Annex 8

REPORT OF THE BILLFISH WORKING GROUP WORKSHOP

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

11-19 June 2008
Tokyo University of Agriculture
Abashiri, Hokkaido, Japan

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 Abashiri City, Hokkaido, Japan from June 11-19, 2008. The goals of the workshop were 1) review swordfish and blue marlin fishery statistics in preparation for their future use in stock assessments, 2) review and finalize research to determine if striped marlin in the North Pacific can be designated a northern stock, 3) review the draft ISC billfish biological research plan, and 4) discuss information requests for the NC Striped Marlin Working Group. Gerard DiNardo, Chair of the BILLWG, welcomed participants from the United States of America (USA), Japan, Chinese Taipei, and the Inter-American Tropical Tuna Commission (IATTC) (Attachment 1). Dr. Michinari Yokohama, Dean of the Faculty of Bioindustry at the Tokyo University of Agriculture, provided the welcoming remarks. Rapporteuring duties were assigned to Ray Conser, Michael Hinton, Gakushi Ishimura, Russell Ito, Minoru Kanaiwa, Kevin Piner, Chi-lu Sun, Lyn Wagatsuma, 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 UDPATE

2.1 Summary of January 2008 Billfish Working Group Workshop

Chairman G. DiNardo reviewed the major accomplishments completed at the last ISC BILLWG Workshop held in Honolulu, Hawaii, USA in January 2008. At that meeting, the working group (WG) finalized the striped marlin assessment and discussed plans to revisit the assessment jointly with the IATTC. Swordfish and blue marlin data was compiled, striped marlin stock structure and vertical distribution was discussed, possible swordfish stock structure scenarios were explored, a group was assigned to develop a draft research plan for billfish age and growth research, and collaborative research projects were identified.

2.2 Status of Work Assignments

G. DiNardo reported that some of the assignments stemming from the January 2008 BILLWG workshop were completed, but that major assignments were not completed and are on-going. The completed assignments include:

- Development of a draft plan for billfish age and growth research (ISC/08/BILLWG-2/06),
- Country reports for all fisheries that catch billfish were requested by the Chair except for Mexico (oversight by Chair),
- IATTC provided copies of data reports describing the catch, effort, and operational aspects of the Spanish longline fleets operating in the EPO, and
- Finalized agenda for the World Fisheries Congress special session on stock structure and habitat requirements of swordfish and billfishes.

Swordfish CPUE time series for the Chile, Ecuador, and Spanish longline fisheries, California gillnet and harpoon fisheries, Mexico gillnet and longline fisheries, and Japanese distant water longline fishery are in the process of being developed. The development of catch, effort, and CPUE estimates for blue marlin harvested in the Japanese coastal fishery, the refinement of the methodology for determining swordfish stock boundaries, and the characterization of EPO data sets that have Japanese captains in Mexican vessels operating within the Mexican EEZ is still ongoing.

3.0 RFMOs and Scientific Organizations

3.1 Northern Committee (NC)

G. DiNardo revisited the 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.

The Northern Committee is tasked with convening a working group by August 2008 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 fishery 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 ways 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 some communication between the NC and the ISC regarding the formation of this working group, but it is unclear what the needs are from the BILLWG. The ISC Chairman has requested clarification on the objectives and needs of the NC.

Discussion. The WG crafted three proposals to address the requested information from the NC and discussed each in detail. The proposals included:

1) The Chair of the ISC Billfish WG would be invited to participate in the NC striped marlin working group;

2) The Chair of the Billfish WG would provide the NC striped marlin working group with a list of all past working papers by June 20 for their review. To ensure proper use of the information or data contained in the WP, data sharing protocols would need to be developed and agreed to prior to the release of the WP; and

3) The Billfish WG would be prepared to support the needs of the NC striped marlin working group on science matters where the BILLWG has expertise and responsibility, once the objectives and requirements of the striped marlin working group have been framed.

The WG agreed that proposals 2 and 3 would be raised for Plenary consideration, and that in the interim, titles of all past WP be provided by June 20. The first proposal was dismissed until the objectives and needs of the NC striped marlin working group are clarified. The WG also agreed that a table characterizing fisheries operating in the North Pacific Ocean that catch striped marlin might be beneficial to the NC striped marlin working group. The fishery specific information contained in the table would include gear, target species, area of operation, recent (2002-2006) catch of target species and striped marlin, percent of striped marlin catch in recent years relative to total (striped marlin) catch and any other information that would provide an overview of the fisheries and practices (e.g., unique gear configurations). Ito and Wagatsuma have agreed to take the lead on the development of this table with input from the WG.

The Chair inquired about the availability of data for BILLWG if maps of fishing effort and catch, and vertical distribution data were assembled. C.L. Sun identified that there may be data available by gear and area from the SPC website. It was noted that since the advent of the WCPFC, some countries have not made this information available on a Pacific-wide basis to either the IATTC or the WCPFC, while others have continued to provide the data to both. The IATTC can provide data to the BILLWG. K. Yokawa reported that Japanese coastal fishery data from 1994 on, and possibly data for the distant-water fishery may be available.

3.2 5th World Fisheries Congress (WFC)

G. DiNardo reported on the status of the special session being held at the 5th WFC meeting being held October 20-24, 2008 in Yokohama, Japan. The special session entitled "Stock Structure and Habitat of Swordfish and Billfishes with Comparative Approaches Among Oceans" will be combined with a theme on adaptive management. Four to five speakers and one poster will be presented by scientists from the USA, Japan, and Spain. Drs. H. Honda, Y. Uozumi, and G. DiNardo will serve as moderators of this special session, and Dr. R. Humphreys will be the keynote speaker. DiNardo reported that there will be no presentations on tagging data. The development of the agenda and schedule of the 5th WFC meeting is still ongoing.

Discussion. The WG expressed concern that the special session on billfish stock structure at the 5th WFC may not provide sufficient information to decide on a swordfish stock structure scenario for use in the stock assessment. The WG discussed several options that would allow enough time to 1) decide on possible stock structure scenarios, 2) develop and review the necessary swordfish CPUE time series and 3) finalize the assessment by July 2009. WG recommendations on this topic are outlined in Section 10.1 of this report.

3.3 8th ISC Plenary

The 8th ISC Plenary Meeting will be held in July 2008 in Takamatsu, Japan. The agenda for this meeting has been circulated by ISC Chairman, Gary Sakagawa. There will be several ISC WG meetings immediately prior to the Plenary meeting. These WGs include the Statistics WG (STATWG), Northern Bluefin Tuna WG (NBFTWG), and the North Pacific Albacore WG (ALBWG). Elections for the ISC Chairman and Vice-Chairman will be held at this year's meeting. DiNardo also reported that an election for a new Bycatch WG chairman will also be held at a later date. At the ISC Plenary meeting, Gerard DiNardo will report on the accomplishments and assignments of the BILLWG made throughout the year. A special seminar will be held in which each WG will present its biological data needs. DiNardo plans to put together a presentation on the draft research plan for billfish age and growth research (ISC/08/BILLWG-2/06) already developed by the BILLWG. DiNardo will also contact Gary Sakagawa in order to clarify the needs for the special session presentation.

Discussion. It was clarified that the special session will be used to identify the biological data needed to advance the stock assessments of all species targeted by ISC WGs. The WG suggested that the Chair requests total catch data from all ISC member countries during the special session.

3.4 IATTC – STRIPED MARLIN

K. Piner reported on the 9th IATTC Stock Assessment Review meeting. An overview of the striped marlin stock assessment was presented and the plan for re-assessing the stock was discussed. It was suggested that the ISC BILLWG and IATTC collaborate in completing the striped marlin assessment.

M. Hinton summarized the IATTC work plan for completing their EPO striped marlin stock assessment by the May 2009 IATTC Stock Assessment Review meeting. In preparing for this, the IATTC, in collaborative studies and by research support, is examining stock structure of striped marlin using results of fisheries and genetic analyses. It is expected that those results will be available no later than early November 2008, and that the stock assessment will be finalized by May 2009. The stock assessment will cover both the north- and southeast Pacific regions.

Discussion. The WG discussed the obstacles that the BILLWG may encounter if the IATTC and BILLWG decide to use different parameters and stock structure hypothesis in their respective stock assessments. It was pointed out that there may be differences in modeling assumptions and structure between the IATTC and BILLWG, but resulting differences in stock assessment results should be minimal. If necessary, each organization will conduct their own assessment. It was agreed that the ISC and IATTC would collaborate when possible, on efforts to complete a striped marlin stock assessment in the Pacific Ocean.

4.0 STRIPED MARLIN DESIGNATION AS A NORTHERN STOCK

4.1 ISC/08/BILLWG-2/01

K. Piner presented the results of analysis of the ratio of age1+ 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 ISC Stock Assessment". Results of the 2007 stock assessment of striped marlin from an assumed single stock in the North Pacific Ocean were used to estimate the percentage of age 1+ biomass north of 20°N latitude and west of 125°W. Assessment 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. The Japanese distant water fleet was used because it was the most consistent data source that was spatially disaggregated and comparable by region. Results indicate that a majority (65-70%) of striped marlin in the western and central North Pacific Ocean occur north of 20°N latitude. This conclusion is consistent with the distribution of fishery catches.

Discussion. It was noted that the area boundaries used in the assessment and this subsequent analysis do not match the management lines used by the IATTC and WCPFC. However, the WG agreed that the results of this analyses represents the situation of the striped marlin in the WCPFC area because it covers the major fishing grounds of striped marlin in the northern WCPFC area. One suggested solution is that the area weighting be changed to reflect the management lines. It was noted that this would not be consistent with the assessment model because both CPUE and size composition likelihood components would need to be recalculated excluding some data from areas 3 and 4 and then the assessment model would need to be re-run. It may be appropriate that the paper include some text to indicate that regions were not drawn based upon management boundaries. However the results should be robust to this issue. The WG also noted that the area around Taiwan might not be included in the area used to calculate the regional weights. The WG recommended that the working paper reflect this issue. It was clarified that incorporating this area into region 1 would only increase the proportion of biomass above 20°N since it would increase the weight of region 1.

The WG questioned if the spatial distribution of marlin might be affected by seasonal oceanographic changes in the North Pacific. It was clarified that the analysis did not explicitly look at seasonal effects, but these effects are implicitly included in the model estimate of selectivity and as a factor to develop the CPUE. Therefore the results presented in the paper could be considered as approximating the average distribution across seasons. The WG recommended clarifying this point in the manuscript.

5.0 COUNTRY REPORTS

5.1 Japan

K. Yokawa submitted a catch table with striped marlin and swordfish catches for Japan through 2004 with provisional data for some fisheries up to 2005.

5.2 U.S.

5.2.1 ISC/08/BILLWG-2/03

R. Ito presented a working paper on the U.S. commercial fisheries for marlins in the north Pacific Ocean. U.S commercial fisheries target or incidentally take marlins (*Istiophoridae*) in the North Pacific Ocean. Three distinct gear types (longline, troll, and handline) commercially exploit five species of marlins. These include striped marlin (*Tetrapturus audax*), blue marlin (*Makaira nigricans*), shortbill spearfish (*T. angustirostris*), sailfish (*Istiophorus platypterus*), and black marlin (*M. indica*). The first two species of marlins comprise the majority of commercial landings (tonnage). The largest fishery for marlins was the Hawaii longline fishery. This fishery takes marlins as incidental catch on sets targeting tuna or swordfish. Troll fisheries in Hawaii, Guam, and Commonwealth of the Northern Mariana Islands (CNMI) comprise the second largest fishery for marlins. These fisheries opportunistically target marlins on a seasonal basis. The Hawaii handline fishery represented the third fishery, with small incidental catches of marlin.

5.2.2 ISC/08/BILLWG-2/02

R. Ito also presented a working paper on the U.S. swordfish fisheries in the North Pacific Ocean. The United States is a major harvesting and consuming nation for swordfish (*Xiphias gladius*). Three major U.S. fisheries in the North Pacific Ocean harvested 1,986 metric tons (mt) in 2007. Of this total, 73% of the swordfish was taken by the U.S. longline fishery (both Hawaii and California), 24% by the drift gill net fishery, and 3% by the harpoon fishery. Historically, the California harpoon was the largest U.S. swordfish fishery in the North Pacific Ocean up to 1980. The California gill net fishery replaced the harpoon fishery as the largest swordfish fishery through 1989. The Hawaii-based longline fishery began in 1988 with many vessels also operating out of California. The U.S. longline fishery became and has remained as the largest producer of swordfish since 1990. While the number of longline vessels in the Hawaii fishery has generally remained stable, the number targeting swordfish in both Hawaii and California based varied substantially due to regulations implemented to protect leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) sea turtles. Longlining for swordfish in Hawaii was severely reduced in 2001, prohibited in 2002 and 2003, and reopened in April 2004 under regulations as the California-based longline fishery for swordfish was closed. The California harpoon and gill net fisheries operated mostly within the California Exclusive Economic Zone (EEZ) while the longline fishery fished primarily on the high seas. Nominal catch-per-unit-effort (CPUE) appeared to be stable for all fisheries.

Discussion. There was discussion as to the similarity in CPUE trends between the deep-set and shallow-set segments of the Hawaii longline fishery. It was noted that the trends are similar, but that the CPUE for the California harpoon and gillnet fisheries appeared to increase after swordfish-target longline fishing from California was prohibited. No clear reason for this increase was apparent, but the WG does not believe it is related to fishery interactions.

5.3 Chinese Taipei

5.3.1 ISC/08/BILLWG-2/11

C.L. Sun presented a working paper that reviewed Taiwan’s billfish fisheries in the north Pacific Ocean. The paper briefly reviewed four Taiwanese fisheries for billfishes in the North Pacific Ocean. Billfishes are incidental catch of distant-water tuna longline fishery (LTLL) and offshore tuna longline fishery (STLL) in Taiwan. Catches of some of the billfish species have increased recently following the development of the distant-water longline fishery that is targeting bigeye tuna. The largest components of the distant-water longline billfish catch was swordfish (49.3%), followed by blue marlin (32.4%), striped marlin (13.1%) and black marlin (2.1%). The offshore tuna longline fishery targets yellowfin and bigeye tuna for Japanese sashimi market, and billfishes are an incidental catch. Based on landing statistics, blue marlin is the dominant species caught in this fishery. The offshore gillnet and coastal harpoon fisheries catch a small amount of billfishes in the water of Taiwan. The offshore gillnet fishery’s main target is sailfish which is typically caught during the summer. Finally, the coastal harpoon fishery appears to target a complex of billfishes, and swordfish and striped marlin are caught in low numbers. Blue marlin and black marlin are the main target species of this fishery in the winter season.

Discussion. Questions regarding the reliability and coverage of data on Taiwan fisheries were raised and it was clarified that distant-water tuna longline fishery (LTLL) data are summarized by 5x5 degree square and month, and that the coverage rate is good for conducting stock assessment. For the offshore tuna longline fishery, the logbook coverage rate is low and thus reported landing data are not adequate to use for stock assessment purposes. However, coverage rate has been increasing in recent years. It was also pointed out that gear configuration information for the LTLL has been collected since 1995.

5.4 Catch Tables

Since most countries did not submit data, the WG did not discuss updates to the catch tables. The U.S. has completed its RFMO data package for Category I, II, & III and has submitted them to the various organizations. John Childers of the SWFSC updated the ISC swordfish catch tables for the California fisheries. The Chair stressed how important it is to provide fisheries statistics and requested each participant to submit catch statistics through 2007 for inclusion in the WG catch tables by conclusion of the meeting.

6.0 BLUE MARLIN

6.1 ISC/08/BILLWG-2/04

M. Kanaiwa presented a working paper on the analysis of blue marlin catch rates by Japanese training vessels. Data collected by Japanese training vessels was used to determine if HPB alone can distinguish effective fishing effort for each gear configuration. Simple GLM and statHBS were used to estimate blue marlin catch rates (CPUE). The estimated standardized CPUE for each HPB configuration did not always conform to prior expectations. For instance a small number of HPB (gear deployed in upper regions of the water column) did not have higher standardized CPUE as expected. This unexpected result was mainly due to the differences in area of operation of the HPB gear categories. Vessels which routinely used fewer HPB were only operating around Japan where the water was relatively cold and therefore not prime fishing grounds for blue marlin. In contrast, other vessels which used gear with higher HPB were operating in a wider area that included tropical oceans where blue marlin is more abundant. In these cases, HPB alone is not a good predictor of gear effects on blue marlin CPUE. Therefore, additional area factors and the interaction term HPB*year were included in the GLM. This model that included spatial effects produced results similar to those obtained using statHBS. These results suggest that the statHBS model is better able to adjust for the effect of annual changes in environmental conditions of the fishing ground than the simpler GLM. A more complicated GLM model using commercial-fishery data may not be the best approach for standardizing catch rates for species such as blue marlin, because of the shortage of the coverage of data for this species. More consideration needs to be given to distinguishing the gear effects.

Discussion. It was noted that the GLM model that was used was fairly simple and that there were ways to extend it using covariates. The addition may bring results from the GLM closer to those of statHBS (as was shown with the addition of interaction terms noted in the presentation). A question was asked about whether or not HPB was related to vessel size. This potential relationship was not examined, but it was noted that there was lower variation in vessel size among the training vessels than is found in the commercial fleet. It was noted that the operations (locations and configurations of fishing gear) of training vessels are directed by training needs (e.g. to maximize the number of species caught), and only partly by the need to achieve maximum catches. It is not clear how areas of operations are chosen for training vessels. Part of it is for training in gear operations, and part is for vessel operations. There is some difference between areas of operation between training and commercial vessels, with training vessels limiting operations in rough sea conditions. Training vessels most frequently use gear that approximates that which is most frequently used by commercial vessels in a fishing area. It is difficult to assume that vessels operating in near-shore areas are smaller than those operating in high-seas regions, as around Hawaii. It may be possible to see some stratification in size of commercial vessels across fishing regions, but not training vessels.

It was noted that the training vessel data set might be suited to testing aspects of pooling of fishing data and using modeled environmental parameters.

It was asked if this (difference between peak seen in 2001 catch in HPB but not in simple GLM: Fig. 7 of working paper) might be case where the GLM averaging provided a closer estimate to changes in abundance than did statHBS, since such a change would not be expected in such a long-lived species as blue marlin. It was noted that in this case the GLM failed to capture a signal that arises apparently from a shift in fishing area versus from a transient in population abundance. When additional factors for fishing area and interactions were added to the GLM, the single year transient became more apparent in the results (Fig. 9 of working paper). There was some discussion about whether or not it would be feasible to develop a GLM which would capture and identify the source of such signals.

It was noted that in the presentation it was shown that the operation areas for shallow and deep gear are not same. This leads to biased estimates of HPB-effects from the GLM, in this case particularly for shallow gear. The comment was made that this kind of situation also occurs for commercial vessels in all oceans. It was mentioned that in an Atlantic working group there was a long discussion on standardizing CPUE of Japanese longline. The most recent conclusions were that GLM trends from deep longline can only be believed in recent years, due to a targeting in the fishery combined with the change in gear not being uniform across the fishing area; and that it is difficult to estimate trends no matter what method used. It was also concluded that there was a negative bias in estimates of abundance due to this problem.

It was recommended that additional oceanographic and gear configuration data be collected using appropriate methodologies (e.g. TDRs) aboard training vessels to improve development of statHBS models. It was suggested that additional data from the appropriate fisheries be collected using TDRs, or made available, to improve evaluation of standardization methods.

It was noted that the work presented here fits well with work looking at best methods for standardizing data, as discussed at Taiwan meeting. The WG encouraged continuation of this type of work.

6.2 ISC/08/BILLWG-2/05

A preliminary analysis of the blue marlin fishery by Japanese long-distance longliners was presented by M. Kanaiwa. A simple GLM was applied to the commercial fishery data for blue marlin taken by Japanese longline fisheries in Pacific Ocean to investigate the difficulties in the CPUE standardization caused by the complexity of the data. These issues arise in standardizing CPUE because of the complexity of Japanese longline fishery. The annual trend of standardized CPUE was found to be declining when the traditional GLM model was applied. At same time the standardized CPUE per each HPB indicated unrealistic results, i.e. the lower HPB (shallower) sets obtained lower catch rates than the larger HBP (deeper) sets.

To explore the reason for this unexpected/unrealistic result, operation patterns of Japanese longliners were analyzed by latitude, longitude, gear configurations and periods. The data of Japanese longliners in 1975 – 2006 was divided into 3 periods arbitrarily based on the historical patterns of the ratio of sets with different gear configuration, and the effects of latitude and longitude on the operational patterns were examined for the periods. Though both shallower and deeper sets were observed all over the Pacific, the apparent tendency was that the proportion of shallower sets increased as the latitude increased, and this tendency was more noticeable in the recent years. After 1993, the majority of sets in the offshore area of Japan, where blue marlin is less abundant, were shallow sets, while almost all sets in tropical waters, the principal distribution region of blue marlin, were deeper sets, with greater than 10 HPB. This unbalanced distribution pattern of gear configuration in the fishing effort of the Japanese longliners is expected to be one of the main reasons for the observed GLM estimate of a steep declining trend in blue marlin standardized CPUE.

The observed strong effects of area and gear configuration could only be adjusted by introducing interaction periods among year, area, gear configuration, and, as well, season into the traditional GLM model. The statHBS standardization presents an alternative to the GLM, but it may also have some problems due to assumptions related to habitat preferences of blue marlin, choice and quantity of data for habitat limiting parameters (e.g. ambient temperature), as well as the method chosen to estimate the vertical distribution pattern of longline gear. Investigations of standardizing methods are continuing.

Discussion. It was noted that much of the discussion in the previous paper applied to this one. The general discussion of ongoing efforts to improve CPUE which began following the previous paper continued. It was noted that there are now a number of groups working on various aspects of the problem.

A clarification of Fig. 9 was requested concerning whether the figure indicated that data with <11 HPB was historically fished, but that now there is little effort in this category. It was explained that much of the shallow gear (which was fished for bigeye and yellowfin in the tropical areas during the early period) had already dropped out of the fishery or shifted to higher latitudes by about 1993. It was also pointed out that in addition to the change in numbers of hooks fished decreasing over time and that there has also been a shift in area.
It was noted that centralized peaks of CPUE are seen in the center of fishing grounds, with decreasing rates with movement from this center. New gear strategies (deep longline) were introduced by skilled skippers first. So, in the center of the fishing ground you found the skilled skippers with new gear. At micro-scales, deep sets tend to occur in good fishing grounds. This sometimes occurs across multiple areas.

There was further discussion on how and when to introduce interaction effects into GLMs to account for shifts in HPB by latitude. There was a discussion of looking at skipper effects, but the data is not available to do this. However, vessel codes are available for Japanese distant water longline vessels, but the skippers change frequently (about every 2-3 years), so this data may not provide significant information to models. It was suggested that generally it is best to avoid adding parameters to GLM analyses, unless there are underlying supporting reasons for doing so (e.g. additional factors which account for shifting gear configuration and area). Additional research will be required on standardization models.

Similar analyses were recommended for the Hawaiian longline observer data, as it relates to blue marlin.

6.3 WCPFC-SC4 Presentation

G. DiNardo presented a progress report and plan for completing a collaborative blue marlin stock assessment currently scheduled for completion in 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. The need and rationale for an updated Pacific-wide blue marlin stock assessment was presented at WCPFC SC2 and discussed with individual country scientists at WCPFC SC3. In both cases there was interest. A formal proposal to conduct the assessment will be presented at the WCPFC SC4 in August 2008. 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 that contribute landings to the analysis.

Discussion. There were questions and discussion about who would be willing to participate in an analysis of blue marlin in the Pacific. It was noted that some agencies have indicated an interest, including SPC. There may be issues, however, in getting participation of some agencies or laboratories, such as CSIRO, due to restrictions on unfunded work. It was mentioned that it might help establishment of the collaboration if the request came from the WCPFC, knowing that they would then turn to their scientific resources, i.e. the ISC and SPC, as participants in an analysis.

7.0 BILLFISH BIOLOGICAL RESEARCH PLAN

7.1 ISC/08/BILLWG-2/06

G. DiNardo presented a provisional ISC biological research plan for billfish in the North Pacific Ocean (NPO). Six billfish species inhabiting the NPO fall under the auspices of the ISC Billfish Working Group including swordfish (*Xiphias gladius),* striped marlin (*Kajikia audax),* blue marlin (*Makaira nigricans),* black marlin (*Makaira indica)*, sailfish (*Istiophorus platypterus),* and shortbill spearfish (*Tetrapturus angustirostris)*. These species are all apex predators of the open ocean and caught by a variety of gears including longline, surface gillnet, harpoon, troll, and purse seine. Future stock assessments for these species will require updates, and in some instances, initial estimates of life history parameters. While a suite of life history parameters are required to advance billfish stock assessments in the NPO the current research plan focuses on age and growth, and length at 50% reproductive maturity studies for swordfish, striped marlin, and blue marlin. Research tasks, potential collaborators, projected costs and timelines are described for each research topic. Success in studying these species will require improved collaboration on the part of researchers in order to leverage all available assets toward the collection of needed data and samples. It will be necessary to further develop our current ISC partnerships between participating countries and management organizations in order to forge the cooperative regional studies needed to advance life history research pertinent to future billfish stock assessment needs.

Discussion. While the WG recognized the inherent difficulties of developing a multinational biological sampling program, they also recognized the overwhelming benefits associated with such a program. There was considerable discussion on what additional types of samples could be collected when samples for growth and reproductive studies are collected (e.g., tissue samples for genetic analyses). While the WG agreed that additional samples could be collected (some with little effort), caution is advised so that the sampling protocols to not impede adoption and implementation of the research plan. It was recognized that the species of concern may need to be expanded to include other billfish species, in particular black marlin. While there was interest to include tagging studies (conventional and electronic) in the research plan, it was recommended that a tag inventory study be conducted to first determine the extent of billfish tagging in the Pacific Ocean. Because the other ISC species working groups are developing similar biological research plans, the WG recommended, to the extent possible, that the sampling programs be developed jointly in an effort to optimize sampling. The WG expressed a desire to review the working paper further and it was agreed that participants would have until June 27 to provide additional comments to the Chair. At that point the research plan would be updated and circulated to the BILLWG for final comment.

8.0 SWORDFISH

8.1 CPUE Series and Review of Length Data

8.1.1 ISC/08/BILLWG-2/07

G. Ishimura presented a preliminary update of swordfish CPUE for the Japanese offshore and distant-water longline fisheries in the Pacific Ocean. CPUEs were estimated using a GLM from 1975 to 2006 using two 5x5 degree spatial stratification scenarios and six gear configurations. The stratification scenario included a 20 area stratification based on historical spatial distributions of average CPUE distributions and a four area block stratification, presumed to be homogenous fishing grounds.

During the period 1975-2006, the proportion of shallow water gear sets has increased in the western Pacific Ocean (adjacent to Japan), while the remaining areas shifted to deep gear sets. CPUE trends in the 20 area stratification scenario varied by area, illuminating the difficulties when applying spatial stratification in CPUE analysis. In the main fishing grounds, CPUE declined slightly in recent years. In the EPO, CPUE were variable in recent years, suggesting no overall trend. Additional studies are required to determine the optimal spatial stratification resolution.

Discussion. The WG recognizes that there are several potential problems with the Japanese distant-water longline data that have made previous standardization of swordfish CPUE difficult. One problem is that gear type 2 (partial night set with 5-6 HPB) includes a mixture of both night and day sets. At present there is not an easy way to distinguish those types of sets using the logbook data. Furthermore, the ratio of day and night sets in gear type 2 may have changed over time. The WG also discussed that the proportion of total trips using gear type 1 (night set with 3-4 HPB) has changed over time. This change is confounded with increased targeting with gear type 1 on blue sharks. Finally, the WG noted that different spatial stratifications may affect the trend of CPUE.

It was clarified that the CPUE presented was described as preliminary because it is not yet for use in the stock assessment. The authors stated that in subsequent analysis that they plan to use finer spatial scale data. The WG recommended the authors consider how the gears types have changed over time as well as changes in the spatial distribution of the effort over time when conducting the next analysis. Furthermore the WG also recommends that the authors consider that several alternative stock structure hypotheses may need to be accommodated in the next assessment. Therefore conducting CPUE standardizations on a smaller scale, that can later be combined (example area weightings), may be more flexible in dealing with different stock structure hypothesis.

8.1.2 ISC/08/BILLWG-2/08

J. Brodziak presented results from generalized additive model (GAM) analyses to standardize swordfish (*Xiphias gladius*) catch rates in the Hawaii-based longline fishery. A preliminary analysis to standardize swordfish catch-per-unit effort in the Hawaii-based longline fishery was conducted. The analysis was based on generalized additive models fit to longline observer data during 1995-2006. GAMs fit to the entire observer data set using monthly, quarterly, or annual time steps explained a high percentage of deviance (>80%) with most of the deviance being explained by the predictor “begin-set time” (>77%). This variable differentiated between targeted swordfish sets and longline sets that were targeting bigeye tuna. Other predictors explained a relatively small percentage of the variability in swordfish catch rates regardless of the time step used. The observer data were split into targeted and non-targeted swordfish sets based on the number of hooks per basket which were believed to provide a proxy measure of the type of fishing operation. Preliminary GAM analyses applied to the targeted and non-targeted data sets suggested that these longline sets had similar patterns in standardized CPUE. However, preliminary examination of patterns of residuals from the GAM scatterplot smoothers suggested that three groupings of targeted fisheries may exist: shallow-sector swordfish, shallow-sector yellowfin tuna, and deep-sector bigeye tuna. Heterogeneity of average swordfish catch rates and their variances in these fishing operations may warrant further investigation. Regardless, the preliminary results provided no indication that the relative abundance of swordfish available to the Hawaii-based longline fishery exhibited a declining trend during 1995-2006.

Discussion. The WG discussed the use of this CPUE analysis for the 2009 stock assessment. The authors clarified that this is not the final analysis. Instead, the results from this analysis will be used to guide a subsequent standardization effort that may employ more typical statistical methods (such as GLM).

8.1.3 ISC/08/BILLWG-2/12

Standardization of Taiwanese distant water tuna longline catch rates for swordfish in the North Pacific, 1995-2006 was presented by C.L. Sun. Catch rates of swordfish for the Taiwanese longline fishery in the North Pacific Ocean was standardized using a general linear model (GLM). Three different models were used. The first model includes the variables year, area, sea surface temperature (SST), bigeye tuna catch rate (BET), yellowfin tuna catch rate (YFT), and the interaction between BET and YFT. Variables in the second model include year, area and SST, while variables in the third model include year, area, SST and number of hooks per basket (HPB). All models indicated increasing trends in standardized CPUE until 2001, thereafter CPUEs decreased gradually.

Discussion. The WG noted that availability of aggregated HPB data is an important improvement in the data available for standardization of CPUE. If HPB is available for the final CPUE standardization, the WG recommends that it is an improvement over the use of bigeye and yellowfin catch rate as a factor.

8.2 ISC/08/BILLWG-2/13

A preliminary economic overview of the swordfish longline fishery in Kesen-numa, Japan was presented by G. Ishimura. Kesen-numa, located on the northern Pacific coast of Honshu Island, Japan, has a longline fishery which is one of only a few Japanese fisheries targeting swordfish. In the past several decades, the number of active vessels in this area has declined from 41 to 23 due to economic hardships. This paper described economical issues surrounding the swordfish longline fishery in Kesen-numa, namely 1) high average age of labour (51 years old) due to lack of young labours and 2) negative profit due to decreased landing values will be more problematic under rising fuel cost. Also this study identified the importance of alternative harvest species, blue shark. This study suggested that further economic analysis are necessary.

Discussion. The WG acknowledged that this is the first economics analysis presented in this WG and it is an important improvement in their understanding of the fishery. It was noted that high opportunity costs of labor in addition to the increased fuel cost have resulted in a reduction of Japanese longline capacity (e.g., number of vessels). The WG was made aware of the economical hardships and challenges facing the Japanese swordfish fishery. The WG encouraged further investigations of the socio-economic aspects of fisheries to improve their operations as well as sustainable developments of billfish fisheries.

9.0 STRIPED MARLIN

9.1 ISC/08/BILLWG-2/10

J. Brodziak presented an analysis on length-based estimates of total mortality for North Pacific striped marlin. Length frequency data from Japanese distant water longline fishing vessels were used to estimate total mortality of North Pacific striped marlin in Japanese fishing regions 1 through 4. Total mortality estimates were calculated from mean length estimates of fully-selected striped marlin (assumed > 120 cm) using the method of Gedamke and Hoenig (2006) and growth parameters used in the most recent striped marlin stock assessment. Observed decreases in striped marlin mean length suggest some seasonal increases in total mortality of striped marlin occurred in regions 1 and 2 during the 1990s.

Discussion. The WG agreed that it can be quite informative to apply relatively simple methods to provide some elements of "ground-truthing" on the results from complex assessment models (e.g. SS2).

It was noted that in some cases, the total mortality rate estimate (Z) was smaller than the natural mortality rate used in the striped marlin assessment (M=0.3 yr^{-1}) and that in general, the Z estimates by area and quarter were highly variable. This may have occurred due to (i) sampling error in the length frequency data; (ii) violation of the equilibrium assumption (during the first period or after the transition); (iii) misspecification of aggregate selectivity, etc. While it is difficult to identify the key causal factor(s), a few suggestions for future work were made.

- Examine the sensitivity of results to the choice of the length at (knife-edge) full selection (L_c=120 cm). It may also be informative to compare this knife-edge selection pattern with the time-varying aggregate selectivity patterns from the last stock assessment.
- Check that the same type of length measurement (LJFL or EFL) was used for both the estimation of growth parameters and for the size frequency data from the Japanese longline fishery. It was noted that this had been a problem in the early stages of the last stock assessment.
- Examine the effect of the constant recruitment assumption, especially in light of the declining recruitment trend evident in the assessment results.
- Fix a common break point year for all the individual area-quarter analyses. However, it was noted that this is not possible with the current software, and would require significant code modification.

The WG discussed, at some length, the best means of comparing the Z estimates from this working paper with those from the last stock assessment. Because of the equilibrium conditions assumed in this working paper (both before the break year and after the transition to a new equilibrium), it is difficult to interpret specific area-quarter Z estimates in isolation. However, each of the area-quarter Z trends can be considered an "observation" of the underlying Z trend for the striped marlin stock; and can be compared to the corresponding Z trend from the stock assessment.

9.2 ISC/08/BILLWG-2/09

J. Brodziak presented a working paper on the maximum sustainable yield-based reference points for North Pacific striped marlin. A standard age-structured production model was applied to calculate external estimates of MSY-based reference points using stock-recruitment estimates from the most recent assessment and a model-averaging approach developed by Brodziak and Legault (2005). Under this approach, two alternative structural models for striped marlin stock-recruitment dynamics were fit under various assumptions about error terms. These were the compensatory Beverton-Holt (B-H) relationship, as was assumed in the stock assessment, and the overcompensatory Ricker relationship in which recruitment was reduced at high spawning biomasses. Annual error terms for fitting the annual stock-recruitment estimates from the stock assessment model were either a multiplicative lognormal distribution with mean unity and constant variance or an additive normal distribution with zero mean and constant variance. In this case, the lognormal provided a positively skewed distribution for recruitment deviations while the normal provided a symmetric distribution. The annual error terms were either independent and identically distributed (iid) uncorrelated random variables or auto-correlated random variables with a lag of 1 year. In this case, the correlated errors provided an explicit model for temporal dependence in annual recruitment deviations as might be observed if recruitment was subject to low frequency environmental forcing. In contrast, the uncorrelated errors presumed temporal dependence was negligible among years.). Stock-recruitment estimates during 1965-2004 were used for fitting parameters of the age-structured production model with three sets of stock-recruitment estimates; these three data sets corresponded to steepness scenarios of h=0.7, 1, and 0.85. Model-averaged results indicated that the B-H model was well-supported for each of the sets of stock-recruitment estimates (Table 3). In contrast, there was very little support for the Ricker model suggesting that overcompensatory recruitment dynamics were unlikely for North Pacific striped marlin.. Under scenarios 1, 2, and 3 the average relative fishing mortality rates during 2001-2003 were: 3.9 to 4.5*F_{MSY} (scenario 1), 1.9*F_{MSY} (scenario 2), and 1.9 to 2.1*F_{MSY} (scenario 3). Model averaged estimates of relative biomass during 2001-2003 indicated that North Pacific striped marlin biomass was well below S_{MSY} and ranged from 29%-34% of S_{MSY} under scenario 1 to 60%-64% of S_{MSY} under scenario 2. Model-averaged estimates of MSY-based reference points indicated that North Pacific striped marlin is currently experiencing overfishing regardless of the steepness scenario assumed in the stock assessment. This conclusion was also robust to model selection uncertainty for the set of alternative models we examined.

Discussion. The WG noted it was useful to estimate MSY based reference points accounting for model uncertainty. This working paper used a standard algorithm which may prove useful for other species as well. The WG commented that the need for some type of model averaging was apparent in the last striped marlin stock assessment.

Aggregate selectivity (i.e. the selectivity pattern for all fleets combined) is an important input for all reference point calculations – including the MSY-based estimates F_{MSY} and B_{MSY}. Even when fleet specific selectivity is constant over a time block, aggregate selectivity may change due to differing catch proportions among the fleets. The BILLWG has used aggregate selectivity from the last assessment to (i) define “current F” (over 2001-03); (ii) calculate MSP reference points (e.g. $F_{20\%}$); (iii) and calculate F_{MSY} and SSB_{MSY} in this working paper. It is not clear whether the same algorithm (for estimating aggregate selectivity) was used in all three of these analyses. To ensure consistency among these WG products, this should be checked.

The WG discussed the “Kobi Plots” in this working paper at some length. Several improvements were suggested. The final point on the Kobi plot should represent “current F” and corresponding SSB as defined in the last assessment (average over 2001-03). Confidence intervals for current F/ F_{MSY} and SSB/SSB_{MSY} could also be added to the plot. For all years or blocks of years prior to “current,” F_{MSY} and SSB_{MSY} could be calculated using the appropriate average aggregate selectivity for that period.

While the WG encouraged further development of this innovative method of producing model-averaged Kobi plots, it was agreed that these preliminary Kobi plots should not be used for describing stock status until the above improvement can be made and further guidance on reference points is provided.

Finally, it was noted that MSY-based estimates (F_{MSY} and B_{MSY}) could also be obtained using traditional surplus production models (e.g. ASPIC). It may be informative to explore these models as well.

10.0 SWORDFISH STOCK ASSESSMENT

G. DiNardo reported that Dean Courtney will conduct model runs for the swordfish stock assessment.

It was discussed that the input files for the models will be available at a later date to ISC member scientists to conduct alternative assessments for the WG. It was noted that all assessments would be conducted under the auspices of the ISC. It was also clarified that in the analyses of the Japanese size-length data, a quarterly time-step should be used.

10.1 Stock Structure

It is unlikely that the special session on billfish stock structure at the 5th WFC will provide sufficient data to decide on a swordfish stock structure scenario for use in the stock assessment. DiNardo discussed options with the WG and reiterated that just such a situation was discussed at the January 2008 ISC BILLWG workshop and options rendered. At that workshop, 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.

The WG reviewed possible scenarios and agreed to consider the possibility of two stock scenario based on the review of upcoming information. WG participants agreed to develop CPUE time series for the single stock scenario and present them at the next Billfish workshop. Because data to determine stock boundaries in the two stock scenario is presently not available, the WG could not render a decision on this issue. Information to assist in this decision is forthcoming (August 2008 presentation at the American Fisheries Society meeting in Ottawa Canada and full analyses completed by October 2008; 5th World Fisheries Congress meeting) and the WG decided to convene a special sub-Group session in November 2008 to discuss these data and recommend a final decision on stock structure for consideration by the full WG in January 2009. The special sub-Group session is necessary to complete the swordfish assessment by July 2009, and will not require full participation from the WG. The WG also agreed to discuss the other conditions of the swordfish stock analysis at the special sub-Group session, and if time permits, review information on stock structure for other billfish stocks. Tentative dates for this special sub-Group session are November 11-14, 2008, location TBA. The Chair will inquire if it would be possible to hold the November 2008 meeting in conjunction with the November ISC PBF WG in an effort to ease travel for WG members.

11.0 BILLFISH COLLABORATIVE RESEARCH

G. DiNardo discussed several collaborative research projects that the WG will continue to work on. As discussed by the BILLWG, the billfish research plan (ISC/08/BILLWG-2/06) will be updated; then presented at the ISC Plenary meeting in July 2008. R. Ito and L. Wagatsuma are tasked with completing a fishery characterization for the Northern Committee striped marlin working group. This characterization should catalog the country, type of fishery, location, gear type, target species, etc. for striped marlin fisheries, and will be submitted to the Northern Committee striped marlin working group at its request. L. Wagatsuma and G. DiNardo will work on a spatiotemporal mapping of the BILLWG's Category I, II, and II data.

12.0 ASSIGNMENTS

12.1 Assignments for BILLWG Members

The members of the ISC BILLWG were given a number of assignments. These assignments include:

- Complete and submit north Pacific swordfish CPUE time series
- Complete and submit data catalogues
- Submit Category I data for 2000-2007
- Complete fishery characterization table for striped marlin working group

While a characterization of EPO data sets that have Japanese captains on Mexican vessels operating within the Mexican EEZ has been provided, additional information may be required. The Chair will review the submitted material and determine if additional data are required.

12.2 Assignments for BILLWG Chairman

The ISC BILLWG Chairman was also tasked with a number of assignments. These tasks include giving presentations at the ISC Plenary meeting in July 2008 and the WCPFC-SC4 meeting in August 2008. The topics that will be discussed in these presentation include:

- ISC Plenary presentation
  - Summary of BILLWG workshops (provide reports)

    - Status of swordfish assessment
    - Northern Committee striped marlin working group – concerns
    - Data tables
    - Catch tables
    - Status of World Fisheries Congress special session
    - Billfish biological research plan.

- WCPFC-SC4
    - BILLWG Activities
    - Blue marlin assessment schedule and proposal
    - Striped marlin as a northern stock
- Request Category I, II and III data from member countries.

Discussion. It was clarified that DiNardo will present working paper ISC/08/BILLWG-2/01 at the WCPFC-SC4 when presenting the BILLWG's opinion of striped marlin as a northern stock.

13.0 FUTURE MEETINGS

The next BILLWG workshop was tentatively scheduled for November 2008. Because of the need to first determine stock structure, the November meeting has been rescheduled to January 13-21, 2009 in Hawaii. A special session to finalize stock structure for the upcoming assessment is tentatively scheduled for November 11-14, 2008, the location TBA. To ease travel for the WG members who also serve on the ISC PBF WG, the Chair will determine the possibility of convening the Billfish special session immediately prior to the November Pacific bluefin tuna workshop.

14.0 ADJOURNMENT

The workshop was adjourned at 2:50pm on June 19, 2008. The Chairman expressed his appreciation to the rapporteurs and to all participants for their contributions and cooperation in completing a successful meeting. The Chairman also thanked the hosts of this meeting, Minoru Kanaiwa and the Tokyo University of Agriculture, for their wonderful hospitality.

15.0 REFERENCE

Gedamke, T. and Hoenig, J.M. 2006. Estimating mortality from mean length data in non-equilibrium situations, with application to the assessment of goosefish. Trans. Amer. Fish. Soc. (135): 476-487.

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	1	10	225	5,067
2001	985	1,326	11	0	1,077	237	3,636	121		129	16	-	30	5	-	-	-		301	151	206		206	-	237	237	351	42	2		395	4,926
2002	764	795	5	0	1,264	291	3,119	251		226	14	-	6	8	1	-	-		506	76	153		153	-	305	305	226	30	0		256	4,415
2003	1,008	826	3	0	1,064	203	3,104	241		91	26	-	11	5	1	-	-		375	79	172		172	-	322	322	552	29	0		581	4,633
2004	(761)	(964)	(2)	(0)	(1,339)	(90)	(3,066)	261		95	8	1	7	5	2	-	1		380	(19)	(75)		(75)	-	-	0	376	34	1		411	(3,951)
2005	(803)						(803)	176		76	1	-	5	9	9	-	8		284	-	(115)		(115)	-	-	0	493	20	0		513	(1,715)
2006																											609	21	0		630	630
2007																											265	13	0		278	278
2008																																

[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	646	90	9	5,579	18,559
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	5	2,401	15,199
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	1,812	216	107	0	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)		(350)	270.1	213	898	169	62	37	1,379	(13,775.1)
2005	(6,972)							(6,972)	437	1,813	1	-	-	5	2	-	18		2,276	(407)		(407)	234.5	1,475		220	76	0	1,771	(11,660.5)
2006																							347.2	1,175		444	71	2	1,692	2,039
2007																								1,444		484	58	0	1,986	1,986
2008																														

[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) only one vessel fished so combined with Hawaii longline

Attachment 1.
List of Participants

Chinese Taipei

Chi-Lu Sun
Institute of Oceanography
National Taiwan University
1, Sect. 4, Roosevelt Rd.
Taipei, Taiwan, 106
886-2-23629842 (tel&fax)
chilu@ntu.edu.tw

Suzan Yeh
Institute of Oceanography
National Taiwan University
1, Sect. 4, Roosevelt Rd.
Taipei, Taiwan, 106
886-2-23629842 (tel&fax)
chilu@ntu.edu.tw

Japan

Momoko Ichinokawa
National Research Inst. of Far Seas Fisheries
5-7-1 Orido, Shimizu
Shizuoka, Japan 424-8633
81-54-336-6014, 81-54-335-9642 (fax)
ichimomo@fra.affrc.go.jp

Gakushi Ishimura
PIFSC, Visiting Scientist
National Research Inst. of Far Seas Fisheries
5-7-1 Orido, Shimizu
Shizuoka, Japan 424-8633
81-54-336-6039, 81-54-335-9642 (fax)
gakugaku@aol.com

Minoru Kanaiwa
Tokyo University of Agriculture
196 Yasaka, Abashiri
Hokkaido, Japan 099-2493
81-152-48-3906, 81-152-48-2940 (fax)
m3kanaiw@bioindustry.nodai.ac.jp

Kotaro Yokawa
National Research Inst. of Far Seas Fisheries
5-7-1 Orido, Shimizu
Shizuoka, Japan 424-8633
81-54-336-6035, 81-54-335-9642 (fax)
Yokawa@fra.affrc.go.jp

United States

Jon Brodziak
NOAA/NMFS PIFSC
2570 Dole Street
Honolulu, HI 96822-2396
808-983-2964, 808-983-2902 (fax)
Jon.Brodziak@noaa.gov

Ramon Conser
NOAA/NMFS SWFSC
8604 La Jolla Shores Dr.
La Jolla, CA 92037
858-546-5688, 858-546-7003 (fax)
Ray.Conser@noaa.gov

Gerard DiNardo
NOAA/NMFS PIFSC
2570 Dole St.
Honolulu, HI 96822-2396
808-983-5397, 808-983-2902 (fax)
Gerard.DiNardo@noaa.gov

Russell Ito
NOAA/NMFS PIFSC
2570 Dole St.
Honolulu, HI 96822-2396
808-983-5324, 808-983-2902 (fax)
Russell.Ito@noaa.gov

Kevin Piner
NOAA/NMFS SWFSC
8604 La Jolla Shores Dr.
La Jolla, CA 92037
858-546-5613, 858-546-7003 (fax)
Kevin.Piner@noaa.gov

Lyn Wagatsuma
Joint Inst. of Marine and Atmospheric Research
2570 Dole St.
Honolulu, HI 96822-2396
808-983-2966, 808-983-2902 (fax)
Lyn.Wagatsuma@noaa.gov

IATTC

Michael Hinton
Inter-American Tropical Tuna Commission
8604 La Jolla Shores Dr.
La Jolla, CA 92307-1508
858-546-7033, 858-546-7133 (fax)
mhinton@iattc.org

Attachment 2.
Working Papers and Background Papers

ISC/08/BILLWG-2/01	Estimation of the ratio of age1+ 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 ISC Stock Assessment. ISC BILLWG. (Kevin.Piner@noaa.gov)
ISC/08/BILLWG-2/02	U.S. Swordfish Fisheries in the North Pacific Ocean. R. Ito, J. Childers. (Russell.Ito@noaa.gov)
ISC/08/BILLWG-2/03	U.S. Commercial Fisheries for Marlins in the North Pacific Ocean. R. Ito and W. Walsh. (Russell.Ito@noaa.gov)
ISC/08/BILLWG-2/04	Analysis of Blue Marlin catches by Japanese training vessels. M. Kanaiwa, K. Yokawa, and K. Bigelow. (m3kanaiw@bioindustry.nodai.ac.jp)
ISC/08/BILLWG-2/05	Preliminary analysis of Blue Marlin's fishery by Japanese offshore and distant-water longliners. M. Kanaiwa and K. Yokawa. (m3kanaiw@bioindustry.nodai.ac.jp)
ISC/08/BILLWG-2/06	Draft ISC Billfish Research Plan: Research of Future Age and Growth and Length at 50% Reproductive Maturity Studies. ISC BILLWG. (Gerard.DiNardo@noaa.gov)
ISC/08/BILLWG-2/07	Updating of the Catch per Unit Effort distribution of swordfish in the Japanese offshore and distant-water longline fishery in the Pacific. G. Ishimura, K. Yokawa, and M. Ichinokawa. (gakugaku@aol.com)
ISC/08/BILLWG-2/08	Generalized Additive Model Analyses to Standardize Swordfish *(Xiphias gladius)* Catch Rates in the Hawaii-based Longline Fishery, 1995-2006. D. Courtney, W. Walsh, and J. Brodziak. (Dean.Courtney@noaa.gov)
ISC/08/BILLWG-2/09	Maximum Sustainable Yield-Based Reference Points for North Pacific Striped Marlin, *Tetrapturus audax*. J. Brodziak and K. Piner. (Jon.Brodziak@noaa.gov)
ISC/08/BILLWG-2/10	An Investigation of Length-Based Estimates of Total Mortality for North Pacific Striped Marlin, *Tetrapturus audax*. J. Brodziak. (Jon.Brodziak@noaa.gov)

ISC/08/BILLWG-2/11	A review of Taiwan's billfish fisheries in the North Pacific Ocean. C. Sun and S. Yeh. (chilu@ntu.edu.tw)
ISC/08/BILLWG-2/12	Standardization of Taiwanese distant water tuna longline catch rates for swordfish in the North Pacific, 1995-2006. S. Yeh and C. Sun. (chilu@ntu.edu.tw)
ISC/08/BILLWG-2/13	Preliminary economic overview of the swordfish longline fishery in Kessen-numa, Japan. G. Ishimura and K. Yokawa. (gakugaku@aol.com)

BACKGROUND PAPER

Brodziak, J. and Legault, C.M. 2005. Model averaging to estimate rebuilding targets for overfished stocks. Can. J. Fish. Aquat. Sci. (62): 544-562.

Attachment 3.

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

BILLFISH WORKING GROUP (BILLWG)

INTERCESSIONAL WORKSHOP AGENDA

Meeting Site: Echo Center 2000
3-3 Kita Nijo-Nishi
Abashiri City, Hokkaido
Japan 093-0012

Meeting Dates: June 11-19, 2008

Draft Agenda:

June 11 (Wednesday), 1000-1030 – Registration

June 11 (Wednesday), 1030-1600

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

2. Adoption of Agenda & Assignment of Rapporteurs

3. Computing Facilities
a. Access
b. Security Issues

4. Summary of January 2008 Billfish WG Workshop and Status of Work Assignments

5. RFMOs
    a. Northern Committee
        • Status Striped Marlin Working Group
        • ISC BILLWG responsibilities and assignments
    b. 5th World Fisheries Congress
        • Status of special session
    c. 8th ISC Plenary
        • Venue
        • Agenda
        • Special seminar – biological data needs
    d. IATTC - Striped Marlin

- 9th IATTC Stock Assessment Review Meeting
- Status of IATTC work plan for striped marlin assessment

6. Striped Marlin designation as a Northern Stock

7. Country Reports and Web-based Data Submittals (Category I, II, and III)
   a. Japan
   b. U.S.
   c. Mexico
   d. Taiwan
   e. Other countries
   f. Update catch tables

June 12 (Thursday), 0930-1600

8. Blue Marlin
   a. Japanese training vessel
   b. Japanese distant-water longline fishery
   c.WCPFC SC4 Presentation

9. Billfish Biological Research Plan

10. Swordfish
   a. CPUE series
      - Japan
      - U.S.
   b. Review of length data

June 13 (Friday), 0930-1500

10. Swordfish (con't)
   a. CPUE series
      - Japan
      - U.S.
   b. Review of length data

11. Striped Marlin
   a. Reference points
   b. Mortality

   Barbecue at Local Pit for Meeting Participants

June 14 (Saturday), 0930-1200

12. Swordfish Stock Assessment
    a. Who and how

13. Billfish Collaborative Research
    a. Identify specific projects

June 14 (Saturday), 1330-1600 – Blue Marlin Steering Committee Meeting

June 15 (Sunday), No Meeting – Excursion to Shiretoko National Park

June 16 (Monday), 0930 - 1200

14. ISC Plenary Presentation

15. Future Meetings

June 16 (Monday), 1330-1630 - Rapporteurs complete sections

Dinner at Local Restaurant for Meeting Participants

June 17 (Tuesday), No Meeting – Finalize Report

June 18 (Wednesday), No Meeting – Circulate report for Review

June 19 (Thursday), 0930-1200

16. Finalize Report

17. Adjournment