Annex 5

REPORT OF THE BILLFISH WORKING GROUP WORKSHOP

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

8-15 January 2008
Honolulu, Hawaii USA

1.0 INTRODUCTION

The 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 from January 8-15, 2008. The goals of the workshop were 1) to review "new" striped marlin CPUE data from the EPO, and assess the utility of updating the previous striped marlin assessment, 2) review research to determine if striped marlin in the North Pacific can be designated a northern stock, 3) compile swordfish and blue marlin fishery statistics in preparation for their future use in stock assessments, and 4) review comparative analyses assessing the impacts of gear configurations and fishing characteristics on catch by hook, depth, and habitat, as well as on CPUE standardization. In addition, the Blue Marlin Steering Committee met to discuss logistical requirements and necessary collaborations for completing a pacific-wide blue marlin stock assessment in 2010. Gerard DiNardo, Chair of the BILLWG, welcomed participants from the United States of America (USA), Japan, Chinese Taipei, the Inter-American Tropical Tuna Commission (IATTC) and the Western Pacific Regional Fishery Management Council (WPRFMC) (Attachment 1). Michael Seki, Deputy Director of NOAA Fisheries, Pacific Islands Fisheries Science Center, provided the welcoming remarks. Rapporteuring duties were assigned to Jon Brodziak, Ray Conser, Dean Courtney, Michael Hinton, Gakushi Ishimura, Russell Ito, Minoru Kanaiwa, Kevin Piner, Chi-lu Sun, Lyn Wagatsuma, William Walsh, and Kotaro Yokawa. Wagatsuma was assigned lead rapporteuring responsibilities. Working papers were distributed and numbered (Attachment 2), and the meeting agenda adopted (Attachment 3).

2.0 MEETING SUMMARIES AND STATUS OF BILLFISH WORKING GROUP ASSIGNMENTS

G. DiNardo presented a summary of the efforts, recommendations and work assignments stemming from the July 19-21, 2007 intercessional workshops of the Marlin and Swordfish Working Groups and 7th ISC Plenary. In addition, recommendations and work assignments stemming from the Third Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC SC3) meeting in August 2007 and the 3rd Northern Committee meeting (NC3) in September 2007 that impact the ISC BILLWG were also presented.

Completion of the North Pacific striped marlin assessment by the ISC prompted a review of policies related to stock designation and organizational responsibilities at the WCPFC SC3 and NC3. Presently, striped marlin in the North Pacific Ocean is not considered a northern stock under the charter of the Northern Committee, and as a result the North Committee does not develop management actions.. The issue was discussed at WCPFC SC3, but no decision reached due to insufficient information. The standard used in determining whether to include a given stock as a northern stock, as acknowledged under the provisions of the WCPFC, states that the stock must lie mostly north of 20ºN. The BILLWG will review the available information during its next workshop and provide relevant information at WCPFC SC4, which is scheduled to meet in August 2008.

Noting the decision of the WCPFC SC3 to defer the consideration on the designation of striped marlin as a northern stock on the basis of lack of information, no action on this issue was taken at NC3. It will revisit the issue next year after additional information has been provided by the ISC and reviewed at WCPFC SC4.

Noting the conservation advice of the ISC and WCPFC SC3 for North Pacific striped marlin, a suite of recommendations were adopted by the Northern Committee to reduce the fishing mortality rate. First, the Northern Committee advises its members to make every effort, on a voluntary basis, not to increase their respective current fishing mortality rates (e.g. catch or effort) on striped marlin in the North Pacific, and to reduce them to the extent practicable.

In addition, the Northern Committee at the request of the WCPFC Commission, will convene a working group that includes fisheries managers, gear technology experts and fishermen, as well as scientists. Among other things, this working group would be tasked with:

- Examining the effects of fishery management measures — that have been taken or are to be taken by members — on catches and fishing mortality rates of striped marlin, including reductions in fishing capacity and fishing effort in fisheries that catch striped marlin.

- Examining existing fisheries data to characterize spatial and temporal patterns of striped marlin catches and catchability.

- Examining fish behavior and fishing technologies in order to identify potential strategies to reduce striped marlin catches without unduly affecting catches of target species, while minimizing adverse impacts on fishermen.

- Identifying potential research, including experimental designs, that would be useful in developing effective ways to reduce the catchability of striped marlin in various fisheries.

- Considering any possible way to further encourage fishermen to work with scientists and managers in order to develop and comply with practical measures in a cooperative and forward looking manner.

To assist the working group in performing these tasks, members of the Northern Committee and ISC should provide, for those fisheries that take striped marlin, any relevant fisheries data and research, as well as descriptive information, with a view to revealing as much detail as possible regarding gear configurations and fishing patterns and practices. This working group is tasked with completing its work and presenting pertinent results at WCPFC SC4 and NC4 scheduled for August and December 2008, respectively. There has been no communication from the NC regarding the formation of this working group or if input from the ISC BILLWG is needed. The Chairman will bring this issue to the attention of the U.S. delegation to the NC.

3.0 BILLFISH CATCH AND EFFORT DATA

3.1 Data Catalogues

Data catalogues were distributed to the ISC BILLWG for review. These catalogues log what information is available on the several species of billfish that the working group (WG) is interested in. These species include striped marlin, swordfish, blue marlin, black marlin, shortbill spearfish, and sailfish. The catalogues are categorized by commercial fisheries, research and training cruises, market samples, and recreational fisheries. WG participants were instructed to fill in the blanks in the data catalogues and submit them to the Chairman by the conclusion of the workshop or shortly after.

3.2 Catch table updates

The Chairman noted the updates made to the striped marlin (Table 1) and swordfish (Table 2) catch tables. In the Chinese Taipei section of both catch tables, the “Other” category has been separated into specific fisheries from 1996-2005.

The Chairman also noted that changes to the Mexico and Korea section of the catch tables may be made in the future, but further investigation is necessary.

4.0 STRIPED MARLIN

4.1 Current Status

K. Piner presented a brief overview of the stock assessment of North Pacific striped marlin completed by the BILLWG. A total of 29 different fisheries, defined by region, country and gear were used in the assessment. Nine fisheries, all of them longline fisheries from the western or central Pacific, provided reasonable measures of abundance. One series was available from the Eastern Pacific but it was shorter and noisier. Size data were available from 13 fisheries from 1970 onward. A decline in catch since the 1960s was observed. Catch-per-unit-effort (CPUE) indices were constructed by combining across gears and countries by area for fives areas in the Pacific. The main CPUE series showed a decline; coastal longlines from Japan and Hawaii showed similar trends. Most of the striped marlin catch comes from the northwest Pacific.

Catch, CPUE and length composition data from the sources described above were included in a Stock Synthesis-2 (SS-2) model of the population dynamics. Due to uncertainty in the controlling factor of recruitment, two parallel hypotheses were forwarded as separate assessment models. In the first, recruitment was determined by a maternal effect described by a Beverton and Holt Spawner-Recruit curve with the steepness parameter set to h=0.7. In the second hypothesis, recruitment was driven by environmental conditions with recruitment variability around a mean level.

Both hypotheses indicated a stock depleted from historical levels, but assuming a maternal effect resulted in a more depleted stock (6% of 1952 levels for maternal effect versus 16% of 1952 levels for environmental effect). Additional forms of uncertainty were identified, including the true nature of the stock delineation, constant catchability of the CPUE series (e.g. targeting and standardization issues), life-history parameters and the true level of catch in the North Pacific. It would be possible to model eastern and western sides of the Pacific in two separate models but the lack of data available for the eastern Pacific constrains this option.

Discussion.

There was general discussion on the uncertainties of the present North Pacific striped marlin assessment. It was noted that the results were driven principally by the Japanese longline fishery in areas 1 – 4, and that the area 5 trend did not decline with the areas 1 – 4 trends. It was also noted that the selectivity of the distant water longline fishery was split at 1979 due to indications of different size distributions in the catch before and after. A question was raised about the handling of the U.S. court-ordered restrictions on the Hawai`i longline fishery during 2002 – 2003. This had been addressed in two ways: first the standardization incorporated parameters which should have handled the changes in set types that resulted from the court order, and second, during the fitting of the SS2 model, a process of iteratively rescaling the process errors was used. There was a discussion of the possibility of unreported catch being the reason for the current sock status (6-16% of 1952 stock levels). It was noted that the BILLWG does not know that there is missing catch, or that it is a significant amount if it exists. Missing catch data was only intended as one possible reason for the current condition, which is the same statement applied to all assessments. It was also pointed out that studies of the Hawai`i longline fishery indicated that when high catches were reported in logbooks, the reported discards had been low (e.g., 50 landed to 10 discarded), but that when reported catches were low, discards were often high (e.g., 10 landed, 1000 discarded). The high discards were generally noted for small fish.

4.2 ISC/08/BILLWG-1/01

J. Brodziak presented analyses of striped marlin CPUE in the Hawaii-based longline fishery from 1994–2006. A suite of generalized linear models (GLMs) were fitted to catch count data reported by fishery observers (N = 13,737 observed longline sets) in order to test hypotheses concerning spatial, temporal, and operational variables as predictors. The fitting method was quasi-likelihood, which represented an improvement over previous generalized additive model (GAM) and GLM analyses, both of which had employed a robust Poisson fitting method. The Bayesian Information Criterion (BIC) was used to identify the 'most probable' model, which included the year and month of fishing to express temporal effects, quadratic and linear terms to express latitudinal and longitudinal spatial effects, respectively, and operational variables (e.g., begin-set time; moon phase; numbers of hooks per set) to represent the effects of different types of fishing activity (e.g., bigeye tuna- or swordfish-targeted). Among these operational variables, begin-set time, moon phase, vessel length, and vessel permit were not identified as important predictors in the previous GAM and GLM analyses, but did yield statistically significant (all F-tests, $P < 0.05$) deviance reductions in the most probable model. This most probable model included all candidate predictors with 191 parameters and explained 38% of the deviance of observed striped marlin CPUE. Its fitted coefficients were then applied to the values of the same predictors that were self-reported by vessel operators in federally mandated logbooks from unobserved trips (*N* = 103,745 unobserved longline sets) to predict CPUE; the angular deviation between the observed and predicted CPUE vectors was 18°. The estimated standardized CPUE from the most probable model was also compared to the model-averaged estimate; this comparison demonstrated that model uncertainty was relatively unimportant among the suite of alternative models investigated for this longline fishery.

Discussion.

There was discussion on the impact on catch-rate trends developed using small-scale data from fisheries (set-by-set), while at the same time fitting to spatial parameters on large-scales (e.g. 2^{nd} order polynomials without binning for latitude, and using the median-spatial location of effort as center to define four regions in the fishery). While there was considerable discussion, no conclusion was reached. It was noted that the observed domed trend in the vessel-length category fitted parameter estimates could result from differing fishing locations and practices by the vessels in the different categories. The 1996 value in the CPUE trend seemed quite high, and it was felt that there needed to be some investigation to determine the reason for this observation.

There was discussion about the utility of this approach and there was general agreement that more comparative analyses of the trends from this standardization approach and those derived from traditional approaches (e.g., GLMs) would be beneficial. In the end it was observed that for the period covered by the Hawai`i fishery index, the standardized CPUE trends from this new approach are similar to those reported previously.

4.3 CPUE series in EPO

M. Hinton reported he was unable to develop a CPUE time series for striped marlin caught in the Eastern Pacific Ocean (EPO) as requested by the WG. Other commitments, as well as lack of requisite catch and effort data from fisheries operating in the area prevented the analyses from being completed. It was also reported that the IATTC will conduct an assessment of striped marlin in the EPO. As a first step towards completion of the IATTC assessment, striped marlin stock boundaries will be defined for stocks present in the EPO, which is expected by Spring 2008. The assessment will commence after the stock boundary analysis is conducted. The results of these analyses will be presented at IATTC scientific meetings, as well as the BILLWG.

Discussion.

To address one of the major uncertainties stemming from the previous North Pacific striped marlin assessment, the WG decided to repeat the assessment assuming a two stock scenario; a separate western and central North Pacific stock and EPO stock. To complete the assessment, an EPO CPUE time series was required and the IATTC agreed to provide the series. Because of other commitments and data issues, the task was not completed. The WG previously agreed to reassess North Pacific striped marlin only if the new EPO CPUE series was available. Because the series is unavailable a reassessment will not be undertaken and the previous assessment stands.

Additional discussion focused on two topics. The first concerned the availability of EPO stock-structure analysis and updated indices, both from previous IATTC assessments and from new/revised work. Of particular interest was information which will include indices for Mexican fisheries, including the coastal recreational fisheries, which have been developed by the IATTC. It was agreed that existing striped marlin CPUE indices from the EPO would be provided to the WG, as well as additional indices when they became available. The other was a discussion of Spanish longline fisheries in the Pacific. It was noted that the available data for these fisheries is at the public domain level (5° by 5° by month without gear configuration or operational details) and that it does not include information on species other than swordfish. The Spanish publish working papers with summarized information on catch of other species and gear configurations for their fleet. The WG (particularly the WCPFC representatives) asked that the information on fishing locations and the reports be provided. Hinton agreed to provide the written reports in electronic format to the Chair for distribution to the WG and WCPFC.

4.4 Review of growth curve

It was reported that no progress has been made in obtaining hard-part samples from large sized striped marlin in the EPO region. No contacts have been established with CICIMAR and CICESE scientists since the last ISC BILLWG Workshop meeting in Korea; this will be a priority during the interim period. This future research topic was elaborated on in the 2nd bullet under section 6.4 of Annex 9 “Report of the Marlin and Swordfish Working Group Workshop” held in Busan, Korea during July 19-21, 2007. The impetus for this research is to include larger sized fish (~250 cm EFL) apparently available from the EPO purse-seine fishery but not available during the previous hard-parts based age and growth work published in Melo-Barrera et al. (2003). The Melo-Barrera study was based on samples obtained from the coastal recreational fishery off Cabo San Lucas, B.C., Mexico; this and other coastal Mexican recreational fisheries do not catch the larger sized striped marlin. Similar large-sized fish, however, are recorded from the seasonal recreational fishery off North Island, New Zealand. An initial age and growth study that included these sizes is reported in Kopf and Davie (2005). The von Bertalanffy parameters were almost identical for the annual growth parameter K (0.22 and 0.23 for NZ and Mexico, respectively) while the asymptotic length L_∞ was much greater for Australia (301 cm LJFL) than Mexico (221 cm LJFL). In recognition of the need to acquire large sized specimens in order to re-evaluate the available age and growth curves, participants at this meeting will meet to strategize on how to move forward with this research. Melo-Barrera and colleagues will need to be contacted in order to obtain the raw size-at-age data for this re-analysis.

Discussion.

The WG discussed the probability of obtaining samples. It was decided that a small working group (Robert Humphreys, Kevin Piner, Michael Hinton, Kotaro Yokawa and Chi-Lu Sun) would develop a draft of the research plan that would address the data needs, including how to best approach obtaining existing data from non-ISC research and programs. The draft plan will be presented at the June 2008 BILLWG workshop for review and comment.

4.5 ISC/08/BILLWG-1/02

K. Piner presented an analysis of stock boundaries for striped marlin in the North Pacific as requested at the WCPFC SC3 and NC 3 meetings. Results of the 2007 stock assessment of striped marlin were used to estimate the ratio of spawning biomass north of 20^{o}N. Estimates of population number-at-age and selectivity patterns and CPUE catchability coefficients from the Japanese distant water longline fleet were used in the analysis. Results indicate that a majority of striped marlin in the western and central North Pacific Ocean occur north of 20^{o}N. This conclusion is consistent with the distribution of fishery catches since the 1960s.

Discussion.

There was some discussion about area-weighting of fitted results. The WG suggested that in current analysis, there is a possibility that the area effect is underestimated below 20° N. The WG decided that the surface areas of regions of the north Pacific lying north and south of 20° N should be calculated and used to evaluate the need for area-weighting. Area weights were recomputed and the analyses repeated. Again, the majority of striped marlin in the western and central North Pacific Ocean occurred north of 20°N. The WG agreed with the methodology used in the analysis and requested that a trajectory of the percent of striped marlin north of 20°N be developed and included in a final working paper for submission to WCPFC SC4.

5.0 ABUNDANCE INDICES CONSIDERATIONS

5.1 ISC/08/BILLWG-1/03

K. Bigelow presented a comparison of gear configurations between the two largest at-sea monitored longline fisheries in the tropical and sub-tropical Pacific Ocean: Japanese training vessel and Hawaii-based tuna longline fisheries. Configuration differed markedly between fisheries in attributes such as hooks deployed between floats, floatline and branchline lengths, distance between hooks and catenary angle (sag ratio). Monitoring with time-depth recorders (TDRs) provided longline depth estimates and capture by hook, depth and habitat. There was good coherence among fisheries in vertical distribution profiles of nominal catch rate CPUE by depth; however absolute CPUE values differed. Catch rate profiles were categorized in relation to depth as increasing, decreasing and no apparent relationship. Bigeye and albacore tuna exhibited an increasing CPUE with depth and decreasing ambient temperature. All three istiophorid billfishes (striped marlin, blue marlin, and shortbill spearfish) and skipjack tuna had decreasing CPUE with depth. The blue shark profile indicated no apparent trend in CPUE with depth for a northern area (north of 20ºN) of the training vessel fishery and Hawaii-based fishery and a decline in CPUE at depths greater than 200 m for a southern area (south of 20ºS). There was no apparent depth or habitat trend in CPUE for yellowfin; however, results may be biased due to capture on longline deployment or retrieval. This study provided nominal CPUE with regard to depth and habitat and additional modeling could be conducted to incorporate covariates (e.g. time, space, bait type and oceanography) to explain catch by hook, depth and habitat.

Discussion.

The authors clarified that commercial Japanese longline data was not used in the analysis because that fishery does not regularly use TDRs on the longline gear. The WG group focused subsequent discussion on the potential of using the depth of longline sets to control striped marlin catch (eliminate shallow hooks on deep sets), which was proposed as a mitigation measure by the Northern Committee (see 2.0). Results of the study indicate that fishing depth could be a method to control striped marlin fishing mortality. It was noted that some fisherman want to catch striped marlin (even if not directly targeted) and reconfiguring the gear to set deeper may impose some operational difficulties. It was pointed out that the findings of this research were consistent with findings from previous research (early 1990s) assessing the removal of shallow hooks to reduce marlin catch.

5.2 ISC/08/BILLWG-1/04

M. Kanaiwa presented findings of a statistical habitat-based standardization (statHBS) model applied to eight species to estimate the catenary angle of longline gear depth. Previous statHBS applications have included a deterministic catenary curve, but recent information indicates that Japanese longliners have modified gear components historically over time, by area and season. Introducing multiple species data, which have different longline vulnerabilities, provides a wider and more various range of vertical (depth) information into the model. The model was applied to yellowfin, skipjack, bigeye and albacore tuna, striped and blue marlin, shortbill spearfish and blue shark, and compared the estimated gear configuration (catenary angle) to a subset of the data from Japanese training vessels and the Hawaii-based tuna fishery that monitored hook depth. The best total likelihood value for Japanese training vessels to the north of 20ºN corresponded to longline gear with a catenary angle of 66º compared to an observed value of 69.1º. The estimated catenary angle for Japanese training vessels to the south of 20ºS was problematic (80º) as this is the largest angle considered in the analysis and larger than the observed angle (66.9º). An angle of 52º was estimated for the Hawaii-based fishery, similar to an observed value of 50.4º. The use of a multiple species approach to estimate actual longline gear depth was encouraging and recommendations for future research are provided.

Discussion.

The WG encouraged further development of this area of research because of its potential to improve CPUE standardization. Better mathematical expressions of the catenary angle continues to be developed, but is complicated by the many factors (e.g. mainline materials, oceanic conditions) affecting fishing performance. The WG noted that estimating the catenary angle with correlations between species (lack of independence) may influence the estimates of variance and catenary angle. The authors clarified that likelihood weighting is being considered to deal with this issue. The WG emphasized that understanding fishing operations of commercial longline fleets should be a priority because of its importance to stock assessments and developing mitigation measures. Furthermore, the WG encouraged expanding the researchers working on this subject to include other members of the BILLWG.

5.3 Abundance trends of large Pelagic Tuna and Billfish

R. Ahrens presented alternative methodologies for developing abundance trends, particularly when a fishery experiences significant expansions/contractions, as well as changes in fishing practices and effort distribution due to species targeting. These changes generally result in a highly nonrandom distribution of fishing effort. The methodology was applied to Japanese longline fishery data.

Walters (2003) suggested that to avoid some of bias due to nonrandom search behavior of fishers, spatial catch and effort data should be treated as a random stratified sample. If strata are small enough spatial and temporal units so that catch rate data can be assumed randomly sampled within each strata and effort has been standardized to account for changes in fishing power, relative abundance trends should be estimated by averaging catch rates across all strata with each strata weighted by stratum size. Assumptions about catch rates in areas prior to fishing as well for periods when fishing no longer occurs were explicitly stated. Assertions made about relative changes in populations of large pelagic tuna and billfish from Japanese spatial catch and effort data require explicit assumptions about catch rates for every species in areas unfished by Japanese pelagic longlines. Relative abundance trends resulting from spatial averaging of Japanese pelagic longline catch rate data where explicit assumptions about catch rate in unfished areas population are made show less population decline in large pelagic tuna and billfish population when compared to simple ratio estimators or when catch rates are averaged over only fished areas. Attention must be paid to the temporal scale over which spatial filling and averaging is performed to reduce seasonal effect that can introduce hyperdepletion due to spatial back filling.

Discussion.

The WG discussed the importance of understanding how spatial cells with missing effort influence the estimates of CPUE. Current methods employed by fishery scientists to estimate CPUE (e.g., GLMs), as well as well as the methods proposed by the authors, are reasonable and dependent upon different assumptions. These assumptions should be explicitly stated in any analysis.

The WG noted that fish movement should be considered in relation to missing effort cells. More importantly, it was agreed that the longline effort in the North Pacific was widely distributed in the earliest time periods and has remain relatively constant in spatial distribution reducing some of the spatial concerns addressed by the authors. Therefore, the GLM type analyses routinely conducted by fishery scientists to estimate CPUE are likely reasonable methods to calculate CPUE. However, the working group concluded that appropriate calculation of nominal CPUE for comparison to the standardized CPUE should consider the spatial effects described by the authors.

6.0 SWORDFISH

The WG discussed the cataloguing of available category I, II, and III data for swordfish by country, reviewed available information on swordfish stock structure in the North Pacific for use in a swordfish stock assessment, and established a time-line for completion of the North Pacific swordfish assessment. The WG proposed two milestones be completed by the June 2008 ISC BILLWG workshop: 1) country reports and descriptions of fisheries for category I, II, and III data and 2) preliminary swordfish CPUE time series. The WG also requested that, if possible, presentations of ongoing independent analyses of swordfish CPUE time series for use in determining swordfish stock boundaries in the North Pacific.

6.1 Stock Structure

R. Humphreys presented information on swordfish stock structure in the Pacific Ocean. Current understanding on larval and mature female distributions, patterns of CPUE abundance, and results of the two most recent population genetic studies were reviewed. Data from movement studies in the Pacific based on traditional tag/recapture and PSAT tagging efforts were not reviewed.

The results of surface tows reported in Nishikawa et al. (1985) conducted throughout the Pacific during 1956-1981 indicate that larval swordfish are distributed in waters bounded by 30°N and 30°S latitude. In subtropical waters, larvae occur only seasonally during the spring-summer periods of the North and South Pacific (6-month offset between hemispheres) but year-round in equatorial waters. Highest catches occur in the western and central portions of the North Pacific although this is likely an artifact of the much higher effort in these areas compared to the South Pacific and eastern Pacific. The easterly-most larval capture record was in the subtropical South Pacific at 108°W longitude. More recent larval surveys conducted off Mexico and off Chile (Easter Island and Sala y Gomez) have yet to report any capture of swordfish larvae. The distribution of reproductive females occurs more broadly across the Pacific including the eastern Pacific (bounded by 20°N and 20°S latitude) although this distribution remains well offshore from the eastern Pacific coastline.

Stock structure delineations incorporated into previous Pacific-wide assessments by Sakagawa and Bell (1980) and Bartoo and Coan (1989) recognized both a single pan-Pacific and three-stock scenario. The latter scenario was based on patterns of high swordfish CPUE from the Japan longline fishery. CPUE concentrations in the high latitude North and Central Pacific, along the eastern Pacific from Mexico to Ecuador, and off eastern Australia were treated as separate stocks in these assessments. Sosa-Nishizaki (1990 and 1991) recognized four Pacific stocks by separating CPUE concentrations along the eastern Pacific into two stocks; Mexico and off South America. Research conducted by Hinton and colleagues at the IATTC have analyzed CPUE trends in each of the five IATTC designated areas within the eastern Pacific and at a finer spatial scale within the eastern equatorial Pacific. A persistent low CPUE occurs parallel to 5° South latitude and it's associated oceanographic conditions has been interpreted as a boundary separating Chilean swordfish as a stock separate from Mexico-Ecuador to the north.

During the 1990s, several genetic studies that analyzed Pacific samples were published. These studies used a variety of molecular techniques and most were limited either by sample size and/or coverage across the Pacific. The two most recent studies (Reeb et al. 2000; Alvarado-Bremer et al. 2006) have more extensive Pacific-wide coverage and represent the best attempts to date to resolve the Pacific-wide population genetics structure of swordfish. Reeb et al. (2000) analyzed a 629 base pair region of mtDNA from samples collected off eastern Japan, Hawaii, Central Equatorial Pacific, California-Mexico, Chile, and off western-eastern Australia. Significant differences between sites were restricted to north-south differences within the western and central Pacific. Japan and Hawaii were both found significantly different from Australia and the Central Equatorial Pacific while eastern Pacific sites (California-Mexico and Chile) were not significantly different from each other and the majority of other sites. Overall, these Pacific-wide genetic differences can be visualized as a U-shaped pattern with the endpoints positioned over Japan and Australia (most significantly different) and the bend along the eastern

Pacific showing clinal, but not significant, genetic differences between adjacent sites. In the Alvarado-Bremer et al. (2006) study, samples from Hawaii, Mexico-Ecuador, Chile, and western-eastern Australia were analyzed using the nuclear *ldh*-A locus. Results differed from Reeb et al. (2000) in that significant pair-wise differences occurred between Chile and the other three sites and between Hawaii and Mexico-Ecuador. Similar to Reeb et al. (2000); differences between Hawaii and western-eastern Australia were significant but not significant between Mexico-Ecuador (California-Mexico in Reeb's study) and western-eastern Australia.

Discussion.

Following the review of this information, four swordfish stock structure scenarios were proposed for the North Pacific Ocean (delineated as north of the equator and north of 5°S latitude from 150°W longitude to the west coast of South America). Two scenarios involve single stocks within the North Pacific designated as scenario 1 (a single stock entirely encompassed within the North Pacific) and type 1+ (a single stock that stretches across the entire North Pacific but beyond 5°S latitude boundary in the eastern Pacific (West of 150 W) to include Chile. The other two scenarios involve two stocks designated as scenario 2 and scenario 2+. Scenario 2 includes one stock encompassing the western and central North Pacific (Japan to Hawaii) and a second stock along the eastern Pacific including (Mexico to Ecuador) with a boundary between stocks at roughly 150 W. Scenario 2+ is the same as type 2 but the eastern Pacific stock extends beyond 5°S latitude boundary in the eastern Pacific (West of 150 W) to include Chile. Spatial and temporal longline CPUE data will be analyzed at the June 2008 ISC BILLWG meeting to evaluate which scenario (if any) is supported by the fishery data. Additional analyses will be presented at the 5th WFC special session on stock structure.

6.2 Recommendations based on review of available information

Regarding country CPUE data summaries, the WG agreed that in order to keep within the time-line established for the ISC swordfish assessment, swordfish CPUE time series should be presented by country and fishery by June 2008 in a format consistent with the plausible stock boundary scenarios laid out above. The WG agreed that CPUE generation for all fisheries except the Japanese and Taiwanese distant water fisheries is possible because all fisheries probably fall within a single stock based on plausible stock separation boundaries. However, CPUE generation for Japan will be more difficult because the Japanese distant water longline fisheries cross plausible stock separation boundaries. Japan is still encouraged to attempt to characterize available time series of annual swordfish CPUE from major Japanese longline fisheries in the north Pacific by June 2008, if possible. The WG suggested that initially the CPUE summary should include a quarterly step for catch and size data and an annual step for CPUE. If the CPUE data quality is sufficient, then CPUE should also be presented quarterly where available. It was agreed, and lead contacts identified, that standardized swordfish CPUE time series would be developed for the Hawaii longline fishery (D. Courtney, W. Walsh and J. Brodziak), Taiwanese longline fisheries (C. Sun), Chile and Ecuador longline fisheries (M. Hinton), Mexico longline and gillnet fisheries (L. Gonzalez Ania and L. Fleischer), California gillnet and harpoon fisheries (K. Piner) and Japanese longline fisheries (K. Yokawa).

6.3 Assessment Schedule and Work Plan

The WG reviewed the data needs and necessary steps to complete the North Pacific swordfish stock assessment, and developed the following work plan. The plan assumes two intercessional meetings between ISC Plenary meetings, and incorporates a special session of the World Fisheries Congress meeting focused in part on the delineation of swordfish stock structure in the North Pacific.

January 8-15, 2008 – ISC BILLWG Workshop; Honolulu Hawaii
- Catalog category I, II, III data availability by country.
- Review available information of swordfish stock structure in the North Pacific.

June 11-19, 2008 – ISC BILLWG Workshop; Hokkaido Japan
- Submit country reports and fisheries descriptions for category I, II, III data.
- Submit standardized CPUEs for identified fisheries.
- Evaluate utility of CPUE data.

July 21-27, 2008 - ISC Plenary Meeting; Takamatsu Japan
- Report progress to plenary

October 20-24, 2008 - One day special session; Yokahama Japan
- Develop plausible stock structure scenarios for the North Pacific swordfish assessment

November 11-18, 2008 (proposed)– ISC BILLWG Workshop, location TBD.
- Resolve final stock structure for swordfish assessment, based on results of WFC.
- Decide on final swordfish assessment model structure.
- Generate final CPUEs based on final swordfish stock structure boundaries and swordfish assessment model structure.
- Conduct analysis for assessment by March.

March 2009 – ISC BILLWG Workshop, location TBD
- Present preliminary swordfish assessment results, modify and finalize at workshop.

July 2009, ISC Plenary Meeting, location TBD
- Present final swordfish assessment results at plenary
- May have to meet just before Plenary meeting for a few days to finalize assessment

G. DiNardo reported on the proposed one day special session at the 5th World Fisheries Congress on stock structure and habitat requirements of swordfish and billfishes. Possible presentations were discussed including one describing the research by Ichinokawa and Brodziak and that of the IATTC. Possible invitees were also discussed and a list developed. The need for a key note speaker was noted and DiNardo, along with his co-convener, will discuss this promptly.

7.0 BLUE MARLIN

7.1 Review of Available Data

Data catalogues for blue marlin were developed and distributed by L. Wagatsuma. Significant data is missing, and WG participants were instructed to complete the catalogues. Wagatsuma is also compiling a list of data holdings and contacts from RFMOs with billfish data.

7.2 ISC/08/BILLWG-1/05

G. Ishimura presented an archiving analysis of blue marlin harvesting in the Japanese coastal fishery. Statistics of Agriculture, Forestry and Fishery of Japan (Norin–tokei) is the only available data of the commercial harvesting statistics for blue marlin in the Japanese coastal fisheries within the northwest of Pacific since 1952. An archiving challenge of this data set for the discrete blue marlin harvest is the aggregation of catch for blue and black marlin as "blue marlin group" rather than blue marlin only catch. To differentiate the discrete blue marlin catch, this study estimated the spatial and temporal distributions of the proportion of blue marlin catch within "blue marlin group" from log-book records of Japanese offshore and distant-water longliners. This study suggested the reduced catch in black marlin resulted in an increased pattern of the proportion of the blue marlin catch in "blue marlin group" in time series.

Discussion.

The paper addressed the inherent difficulty in estimating catches of blue and black marlins in the Japanese coastal fishery, which includes small longline vessels as well as others that fish with gill nets, set nets, drift nets, or harpoons. The analytical difficulty reflects the practice in this fishery of reporting these species together as the 'blue marlin group'. The authors utilized the proportions of these species taken in other fisheries to estimate the fractions of each taken by this fishery.

The discussion considered the results from four major perspectives, which were the length of the time series available for review, the distribution, characteristics, and magnitude of fishing effort, seasonality in the catches and distributions of these species, and use of the results to generate testable hypotheses. The length of the time series would seem to permit reasonable comparisons between distant water and coastal fisheries since 1994, whereas data from earlier years appear insufficient to support meaningful inferences. Fishing effort was a major focus of discussion because there have been geographical shifts (e.g., there has been little effort by the Japanese in the East China Sea, an area where blue marlin are abundant, since about 1990) and because the different gears may catch different proportions of these species. The results appeared to indicate a relative increase in the proportion of blue marlin in the 'blue marlin group' catch, which may have reflected some diminution in the catch of black marlin. Because the catch of the latter species was very low, however, characterization of any such change in the black marlin catch as a 'decline' did not seem warranted. Seasonality in catches of both species was discussed, using the graphical results to consider blue marlin, as well as the personal expertise of participants regarding the distribution of black marlin. Finally, several possible hypotheses were proposed. Participants expressed interest in evaluating the effects on catches and species-specific catch proportions caused by changes in gear types, economic incentives, and geographical shifts in effort.

7.3 Blue Marlin Steering Committee Meeting

G. DiNardo reported on the outcome of the first meeting of the Blue Marlin Steering Committee (BMSC). The goal of the BMSC is to assist with the planning and completion of a Pacific-wide blue marlin assessment currently scheduled for 2010. The report of that meeting is included as Attachment 4.

8.0 STOCK STATUS DETERMINATIONS

8.1 Striped marline biological reference points

J. Brodziak described the results of preliminary work on estimating biological reference points for North Pacific striped marlin. This research was previously presented at the July 2007 ISC Plenary Meeting (ISC/07/MARWG&SWOWG-2/03). In this work, the WG characterized uncertainty in potential biological reference points using the alternative assessment models. Fishery selectivity estimates from the stock-recruitment and environmentally-driven recruitment models provided alternative views on potential reference points for striped marlin. Standard spawning biomass per recruit and yield per recruit reference points from the alternative scenarios were numerically similar. As a result, the WG noted that the potential reference points were robust to uncertainty in the assessment model.

Discussion, The relative benefits of maintaining various levels of striped marlin spawning potential ratio (SPR) as a biological reference point were discussed. The 20% and 40% values of SPR were put forward as candidate reference points. These SPR values were roughly 2-fold and 4-fold greater than the SPR value at the current fishing mortality rate (9%).

The WG also observed that using the F_{MAX} reference point as a target would diminish SPR values to less than 1% of the maximum spawning potential. This, combined with the fact that the F_{MAX} values for Model 1 and Model 2 were over 5-fold larger than the striped marlin natural mortality rate, indicated that using F_{MAX} as a target or limit reference point was not appropriate for striped marlin.

The WG also considered the consequences of maintaining the current fishing mortality rate for striped marlin. In this case, the current fishing mortality rate was defined as the average quarterly fishing mortality during 2001-2003 which was $F_{STATUS\ QUO}$=0.18 under Model 1 and $F_{STATUS\ QUO}$ =0.16 under Model 2. Thus, $F_{STATUS\ QUO}$ was 2-fold higher than natural mortality under either assessment model.

The WG considered stochastic age-structured projections to show potential management implications of applying a constant fishing mortality equal to the $F_{STATUS\ QUO}$, $F_{20\%}$ and $F_{40\%}$ reference points to the striped marlin stock during 2004-2009. Stochastic projections were conducted by randomly resampling the cumulative distribution function of recruitment (1996-2003) starting with assessment estimates of stock size in 2004 using the AGEPRO module from the NOAA Fisheries Toolbox. Relative performance of the alternative reference points was measured by trends in spawning biomass and yield under the stock-recruitment (Figures 1 and 2) and environmentally-driven recruitment (Figures 3 and 4) models. This comparison showed the intrinsic tradeoff between biological conservation and fishery yield benefits under the alternative reference points. Results show that fishing at $F_{STATUS\ QUO}$ would reduce spawning biomass and decrease landings while fishing at the $F_{20\%}$ or $F_{40\%}$ reference points would increase relative spawning biomass and increase landings. Overall, the relative merits of fishing at $F_{STATUS\ QUO}$ depend on whether recent average recruitment can be sustained at the current low SPR of roughly 9%.

Figure 1. Projected trends in average spawning biomass of striped marlin at constant quarterly fishing mortality rates equal to $F_{STATUS\ QUO}$ (=$F_{9\%}$), $F_{20\%}$, and $F_{40\%}$ reference points under assessment Model 1.

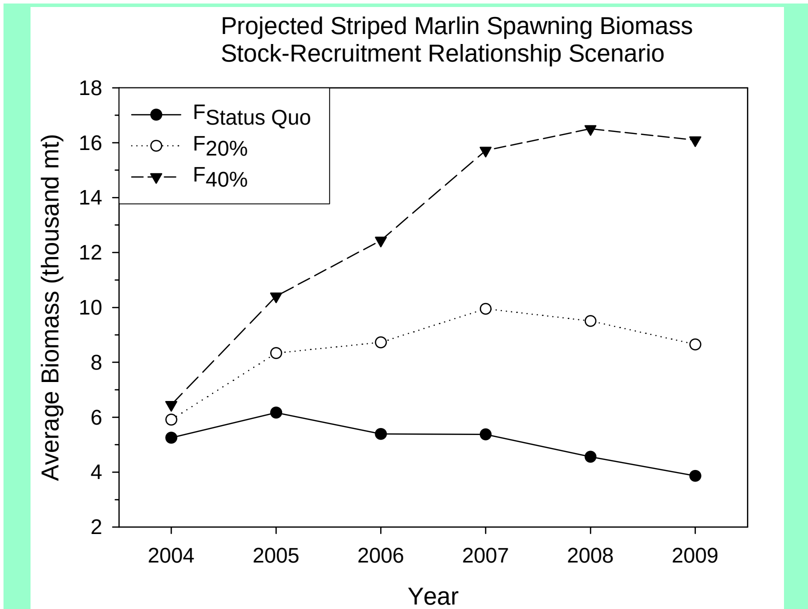


Figure 2. Projected trends in average landings of striped marlin at constant fishing mortality rates equal to $F_{STATUS\ QUO}$, $F_{20\%}$, and $F_{40\%}$ reference points under assessment Model 1.

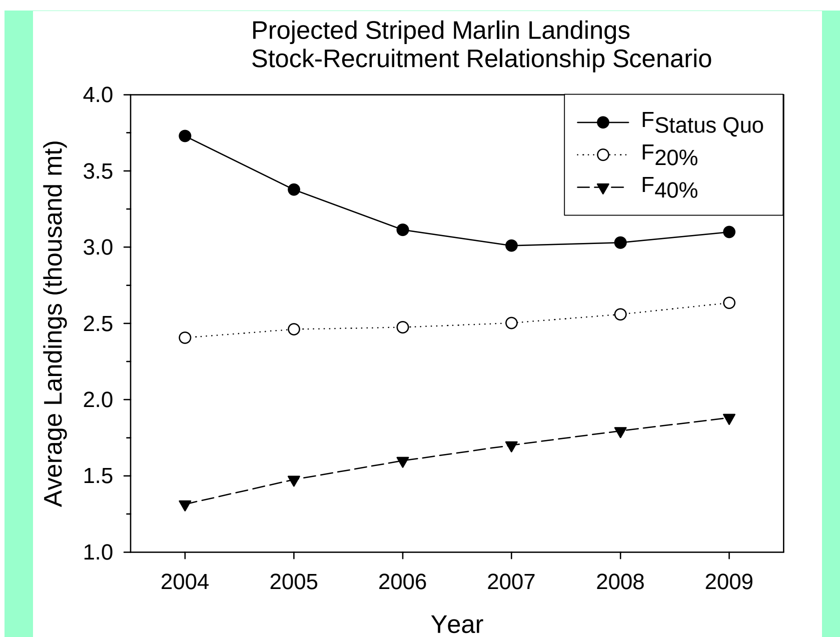


Figure 3. Projected trends in average spawning biomass of striped marlin at constant fishing mortality rates equal to $F_{STATUS\ QUO}$, $F_{20\%}$, and $F_{40\%}$ reference points under assessment Model 2.

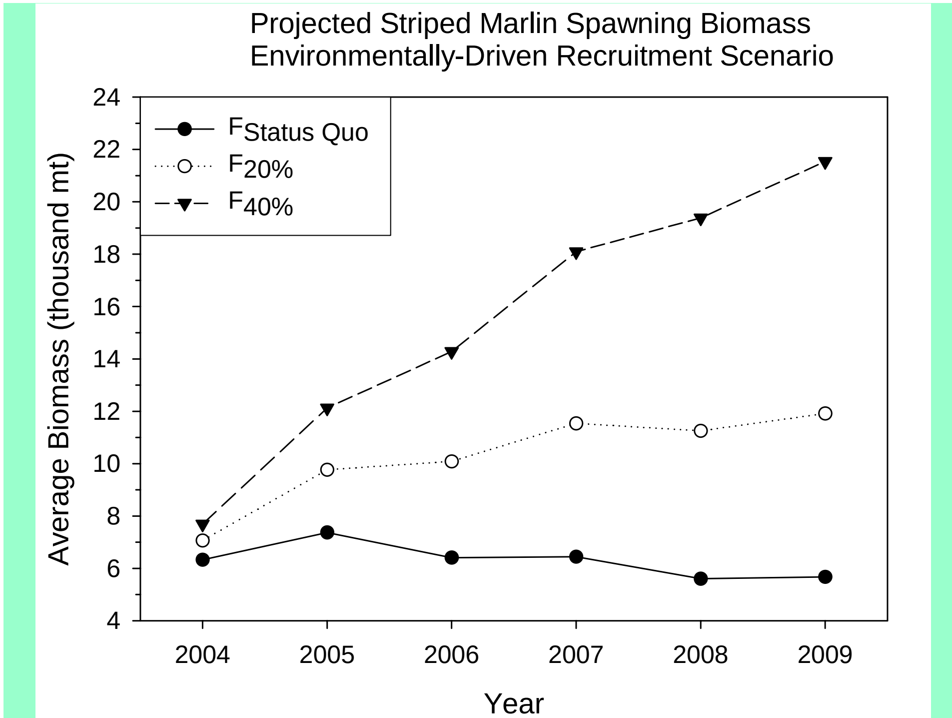
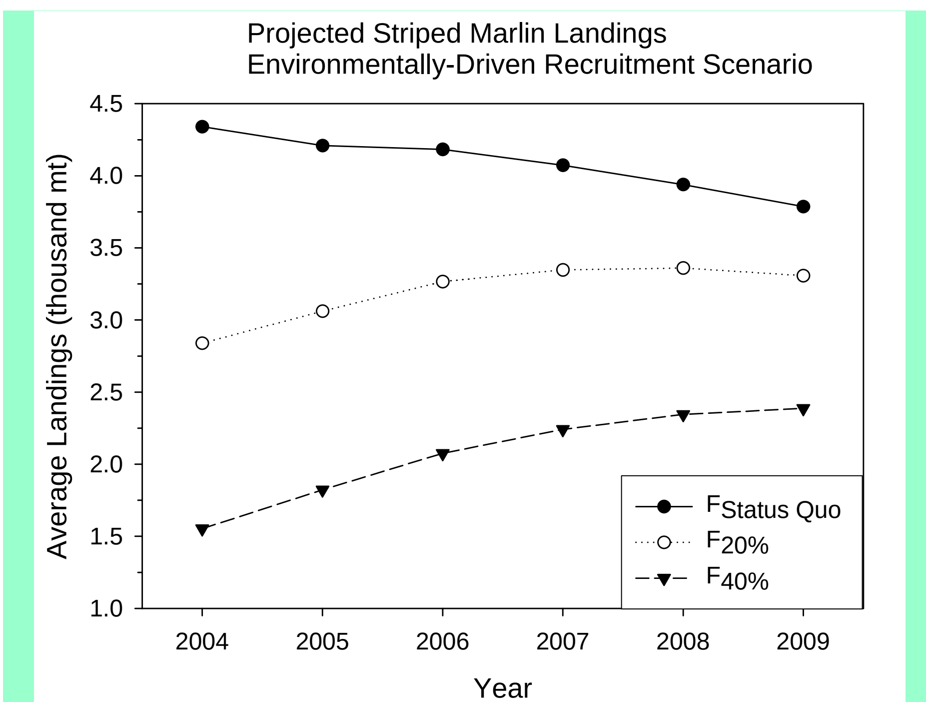


Figure 4. Projected trends in average landings of striped marlin at constant fishing mortality rates equal to $F_{STATUS\ QUO}$, $F_{20\%}$, and $F_{40\%}$ reference points under assessment Model 2.



8.2 Albacore biological reference points.

R. Conser presented a brief overview of how the ISC Albacore WG was addressing the issue of biological reference points for North Pacific albacore. Albacore recruitment over the 50-year assessment time horizon fluctuated without trend. As a result, a stock-recruitment relationship was not assumed or estimated for calculating potential albacore reference points. Instead, the Albacore WG developed limit reference points based on percentiles of observed spawning biomasses in addition to the classical MSY target and limit reference points. The goal of these new spawning stock biomass-based reference points was to keep spawning biomass above the minimum observed level in the face of what appears to be environmentally-driven recruitment fluctuations. It was noted that the Northern Committee would need to select the appropriate percentile of spawning biomass to use as a limit reference point.

Discussion.

The WG focused on the concept of MSY and its use for management advice. It was noted that the IATTC management objective is for MSY, and at least conceptually, the WCPFC is based on MSY. A suite of MSY –based reference points was presented with both the recent ISC North Pacific albacore and the striped marlin assessments. For the albacore assessment, steepness has been high (1.0). When coupled with a flat-topped yield-per-recruit curve, this results in large F_{msy} estimates (F_{msy}>2.0). While this classical MSY estimate has been presented to managers, the Albacore WG has also presented a broader suite of MSY-proxy reference points that may form a better basis for fisheries management.

9.0 BILLFISH COLLABORATIVE RESEARCH AND WORK ASSIGNMENTS

The following assignments are to be completed no later than the June 2008 ISC BILLWG workshop.

1. R. Humphreys, with collaboration from M. Hinton, C.L.Sun, K. Piner, and K. Yokawa, will develop a draft of the research plan for billfish age and growth research. The plan should be submitted to the Chairman within a month after the conclusion of the January 2008 ISC BILLWG workshop, and will be included as an Appendix in this report.

2. Swordfish CPUE time series will be developed for the following fisheries (country/organization leads are indentified in parentheses):

   • Hawaii Longline fishery (D. Courtney, W. Walsh and J. Brodziak)
   • Taiwanese Longline fisheries (C.L. Sun)
   • Chile, Ecuador, and Spanish longline fisheries (M. Hinton)
   • California gillnet and harpoon fisheries (K. Piner and R. Conser)
   • Mexico gillnet and longline fisheries (L. Gonzalez Ania and L. Fleischer)
   • Japanese distant water longline fishery (K. Yokawa)

3. G. Ishimura will continue his research and develop catch, effort and CPUE estimates for blue marlin harvested in the Japanese coastal fishery.

4. M. Ichinokawa and J. Brodziak to refine their methodology for determining swordfish and possibly striped marlin stock boundaries.

5. G. DiNardo will contact all country representatives to request country reports for all fisheries that catch billfish. At the same time requests will be made for category I, II, and III data for use in the pending swordfish and blue marlin assessments.

6. M. Hinton will provide the Chair with electronic files of reports describing the catch, effort and operational aspects of the Spanish fleets operating in the EPO.

7. M. Hinton will characterize the EPO data sets that have Japanese captains on Mexican vessels operating within the Mexican EEZ.

8. G.DiNardo, with assistance from his co-convener, will finalize the agenda of the World Fisheries Congress special session of stock structure and habitat requirements of swordfish and billfishes.

Other research projects include:

1. K. Yokawa, C.L.Sun, and G. DiNardo will conduct blue marlin size data and CPUE fleet comparisons between Japan, Taiwan and USA longline fisheries. EPO purse seine size data will be provided.

2. M. Hinton (IATTC) and K. Yokawa (Japan) to work collaboratively on striped marlin and swordfish stock boundary issues. Research on striped marlin stock boundaries will be conducted first, followed by swordfish.

The Chairman discussed possible new directions that could benefit the WG. The incorporation of GIS could greatly contribute to the WGs assessments. The Chairman urged collaborations between working group members and associates with GIS knowledge. It was noted that the capability of using Coast Watch data (SST, etc.) would be an advantage. The capabilities of a fisheries oceanographer could also be beneficial to the WG.

10.0 FUTURE MEETINGS AND RELEVANT SYMPOSIA

For the remainder of the calendar year, BILLWG workshops are scheduled for June 11-19, 2008 in Abashiri, Japan and November 11-18, 2008 at a location to be determined.

The 8th meeting of the ISC plenary is scheduled for July 22-27, 2008 in Takamatsu, Japan.

A special session on swordfish stock structure and billfish habitat requirements will be convened at the 5th World Fisheries Congress in Yokohama, Japan from October 20-24, 2008. The session will identify plausible swordfish stock boundaries for application in the North Pacific swordfish stock assessment.

11.0 ADJOURNMENT

The workshop was adjourned at 12:25 on January 15, 2008. The Chairman expressed his appreciation to the rapporteurs and to all participants for their contributions and cooperation in completing a successful meeting.

12.0 REFERENCES

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Table 1. Striped marlin catches (in metric tons) by fisheries, 1952-2005. Blank indicates no effort. - indicates data not available. 0 indicates less than 1 metric ton. Provisional estimates in ( ).

	Japan							Chinese Taipei[1]												Costa Rica[1]	Korea			Mexico			United States					
Year	Distant-water and Offshore Longline	Coastal Longline	Other Longline	Small Mesh Gillnet	Large Mesh Gillnet	Other[2]	Total	Distant-water Longline	High-seas Drift Gillnet	Offshore Longline	Offshore Gillnet	Offshore Others	Coastal Harpoon	Coastal Setnet	Coastal Gillnet & Other net	Coastal Longline	Coastal others	Other	Total	Sport	Longline	High-seas Drift Gillnet	Total	Longline	Sport[1]	Total	Longline	Troll	Handline	Sport[1]	Total	Grand Total
1952	2,901		722	0	0	1,564	5,187												-		-		0			0				23	23	5,210
1953	2,138		47	0	0	954	3,139												-		-		0			0				5	5	3,144
1954	3,068		52	0	0	1,088	4,208												-		-		0			0				16	16	4,224
1955	3,082		28	0	0	1,038	4,149												-		-		0			0				5	5	4,154
1956	3,729		59	0	0	1,996	5,785												-		-		0			0				34	34	5,819
1957	3,189		119	0	0	2,459	5,766												-		-		0			0				42	42	5,808
1958	4,106		277	0	3	2,914	7,301			543								387	930		-		0			0				59	59	8,290
1959	4,152		156	0	2	3,191	7,501			391								354	745		-		0			0				65	65	8,311
1960	3,862		101	0	4	1,937	5,905			398								350	748		-		0			0				30	30	6,683
1961	4,420		169	0	2	1,797	6,388			306								342	648		-		0			0				24	24	7,060
1962	5,739		110	0	8	1,912	7,770			332								211	543		-		0			0				5	5	8,318
1963	6,135		62	0	17	1,910	8,124			560								199	759		-		0			0				68	68	8,951
1964	14,304		42	0	2	2,344	16,691			392								175	567		-		0			0				58	58	17,316
1965	11,602		19	0	1	2,796	14,418			355								157	512		-		0			0				23	23	14,953
1966	8,419		112	0	2	1,573	10,106			370								180	550		-		0			0				36	36	10,692
1967	11,698		127	0	3	1,551	13,379	2		385								204	591		-		0			0				49	49	14,019
1968	15,913		230	0	3	1,040	17,186	1		332								208	541		-		0			0				51	51	17,778
1969	8,544	600	3	0	3	2,630	11,780	2		571								192	765		-		0			0				30	30	12,575
1970	12,996	690	181	0	3	1,029	14,899	0		495								189	684		-		0			0				18	18	15,601
1971	10,965	667	259	0	10	2,016	13,917	0		449								135	584		-		0			0				17	17	14,518
1972	7,006	837	145	0	243	990	9,221	9		380								126	515		-		0			0				21	21	9,757
1973	6,299	632	118	0	3,265	630	10,944	1		568								139	708		-		0			0				9	9	11,661
1974	6,625	327	49	0	3,112	775	10,888	24		650								118	792		-		0			0				55	55	11,735
1975	5,193	286	38	0	6,534	685	12,736	64		732								96	892		-		0			0				27	27	13,655
1976	4,996	244	34	0	3,561	571	9,406	32		347								140	519		-		0			0				31	31	9,956
1977	2,722	256	15	0	4,424	547	7,964	17		524								219	760		-		0			0				41	41	8,765
1978	2,464	243	27	0	5,593	418	8,745	0		618								78	696		-		0			0				37	37	9,478
1979	4,898	366	21	0	2,532	526	8,343	26		432								122	580		-		0			0				36	36	8,959
1980	5,871	607	5	0	3,467	537	10,488	61		223								132	416		-		0			0				33	33	10,937
1981	3,957	259	12	0	3,866	538	8,632	17		491								95	603		-		0			0				60	60	9,295
1982	5,211	270	13	0	2,351	655	8,500	7		397								138	542		-		0			0				41	41	9,083
1983	3,575	320	10	22	1,845	792	6,564	0		555								214	769		-		0			0				39	39	7,372
1984	3,335	386	9	76	2,257	719	6,782	0		965								330	1,295		-		0			0				36	36	8,113
1985	3,698	711	24	40	2,323	732	7,528	0		513								181	694		-		0			0		18		42	60	8,282
1986	5,178	901	33	48	3,536	571	10,267	0		179								148	327		-		0	-		0		19		19	38	10,632
1987	5,439	1,187	6	32	1,856	513	9,033	31		383								151	565		-		0	-		0	272	30	1	28	331	9,929
1988	5,768	752	7	54	2,157	668	9,406	7		457								169	633		-		0	-		0	504	54		30	588	10,627
1989	4,582	1,081	13	102	1,562	537	7,877	8		184								157	349		-		0	-		0	612	24	0	52	688	8,914
1990	2,298	1,125	3	19	1,926	545	5,916	2		137								256	395		-		0	-	181	181	538	27	0	23	588	7,080
1991	2,677	1,197	3	27	1,302	506	5,712	36		254								286	576	106	-		0	-	75	75	663	41	0	12	716	7,185
1992	2,757	1,247	10	35	1,169	302	5,520	1		219								197	417	281	-		0	-	142	142	459	38	1	25	523	6,883
1993	3,286	1,723	1	0	828	443	6,281	5		221								142	368	438	-		0	-	159	159	471	68	1	11	551	7,797
1994	2,911	1,284	1	0	1,443	383	6,022	1		137								196	334	521	-		0	-	179	179	326	35	0	17	378	7,434
1995	3,494	1,840	3	0	970	278	6,585	27		83								82	192	153	-		0	-	190	190	543	52	0	14	609	7,729
1996	1,951	1,836	4	0	703	152	4,646	26		162	8	6	30	3	-	-	-		235	122	348		348	-	237	237	418	54	1	20	493	6,081
1997	2,120	1,400	3	0	813	163	4,499	59		290	9	-	33	3	-	2	-		396	138	828		828	-	193	193	352	38	1	21	412	6,466
1998	1,784	1,975	2	0	1,092	304	5,157	90		205	15	-	19	6	1	9	-		345	144	519		519	-	345	345	378	26	0	23	427	6,937
1999	1,608	1,551	4	0	1,126	183	4,472	66		128	7	-	26	5	1	3	-		236	166	352		352	-	266	266	364	28	1	12	405	5,897
2000	1,152	1,109	8	0	1,062	297	3,628	153		161	17	1	29	6	1	1	-		369	97	436		436	-	312	312	200	14		10	224	5,066
2001	985	1,326	11	0	1,077	237	3,636	121		129	16	-	30	5	-	-	-		301	151	206		206	-	237	237	351	42			393	4,924
2002	764	795	5	0	1,264	291	3,119	251		226	14	-	6	8	1	-	-		506	76	153		153	-	305	305	226	29	0		255	4,414
2003	1,008	826	3	0	1,064	203	3,104	241		91	26	-	11	5	1	-	-		375	79	172		172	-	322	322	538	28	0		566	4,618
2004	(761)	(964)	(2)	(0)	(1,339)	(90)	(3,066)	261		95	8	1	7	5	2	-	1		380	(19)	(75)		(75)	-	-	0	376	22	2		400	(3,940)
2005	(803)						(803)	176		76	1	-	5	9	9	-	8		284	-	(115)		(115)	-	-	0	517	19	0		536	(1,738)
2006																											602	25	0		627	(627)

[1] Estimated from catch in number of fish

[2] Contrains bait fishing, net fishing, trapnet, trolling, harpoon, etc.

Table 2. Swordfish catches (in metric tons) by fisheries, 1952-2005. Blank indicates no effort. - indicates data not available. 0 indicates less than 1 metric ton. Provisional estimates in ( ).

	Japan								Chinese Taipei[5]											Korea			Mexico	United States[6]						
																								Hawaii	California					
Year	Distant-water and Offshore Longline[2]	Coastal Longline	Driftnet	Harpoon[3]	Other Bait Fishing	Trapnet	Other[4]	Total	Distant-water Longline	Offshore Longline	Offshore Gillnet	Offshore Others	Coastal Harpoon	Coastal Setnet	Coastal Gillnet & other net	Coastal Longline	Coastal Others	Other	Total	Longline	High-seas Drift Gillnet	Total	All Gears	Longline	Longline	Gill Net	Harpoon	Unknown[7]	Total	Grand Total
1952	8,890	152	0	2,569	6	68	6	11,691	-	-									-	-			-	-	-	-	-	-	-	11,691
1953	10,796	77	0	1,407	20	21	87	12,408	-	-									-	-			-	-	-	-	-	-	-	12,408
1954	12,563	96	0	813	104	18	17	13,611	-	-									-	-			-	-	-	-	-	-	-	13,611
1955	13,064	29	0	821	119	37	41	14,111	-	-									-	-			-	-	-	-	-	-	-	14,111
1956	14,596	10	0	775	66	31	7	15,485	-	-									-	-			-	-	-	-	-	-	-	15,485
1957	14,268	37	0	858	59	18	11	15,251	-	-									-	-			-	-	-	-	-	-	-	15,251
1958	18,525	42	0	1,069	46	31	21	19,734	-	-									-	-			-	-	-	-	-	-	-	19,734
1959	17,236	66	0	891	34	31	10	18,268	-	427								91	518	-			-	-	-	-	-	-	-	18,786
1960	20,058	51	1	1,191	23	67	7	21,400	-	520								127	647	-			-	-	-	-	-	-	-	22,047
1961	19,715	51	2	1,335	19	15	11	21,147	-	318								73	391	-			-	-	-	-	-	-	-	21,538
1962	10,607	78	0	1,371	26	15	18	12,115	-	494								62	556	-			-	-	-	-	-	-	-	12,671
1963	10,322	98	0	747	43	17	16	11,243	-	343								18	361	-			-	-	-	-	-	-	-	11,604
1964	7,669	91	4	1,006	42	17	28	8,858	-	358								10	368	-			-	-	-	-	-	-	-	9,226
1965	8,742	119	0	1,908	26	14	182	10,991	-	331								27	358	-			-	-	-	-	-	-	-	11,349
1966	9,866	113	0	1,728	41	11	4	11,764	-	489								31	520	-			-	-	-	-	-	-	-	12,284
1967	10,883	184	0	891	33	12	5	12,008	-	646								35	681	-			-	-	-	-	-	-	-	12,689
1968	9,810	236	0	1,539	41	14	9	11,649	-	763								12	775	-			-	-	-	-	-	-	-	12,424
1969	9,416	296	0	1,557	42	11	5	11,327	0	843								7	850	-			-	-	-	-	-	-	-	12,177
1970	7,324	427	0	1,748	36	9	1	9,545	-	904								5	909	-			-	5	-	-	612	10	627	11,081
1971	7,037	350	1	473	17	37	0	7,915	-	992								3	995	-			-	1	-	-	99	3	103	9,013
1972	6,796	531	55	282	20	1	1	7,686	-	862								11	873	-			2	0	-	-	171	4	175	8,736
1973	7,123	414	720	121	27	23	2	8,430	-	860								119	979	-			4	0	-	-	399	4	403	9,816
1974	5,983	654	1,304	190	27	16	1	8,175	1	880								136	1,017	-			6	0	-	-	406	22	428	9,626
1975	7,031	620	2,672	205	58	18	2	10,606	29	899								153	1,081	-			-	0	-	-	557	13	570	12,257
1976	8,054	750	3,488	313	170	14	1	12,790	23	613								194	830	-			-	0	-	-	42	13	55	13,675
1977	8,383	880	2,344	201	71	7	1	11,887	36	542								141	719	-			-	17	-	-	318	19	354	12,960
1978	8,001	1,031	2,475	130	110	22	1	11,770	-	546								12	558	-			-	9	-	-	1,699	13	1,721	14,049
1979	8,602	1,038	983	161	45	15	1	10,845	7	661								33	701	-			7	7	-	-	329	57	393	11,946
1980	6,005	849	1,746	398	30	15	1	9,045	10	603								76	689	-			380	5	-	160	566	62	793	10,907
1981	7,039	727	1,848	129	59	10	0	9,812	2	656								25	683	-			1,575	3	0	473	271	2	749	12,819
1982	6,064	874	1,257	195	58	7	0	8,546	1	855								49	905	-			1,365	5	0	945	156	10	1,116	11,932
1983	7,692	999	1,033	166	30	9	2	9,931	0	783								166	949	-			120	5	0	1,693	58	7	1,763	12,763
1984	7,177	1,177	1,053	117	98	13	0	9,635	-	733								264	997	-			47	3	12	2,647	104	75	2,841	13,520
1985	9,335	999	1,133	191	69	10	0	11,737	-	566								259	825	-			18	2	0	2,990	305	104	3,401	15,981
1986	8,721	1,037	1,264	123	47	9	0	11,201	-	456								211	667	-			422	2	0	2,069	291	109	2,471	14,761
1987	9,495	860	1,051	87	45	11	0	11,549	3	1,328								190	1,521	-			550	24	0	1,529	235	31	1,819	15,439
1988	8,574	678	1,234	173	19	8	0	10,686	-	777								263	1,040	-			613	24	0	1,376	198	64	1,662	14,001
1989	6,690	752	1,596	362	21	10	0	9,431	50	1,491								38	1,579	-			690	218	0	1,243	62	56	1,579	13,279
1990	5,833	690	1,074	128	13	4	0	7,742	143	1,309								154	1,606	-			2,650	2,436	0	1,131	64	43	3,674	15,672
1991	4,809	807	498	153	20	5	0	6,292	40	1,390								180	1,610	-			861	4,508	27	944	20	44	5,543	14,306
1992	7,234	1,181	887	381	16	6	0	9,705	21	1,473								243	1,737	-			1,160	5,700	62	1,356	75	47	7,240	19,842
1993	8,298	1,394	292	309	43	4	1	10,341	54	1,174								310	1,538	-			812	5,909	27	1,412	168	161	7,677	20,368
1994	7,366	1,357	421	308	37	4	0	9,493	-	1,155								219	1,374	-			581	3,176	631	792	157	24	4,780	16,228
1995	6,422	1,387	561	440	17	7	0	8,834	50	1,135								225	1,410	-			437	2,713	268	771	97	29	3,878	14,559
1996	6,916	1,067	428	633	9	4	0	9,057	9	701	2	-	19	10	-	-	-		741	12		12	439	2,502	346	761	81	15	3,705	13,954
1997	7,002	1,214	365	396	11	5	0	8,993	15	1,358	1	1	27	8	-	24	-		1,434	246		246	2,365	2,881	512	708	84	11	4,196	17,234
1998	6,233	1,190	471	535	9	2	0	8,441	20	1,178	8	-	17	15	1	-	-		1,239	123		123	3,603	3,263	418	931	48	19	4,679	18,085
1999	5,557	1,049	724	461	2	5	0	7,798	70	1,385	4	-	51	5	1	-	-		1,516	104		104	1,136	3,100	1,229	606	81	27	5,043	15,597
2000	6,180	1,121	808	539	7	5	1	8,661	325	1,531	5	-	74	5	1	1	-		1,942	161		161	2,216	2,949	1,885	649	90	33	5,606	18,586
2001	6,932	908	732	255	5	15	0	8,848	1,039	1,691	17	-	64	8	1	1	-		2,821	349		349	780	220	1,749	375	52	19	2,415	15,213
2002	6,230	965	1,164	222	8	11	0	8,600	1,633	1,557	7	1	1	16	1	1	-		3,217	350		350	465	204	1,320	302	90	3	1,919	14,551
2003	5,352	1,039	1,198	167	10	4	0	7,770	1,084	2,196	3	-	-	8	-	-	-		3,291	311		311	671	147	1,811	216	107	1	2,282	14,325
2004	(6,165)	1,454	1,339	33	33	23	1	(9,048)	884	1,828	5	-	-	7	1	-	3		2,728	(350)			270.1	287	898	182	69	37	1,473	(13,869)
2005	(6,972)							(6,972)	437	1,813	1	-	-	5	2	-	18		2,276	(407)			234.5	1,609		220	77	0	1,906	(11,561)
2006																							347.2	1,194		442	71	0	1,707	(2,054)

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

[4] For 1952-1970 "Other" refers to catches by other baitfishing methods, trap nets, 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.

(Shaded cell) only one vessel fished so combined with Hawaii longline

Attachment 1. List of Participants

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Attachment 2. Working Papers and Background Papers

WORKING PAPERS

ISC/08/BILLWG-1/01	Model Selection for standardizing striped marlin catch-per-unit-effort in the Hawaii-based longline fishery. J. Brodziak and W. Walsh. (Jon.Brodziak@noaa.gov)
ISC/08/BILLWG-1/02	Estimation of ratio of spawning biomass of striped marlin above 20°N in the Central and Western North Pacific Ocean using the Japanese distant water longline fleet and the 2007 stock assessment. K. Piner and R. Conser. (Kevin.Piner@noaa.gov)
ISC/08/BILLWG-1/03	A comparison of gear configuration and capture by hook, depth, and habitat for Japanese training vessel and Hawaii-based tuna longline fisheries. M. Kanaiwa, K. Bigelow, and K. Yokawa. (m3kanaiw@bioindustry.nodai.ac.jp)
ISC/08/BILLWG-1/04	A comparison of observed catenary angles and estimated angles with a statistical habitat-based standardization model with a multiple species approach. M. Kanaiwa, K. Bigelow, and K. Yokawa. (m3kanaiw@bioindustry.nodai.ac.jp)
ISC/08/BILLWG-1/05	Archiving Blue Marlin harvesting in Japanese coastal fishery. G. Ishimura, K. Yokawa, and M. Ichinokawa. (Gakugaku@aol.com)

BACKGROUND PAPERS

ISC/07/PLENARY	Report of the 7th Meeting of the ISC Plenary Session (July 2007).
ISC/07/PLENARY/ANNEX_8	Report of the Marlin and Swordfish Working Group Joint Workshop (March 2007).
ISC/07/PLENARY/ANNEX_9	Report of the Marlin and Swordfish Working Group Workshop (July 2007).
ISC/07/MARWG&SWOWG-2/03	Preliminary Calculations of Yield and Spawning Biomass Per Recruit; Biological Reference Points for Striped Marlin. J. Brodziak. (Jon.Brodziak@noaa.gov)

ISC/07/MARWG&SWOWG-2/04	Evaluation of Model Performance from the 2007 ISC Striped Marlin Stock Assessment. K. Piner, R. Conser, G. DiNardo, and J. Brodziak. (Kevin.Piner@noaa.gov)

Attachment 3. Agenda

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

BILLFISH WORKING GROUP (BILLWG)

INTERCESSIONAL WORKSHOP
AGENDA

Meeting Site: Hawaii Imin International Conference Center @ Jefferson Hall
Tagore Room
1601 East-West Road
Honolulu, HI 96848

Meeting Dates: January 8-15, 2008

January 8 (Tuesday), 0930-1000 – Registration
January 8 (Tuesday), 1000-1630

1. Opening of Billfish Working Group Workshop
   a. Welcoming Remarks
   b. Introductions

2. Adoption of Agenda & Assignment of Rapporteurs

3. Computing Facilities
   a. Access

4. Status of Billfish WG Work Assignments

5. Meeting Summaries
   a. 7th ISC Plenary
   b. WCPFC SC3
   c. Northern Committee
   d. 4th WCPFC

6. Billfish Catch & Effort Data
   a. Data catalogues (Category I, II and III)
   b. Update catch tables

7. Striped Marlin
   a. Current status
   b. CPUE series
      - EPO

- Re-estimation of CPUE series
  (Japan, USA, Taiwan, etc.) (WP)

c. Reanalysis of growth curve
d. Other Issues (WP)
e. Next Step (re-analysis of assessment?)

January 9 (Wednesday), 0900-1600

7. Striped Marlin (continued)
   a. Current status
   b. CPUE series
      - EPO
      - Re-estimation of CPUE series
        (Japan, USA, Taiwan, etc.)

   c. Review of growth curve
   d. Other Issues
   e. Next Step (re-analysis of assessment?)

8. Abundance Indices Considerations
   a. Effort distribution (WP?)
   b. Operational aspects (WP)

9. Swordfish
   a. Review available information
   b. Review assessment schedule and workplan
   c. 5th World Fisheries Congress
      - Swordfish Stock Structure and
        Habitat Requirements session
      - Working Group participants
      - Invitees

Reception for Meeting Participants

January 10 (Thursday), 0900-1200

9. Swordfish (continued)
   a. Review available information
   b. Review assessment schedule and work plan
   c. 5th World Fisheries Congress
      - Swordfish Stock Structure and
        Habitat Requirements session
      - Working Group participants
      - Invitees

January 10 (Thursday), 1330-1630 – Blue Marlin Steering Committee Meeting

January 11 (Friday), 0900- 1630

10. Blue Marlin
    a. Review of available data
    b. Catch from Japanese Coastal fishery (WP)
    c. Work plan

11. Stock Status Determinations (WP)
    a. Review and adoption of robust protocols for computing projections
    b. Develop draft protocols for computing "snailplots" and other management decision tools

January 12 (Saturday), 0900 - 1200

12. Billfish Collaborative Research
    a. Identify specific projects

13. Future Meetings

January 12 (Saturday), 1330-1630 - Rapporteurs complete sections

Dinner at Local Restaurant for Meeting Participants

January 13 (Sunday), No Meeting – Finalize Report and Circulate

January 14 (Monday), No Meeting – WG Review Report

January 15 (Tuesday), 0900-1200

14. Finalize Report

15. Adjournment

Attachment 4.

Report of the First Meeting of the Blue Marlin Steering Committee

The first meeting of the ISC BILLWG Blue Marlin Steering Committee (BMSC) was convened on January 10, 2008 in Honolulu, HI. In attendance were Drs. Gerard DiNardo (NOAA Fisheries, PIFSC), Michael Hinton (IATTC), Chi-lu Sun (NTU) and Kotaro Yokawa (NRIFSF, Japan). The goal of the BMSC is to assist the ISC BILLWG with the planning and completion of a Pacific-wide blue marlin stock assessment currently scheduled for July 2010. Because blue marlin is a pan-Pacific stock, completion of the stock assessment requires a multi-national and –organizational approach that may include countries and organizations outside current ISC membership. At the meeting the BMSC discussed potential partners (countries and organizations), research topics and deliverables, including a timeline.

Partners

At the WCPFC SC2, Gerard DiNardo (then Chairman of the ISC Marlin Working Group) presented a progress report and research plan for the working group, including a stock assessment completion schedule. The need and rationale for an updated Pacific-wide blue marlin stock assessment was also discussed, and participates expressed an interest in a collaborative approach. The notion of completing a collaborative blue marlin assessment was discussed with individual country scientists at WCPFC SC3 and again there was interest, prompting the need for a formal proposal to be presented at the WCPFC SC4 in August 2008.

Working with other BMSC members, DiNardo will develop the proposal and present it at the ISC Plenary in July 2008 for review and comment. The proposal will also be presented at the WCPFC SC4 for comment and approval. Potential partners should include scientists from Japan (NRIFSF), Taiwan (NTU), Mexico, U.S. (NMFS), and Korea (NFRDI), as well as scientists from SPC, IATTC and other WCPFC member countries contribute significant landings to the analysis.

Research topics and deliverables

A timeline delineating research topics and deliverables has been developed (Figure 4.1). Specific blue marlin research topics be accomplished in the short term are outlined in section 9.0 of the workshop report.

Figure 4.1. Proposed timeline for completion of the blue marlin assessment.

Jan. 2008 ----------- 1st BMSC meeting

- Potential partners (SPC, FFA, etc.)
- Research Plan (topics/deliverables)

↓

- Discuss with SPC
- Assemble available data
- Data gap analysis

↓

July 2008 ----------- Progress Report ISC Plenary

↓

Aug. 2008 ---------- Present proposal WCPFC SC4

- Identify interest and partners

↓

- Assemble all data
- Identify stock structure
- Identify model structure
- Develop standardized CPUEs

↓

July/Aug. 2009 ---- Present progress report to ISC Plenary and WCPFC SC5

- Standardized CPUE series
- Cat 1, 2, and 3 data
- Stock and Model structure

↓

- Complete Assessment

↓

July/Aug. 2010 ---- Present assessment results to ISC Plenary and WCPFC SC6