Maturity and Fecundity
    d. Natural Mortality Rate
    e. Stock-Recruitment Relationship

January 19 (Saturday), 9:30-17:00

8. Finalize Summaries of Pacific Blue Marlin Fishery Statistics
    a. Catch Table
    b. Standardized CPUE Table
    c. Size Composition Table

9. Finalize Life History Parameters for Pacific Blue Marlin
    a. Growth
    b. Length-Weight Relationship
    c. Maturity and Fecundity
    d. Natural Mortality Rate
    e. Stock-Recruitment Relationship
    f. Life History Parameter Summary Table

January 20 (Sunday), No Meeting

January 21 (Monday), 9:30-17:00

8. and 9. Complete All Work, as Needed

10. Work Plan and Assignments
    a. Assessment Models for Blue Marlin
    b. Approaches for BILLWG Assessment
    c. Definition of Work Group(s) for Assessment
    d. Update North Pacific Swordfish Assessment
        i. Northern Committee Request
        ii. Updated Catch Information

11. Other Business
    a. Future Meetings
    b. World Billfish Conference
    c. Other Issues

12. Rapporteurs and Participants Complete Report Sections

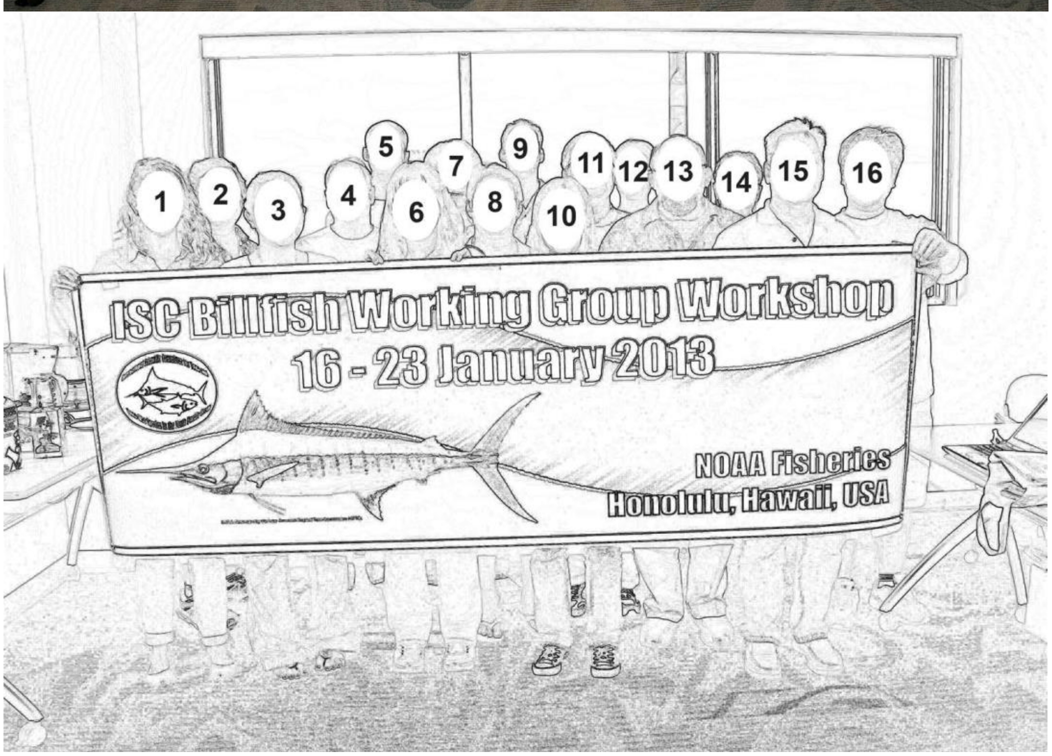
January 22 (Tuesday), 9:30-13:00

13. Complete Workshop Report and Circulate; WG Reviews Report

January 23 (Wednesday), 9:30-13:00

14. Clearing of Report

15. Adjournment



ISC Billfish Working Group: 1) Lennon Thomas, 2) Jon Brodziak, 3) Lyn Katahira, 4) Gerard DiNardo, 5) Yi-Jay Chang , 6) Ai Kimoto, 7) Nan-Jay Su, 8) Darryl Tagami, 9) Joseph O'Malley, 10) Hui-hua Lee, 11) Chi-Lu Sun, 12) Minoru Kanaiwa, 13) Michael Hinton 14) William Walsh, 15) Russell Ito, 16) Kotaro Yokawa.

Attachment 3. Working Papers and Presentations

WORKING PAPERS

ISC/13/BILLWG-1/01	Combining Information on Length-Weight Relationships for Pacific Blue Marlin. Jon Brodziak. (Jon.Brodziak@noaa.gov)
ISC/13/BILLWG-1/02	A Bayesian hierarchical meta-analysis of blue marlin *(Makaira nigricans)* growth in the Pacific Ocean. Yi-Jay Chang, Jon Brodziak, Hui-Hua Lee, Gerard DiNardo, and Chi-Lu Sun. (Yi-Jay.Chang@noaa.gov)
ISC/13/BILLWG-1/03	Combined with ISC/13/BILLWG-1/05
ISC/13/BILLWG-1/04	U.S. Commercial Fisheries for Marlins in the North Pacific Ocean. Russell Y. Ito. (Russell.Ito@noaa.gov)
ISC/13/BILLWG-1/05	Standardization of abundance indices for blue marlin in the Pacific ocean by Japanese offshore and distance longline. Minoru Kanaiwa, Ai Kimoto, Kotaro Yokawa, and Michael Hinton. (m3kanaiw@bioindustry.nodai.ac.jp)
ISC/13/BILLWG-1/06	Input data of blue marlin caught by Japanese fisheries for the stock assessment in the Pacific Ocean. Ai Kimoto and Kotaro Yokawa (aikimoto@affrc.go.jp)
ISC/13/BILLWG-1/07	Age-structured natural mortality for Pacific blue marlin based on meta-analysis and ad hoc mortality models. Hui-Hua Lee and Yi-Jay Chang. (Huihua.Lee@noaa.gov)
ISC/13/BILLWG-1/08	A summary of blue marlin conventional tag recapture data from NMFS-SWFSC Cooperative Billfish Tagging Program in the Pacific Ocean. Tim Sippel, James Wraith, and Suzy Kohin. (Tim.Sippel@noaa.gov)
ISC/13/BILLWG-1/09	Standardizing catch and effort data of the Taiwanese distant-water tuna longline fishery for blue marlin *(Makaira nigricans)* in the Pacific Ocean, 1967-2011. Chi-Lu Sun, Nan-Jay Su, and Su-Zan Yeh. (chilu@ntu.edu.tw)
ISC/13/BILLWG-1/10	Sex-specific growth parameters and natural mortality rates of blue marlin *(Makaira nigricans)* in the northwest Pacific Ocean. Chi-Lu Sun, Nan-Jay Su, Su-Zan Yeh, and Yi-Jay Chang. (chilu@ntu.edu.tw)

ISC/13/BILLWG-1/11	Updated Blue Marlin Catches in the North and South Pacific from WCPFC Data. Darryl Tagami and Haiying Wang. (Darryl.Tagami@noaa.gov)
ISC/13/BILLWG-1/12	Revised Review of Life History Parameters for Blue Marlin *Makaira nigricans.* Lennon R. Thomas, Robert L. Humphreys, Jr., Yi-Jay Chang, and Chi-Lu Sun. (Lennon.Thomas@noaa.gov)
ISC/13/BILLWG-1/13	Catch Statistics, Size Compositions, and CPUE Standardizations for Blue Marlin *Makaira nigricans* in the Hawaii-based Pelagic Longline Fishery in 1995-2011. William A. Walsh, Yi-Jay Chang, and Hui-Hua Lee. (William.Walsh@noaa.gov)
ISC/13/BILLWG-1/14	A Catch History for Blue Marlin *Makaira nigricans* in Hawaiian Waters: 1948-2011. William A. Walsh. (William.Walsh@noaa.gov)

PRESENTATIONS

Future projections of the Western and Central North Pacific Striped Marlin Stock presented. Hui-Hua Lee . (huihualee@noaa.gov)

Feasibility of Using Hawaii Invitational Billfish Tournament Data in Blue Marlin Stock Assessments. Joseph O'Malley. (Joseph.OMalley@noaa.gov)

Data from 2003 Blue Marlin Assessment. Jon Brodziak. (Jon.Brodziak@noaa.gov)

BACKGROUND PAPERS

Apostolaki, P. 2012. Peer review of Stock assessment of striped marlin in the Western and Central North Pacific Ocean. Center for Independent Experts, December 2012.

Carruthers, T. 2012. Center for Independent Experts (CIE) Independent Peer Review of the 2012 Stock Assessment of Striped Marlin in the Western and Central North Pacific Ocean. Center for Independent Experts, December 2012.

Chen, Y. 2012. CIE Independent Peer Review Report on Stock Assessment of Striped Marlin, *Tetrapturus audax*, in the Western and Central North Pacific Ocean. Center for Independent Experts, December 2012.

ICCAT Report of the 2011 Blue Marlin Stock Assessment and White Marlin Data Preparatory Meeting (April 2011).

Kleiber, P., Hampton, J., Hinton, M.G., Uozumi, Y. 2003. Update of the blue marlin stock assessment. 15th Meeting of the Standing Committee on Tuna and Billfish, Honolulu, Hawaii, 22-27 July 2002. (BBRG-10).

Kimoto, A., and Yokawa, K., 2010. Overview of the Japanese fisheries for blue marlin in the Pacific ocean up to 2010.(ISC/12/BILLWG-1/08)

Kimoto, A, and Yokawa, K., 2010. Overview of the Japanese fisheries for blue marlin in the Pacific ocean up to 2010. (ISC/12/BILLWG-1/08).

Lee, H., Piner, K., and BILLWG. 2012. Future Projections of the Western and Central North Pacific Striped Marlin Stock. Ninth Regular Session of the Western and Central Pacific Fisheries Commission (WCPFC9), Manila, Philippines, 2-6 December 2012. (WCPFC9-2012-IP18)

Lee, H.H., Piner, K.R., Humphreys, R., Brodziak, J. 2012. Stock Assessment of Striped Marlin in the Western and Central North Pacific Ocean in 2011. (ISC/SAR/MLS/2012)

ICCAT. 2011. Report of the 2011 Blue Marlin Stock Assessment and White Marlin Data Preparatory Meeting, Madrid, Spain, 25-29 April 2011. (SCRS 2011-06)

ISC BILLWG. 2012. Report of the BILLWG Workshop April 2012, Shanghai, China, 2-9 April 2012.

Schirripa, M.J., Babcock, E.A. 2012. Possible stock production models for blue marlin the Atlantic Ocean up to 2009. Collect. Vol. Sci. Pap. ICCAT, 68(4): 1479-1497. (SCRS/2011/046)

Su, N.J., Sun, C.L., Punt, A.E., Yeh, S.Z., and DiNardo, G. 2011. Evaluation of a spatially sex-specific assessment method incorporating a habitat preference model for blue marlin (*Makaira nigricans*) in the Pacific Ocean. Fisheries Oceanography 20(5): 415- 433.

Su, N.J., Sun, C.L., Punt, A.E., Yeh, S.Z., Chiang, W.C., Chang, Y.J., and Chang, H.Y. 2013. Effects of sexual dimorphism on population parameters and exploitation ratios of blue marlin *(Makaira nigricans)* in the northwest Pacific Ocean. Aquat. Living Res. (in press).

Su, N.J., Sun, C.L, Punt, A.E., Yeh, S.Z., and DiNardo, G. 2012. Incorporating habitat preference into stock assessment and management of blue marlin (*Makaira nigricans*) in the Pacific Ocean. Marine and Freshwater Research 63: 565-575.

Sun, C.L., Chang Y.J., Tszeng, C.C., Yeh, S.Z., and Su, N.J. 2008. Reproductive biology of blue marlin (*Makaira nigricans*) in the western Pacific Ocean. Fish. Bull. 107: 420-432.

Sun, C.L., Chang, Y.J., Yeh, S.Z., Su, N.J. 2012. A Review of Life History Parameters of the Pacific Blue Marlin. ISC Billfish Working Group Workshop, 2-9 April 2012, Shanghai, China. (ISC/12/BILLWG-1/06).

Wang, S.P., Sun, C.L., Yeh, S.Z., Chiang, W.C., Su, N.J., Chang, Y.J., and Liu, C.H. 2006. Length distributions, weight-length relationships, and sex ratios at lengths for billfishes in Taiwan waters. Bull. Mar. Sci. 79(3): 865-869.