Annex 9

REPORT OF THE MARLIN AND SWORDFISH WORKING GROUP WORKSHOP

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

(July 19-21, 2007, Busan, Korea)

1.0 INTRODUCTION

The joint intercessional workshop of the Marlin (MARWG) and Swordfish (SWOWG) Working Groups of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) was convened in Busan, Korea from July 19-21, 2007. Goals of the MARWG intercessional workshop were to finalize the North Pacific striped marlin stock assessment, discuss reference points, and develop management advice. For the SWOWG intercessional workshop, the goals were to review and catalog available Category I, II, and III data, identify data gaps, suggest collaborative research projects, and discuss an assessment time line.

Gerard DiNardo, Chair of the MARWG, and Robert Humphreys, Chair of the SWOWG, welcomed participants from the United States of America (USA), Japan, Chinese Taipei, Mexico, Republic of Korea, and the Inter-American Tropical Tuna Commission (IATTC) (Attachment 1). Rapporteuring duties were assigned to Brodziak, Hinton, Humphreys, Piner, and Wagatsuma. Wagatsuma was assigned lead rapporteuring responsibilities. Working papers were distributed and numbered (Attachment 2), and the meeting agenda adopted (Attachment 3).

2.0 ADMINISTRATIVE ACTIVITIES

2.1 Consolidation of ISC Marlin and Swordfish Working Groups

Gerard DiNardo presented a proposal to consolidate the MARWG and SWOWG into a single working group (WG). Rationale for the proposed consolidation included:

- Identical membership (participants) are the same in both working groups;
- Working group workshops are always conducted jointly;
- Data submissions and necessary research collaborations are conducted by the same individuals, regardless of the working group; and
- Assessments are conducted by members of both working groups.

Thus, it would be more efficient and economical to combine the ISC MARWG and SWOWG into one. Japan voiced support for this idea, as it will be more cost and labor effective to operate under one WG. Chinese Taipei also voiced support and sought clarification regarding assessment scheduling under a single WG structure. In particular, whether the WG will conduct assessments each year for all species. It was indicated that after a major assessment is conducted, say for striped marlin, the WG would not conduct a major assessment on striped marlin for another 2-3 years. In the off-years, the CPUE trends would certainly be updated and reviewed.

Participants discussed the proposal and agreed that a single WG is appropriate. Participants selected ISC Billfish Working Group (BILLWG) as an appropriate name. It was further agreed that the chairman of the ISC MARWG present the proposal to the ISC Plenary for discussion and decision.

2.2 Chairman elections

It was agreed that if the ISC Plenary supports the establishment of the Billfish WG, then one chairman should be elected. Nominations were taken and a vote conducted, with Chinese Taipei, Mexico, Japan, and the USA all voting for the election of Gerard DiNardo as Chairman for the ISC Billfish WG.

Gerard DiNardo graciously accepted the position and thanked all for their vote of confidence. He also noted that the past success of the MARWG and SWOWG is due to the commitment and dedication of all participants past and present.

2.3 Establishment of blue marlin assessment “steering committee”

At the March 2007 Workshop of the MARWG and SWOWG, participants agreed that a Pacific-wide blue marlin stock assessment should be conducted under the auspices of the ISC. Conducting the assessment will require collaboration with other Pacific fishery organizations (such as SPC, CSIRO, IATTC, etc.). DiNardo asked for volunteers to help organize a steering committee to initiate support for this work and enlisted Kotaro Yokawa, Chi-Lu Sun, and Michael Hinton.

In the discussion, it was noted that one of the significant problems we will be facing is that of blue and black marlin data being lumped together either by design or inadvertently through misidentifications. Since these efforts will need to be undertaken to estimate catch and effort data for both species simultaneously, and it will take considerable time to sort through, it was recommended that consideration be given to undertaking stock assessments on both species concurrently.

3.0 PROGRESS OF ASSIGNMENTS

3.1 Assignments from March 2007 Intercessional Meeting

The MARWG Chairman was given a number of assignments following the March 2007 joint intercessional workshop. These assignments are as follows:

- Contact Luis Fleischer (Mexico) and request that the reported swordfish catch, effort, and CPUE series (ISC/07/MARWG&SWOWG-1/04) be decomposed annually by gear.

- Contact Bill Walsh (USA) and request the submitted swordfish CPUE series from the Hawaii-based longline fishery (ISC/07/MARWG&SWOWG-1/04) be decomposed annually by gear, making them comparable with similar series from other Pacific Ocean swordfish fisheries.

- Explore options of linking the World Swordfish Meeting with an established meeting, such as the World Fisheries Congress Meeting or the next International Billfish Symposium.

- Requested that the IATTC develop an index of swordfish abundance for the eastern Pacific Ocean.

The Chairman updated the WG on the status of these assignments. It was reported that Mexico has provided the requested data on the swordfish fishery. Updates on marlin catch and effort were also provided. Updated Chinese Taipei catch data was also provided at the March 2007 intercessional workshop. These data will be incorporated into the WG catch tables at the next intercessional workshop (January 2008), and reflected in the data catalogues. The current catch tables are included as Tables 1 and 2. It was also reported that William Walsh was contacted and is currently working on re-expressing the CPUE series on an annual basis. These data will be available at a later date. The IATTC reported that the swordfish abundance index is not complete at this time, but should be available shortly.

3.2 ISC/07/MARWG&SWOWG-2/01

Kotaro Yokawa summarized existing Japanese billfish catch weight statistics (other than striped marlin), as well as recent size data of swordfish caught by Japanese major fisheries. Current fishery statistics for blue marlin, black marlin, sailfish, and spearfish from Japanese fisheries are available, but are not in a convenient format for use in stock assessments. With some additional processing, these data, as well as historical statistics, will be available for use in upcoming stock assessments. Recent sample frequencies of swordfish caught by longline, drift net and harpoon fisheries, and unloaded in Kessennuma fishing port, the largest swordfish fishing port in Japan, were reported. However, the size frequency data are not bias corrected, and are believed to contain rough information about annual change of swordfish stocks and fisheries catching swordfish due to their relatively higher converge. No significant changes in length frequency among years are observed for all fisheries. This would suggest that there was no remarkable change in both the status of the swordfish stock and fisheries catching them in the northwest Pacific.

Discussion. Yokawa provided clarification on the length composition of catch of swordfish by surface longline, indicating that surface longlines in 2004 and 2005 are actually night sets targeting swordfish and blue sharks. Yokawa mentioned that only partial data coverage exists for the coastal longline fishery. Logbook coverage of the coastal longline started in 1994 and covers 80-90% of trips. The footnote “1” for all the data columns of Table 2 (ISC/07/MARWG&SWOWG-2/01) except “offshore and distant water longline” refers to the origin of the data as coming from yearbooks rather than logbooks. A question was raised regarding how far back in time the fishery statistics could be extended in Table 1 (presently it is 1971). Apparently the statistics may be retrievable back to 1951. Regarding the importance of the port landings recorded from Kessennuma, Japan, it was noted that this port contributes a large proportion of the annual swordfish landings. It was noted that sex identity information for landed swordfish is not available as the swordfish are landed gilled and gutted.

4.0 WORKING GROUP DATA CATALOGUES

At the intercessional MARWG and SWOWG workshop in November, 2006, data catalogues were developed for swordfish and striped marlin. These data catalogues have been revised and now encompass several species of billfish, separated by country and type of fisheries (commercial, recreational, market sampling, and research/training). Catalogues were sent to working group participants for review and updating, and submitted back to the Chairman. The Chairman clarified that these catalogues are for use by the MARWG and SWOWG in conducting stock assessments, and should not be confused with the data requests from the ISC Statistics Working Group. It was also clarified that these catalogues represent data that is available, and not necessarily data that is obligated for submission. Further, the spatial resolution of data should be documented in the data catalogue. Currently, the Chairman is waiting on the submissions of the catalogue updates from the country representatives.

It was clarified that the spatial resolution of data should be documented in the data catalogue.

5.0 SWORDFISH

5.1 Area Stratification

5.1.1 ISC/07/MARWG&SWOWG-2/02

Momoko Ichinokawa described a new method to objectively determine area stratification for swordfish CPUE standardization analyses, which we call the “tree-glm” algorithm. This method combines the binary recursive fitting approach used in tree regression with

CPUE standardization analysis using generalized linear models (GLM). We evaluated the performance of the new method by comparing GLM fits using old and new tree-glm area stratifications for swordfish. Results show that the tree-glm algorithm produced a better fit to swordfish CPUE data in the main fishing grounds than the old area stratification. We also investigated the empirical relationships among the number of areas selected by the stratification algorithm, goodness-of-fit measures (AIC and BIC), the complexity (number of explanatory variables) of the GLM, and total amount of data. The results suggest the tree-glm algorithm will provide an objective way to determine the area stratification for standardizing swordfish CPUE in the whole North Pacific. However, there are still some computational issues to be resolved, such as limited PC memory and speed, before applying the approach to longline data for the whole North Pacific. In addition, because the tree-glm method can produce different area stratifications that have similar goodness-of-fit values depending on the structural complexity of GLM, additional model selection criteria (other than AIC or BIC) should be considered to choose the best model consistent with swordfish biology and oceanographic characteristics.

Discussion. One observation was that the method appears to create increased numbers of strata in areas where the number of observations of catch rates are highest. It was asked whether this was related to some property of the method that was not clearly shown. It was explained that the issue in this case is whether or not the objective function is structured to provide information about the parameters of the GLM which are considered important, e.g. the precision of the estimates of the parameters versus the r^2 of the overall fit. Another observation on the stratification results was that they were similar to stratifications based on oceanographic provinces (at lower resolutions), with further splits that fall into stratifications in which previous models have shown interactions of gear and oceanographic conditions. It was pointed out that the initial stratifications were along latitudes, which was different than the stratifications which are being used in SS2 or Multifan-CL: it had been imagined that the initial results would give indication of north/south migrations. It was pointed out that to make comparisons to results in SS2 and Multifan-CL, the same number of strata should be used. It was pointed out that we are using principally categorical data, and we might well see different results if we shift our time scale from quarterly to monthly: this was an example of the many sources of variability that we are attempting to capture in the simplified model structure. It was asked if the results of the work, as it stands, is ready for application, and it was pointed out that it was still in a research status with much work left to do from its current starting point.

It was recommended that a bootstrapping approach be used to check on the minimum number of observations necessary to compare models with different levels of strata.

5.2 Research needs

Specific research needs to facilitate a swordfish stock assessment were identified including the lack of sex-specific length data, length-weight relations, stock boundaries, and conversion ratios. An international sampling program involving ISC member countries and participating organizations was offered as a potential platform to collect biological samples. A follow-up comment suggested the need to narrow the purpose of such a sampling program and to clearly explain the necessity of the sampling program. This proposal received general agreement from participants and will be put forward to the Plenary. It was mentioned that a collaboration (including IATTC, NMFS, CSIRO, and Chile), intend to submit a proposal for a swordfish satellite tagging with coordinated genetic sampling to PFRP next year. It was mentioned that in the Atlantic, there is an ICCAT request to collect size data measured from 20% of each counties landing. This is considered by ICCAT as the minimum sampling threshold for conducting length at age analyses. Other comments raised included assessing current deficiencies in sampling programs and developing more robust programs. It was also pointed out that the lack of sex-specific data from dimorphic species will be problematic in future assessments. Another research proposal offered recommended that Japan conduct a project on CPUE standardization. Other countries would be encouraged to participate. This would include discussions of uniting these CPUE issues into a single research project and holding a small special meeting regarding CPUE standardization; an idea previously proposed at the March 2007 MARWG and SWOWG workshop in Taipei.

5.3 World Swordfish Meeting

The next World Fisheries Congress is scheduled to be held during October 2008 in Yokohama, Japan and there was a suggestion that a "World Swordfish Meeting" be convened as part of the World Fisheries Congress meeting. Unfortunately this would not provide sufficient time to cover all aspect of swordfish biology, ecology, and stock assessments. Instead, the scope of such a meeting would be limited to a half-day and used as a forum to concentrate on specific issues that outside experts can address and thereby offer sage advice and experience in our efforts toward a North Pacific swordfish stock assessment. Immediately following this half-day swordfish session, our ISC intercessional meeting would be held in order to involve these experts that would be present. At some later date, an actual World Swordfish Meeting could still be organized if desired. This is one proposal on how this WG could proceed on this matter.

In the follow-up discussion, it was suggested that we insure the participation of swordfish experts from Canada and Spain. Other participants voiced their approval and further recommended the involvement of ICCAT. The chair noted that in order to begin the process of an actual World Swordfish Meeting, a steering committee needs to be formed in order to properly organize and plan this event for such a meeting.

The WG recommends going forward with the idea of a half-day swordfish session at the World Fisheries Congress in October 2008 that would focus on topics needed to facilitate completion of the swordfish stock assessment. Also recommended, is that a World Swordfish meeting be considered at a later date.

6.0 STRIPED MARLIN

6.1 Biological Reference Points

6.1.1 ISC/07/MARWG&SWOWG-2/03

At the March 2007 Intercessional workshop of the ISC MARWG and SWOWG, Jon Brodziak presented preliminary calculations of biological reference points for striped marlin in the North Pacific. In the work reported here, biological reference points were recalculated to incorporate the WG's comments. In particular, more age groups were included. The number of quarterly age groups was increased to represent ages 1.0 through 19.75 years. In addition, reference points were calculated using the fishery selectivity estimates from Model 1 (steepness h=0.7) and Model 2 (steepness h=1.0). The results showed that yield-per-recruit and spawning-biomass-per-recruit as functions of fishing mortality were very similar for the two models. Estimates of spawning potential ratios and associated biological reference points from the two models were also very similar. Although estimates of striped marlin reference points were similar, equilibrium yields were higher under Model 2 than Model 1. This was due to differences in recent recruitment estimates from the two models; both models exhibit a declining trend in recruitment since the 1970s.

Discussion. The working group discussed the reference points from the presentation. A recommendation was made to include uncertainty in future calculations. No single reference point was endorsed in the presentation. Other potential methods to characterize the current status of striped marlin were mentioned, but the working group focused on the suitability of F_{spr} as a candidate. It was recommended that a range of F_{spr} be presented to the plenary encompassing $F_{current}$ to $F_{40\%spr}$. The $F_{current}$ used would be the same average as used to characterize recent F in the WG document Annex 8. For each candidate reference point the tradeoff in yield-per-recruit and spawning biomass per recruit would be shown.

6.1.2. Reanalysis of Biological Reference Points

The analyses requested in the discussion of section 6.1.1 are described here. These analyses were conducted, summarized, and presented to the WGs for review and consideration.

The WG reviewed and discussed a range of yield- and spawning-biomass-per-recruit reference points for striped marlin described in Brodziak's working paper (ISC/07/MARWG&SWOWG-2/03). Biological reference points were calculated using the fishery selectivity estimates from Model 1 and Model 2. The WG noted that the results showed that yield-per-recruit and spawning-biomass-per-recruit as functions of fishing mortality were very similar for the two models (Figures 1 and 2). As a result, estimated spawning potential ratios and associated biological reference points from the two models were also very similar. Thus, the WG concluded that striped marlin reference points were robust with respect to the assessment modeling scenario and focused on the selection of an appropriate range of spawning potential ratios to ensure stock conservation and maintain fishery yield to the extent practicable. In this context, the WG considered the reference points to be suitable example candidates for target fishing mortality rates that would both maintain spawning potential and fishery yield in the absence of guidance to the contrary.

The WG focused on how the concept of spawning potential ratio might be used to help conserve the reproductive potential of the striped marlin stock. In this context, the spawning potential ratio (SPR) for a particular fishing mortality F is the ratio of the equilibrium spawning output realized at F to the unfished spawning output of the fish stock. Spawning potential ratios are usually expressed as a percentage of the maximum spawning potential which occurs when the stock is unfished. The fishing mortality that produces a particular percentage (%) of the maximum spawning potential (MSP) is denoted as $F_{\%MSP}$ or more succinctly as $F_{\%}$. For example, fishing the striped marlin stock at $F_{20\%}$ would maintain the stock at 20% of the unfished spawning potential over time. Higher fishing mortalities lead to lower SPR values and lower fishing mortalities lead to higher SPR values, all else being equal. The WG agreed that maintaining some positive level of reproductive potential will be necessary to sustain the striped marlin stock for current and future fisheries.

The WG discussed the relative benefits of maintaining various levels of striped marlin spawning potential as a biological reference point and concluded that it would be useful to consider the 20% and 40% values of MSP as candidate reference points. One rationale for this choice was that both the $F_{20\%}$ and $F_{40\%}$ have been used as biological reference points in the management of various teleost stocks. Another rationale was that the $F_{20\%}$ ($F_{20\%}$ =0.106 using model 1 and $F_{20\%}$ =0.100 using model 2) and $F_{40\%}$ ($F_{40\%}$ =0.055 using model 1 and $F_{40\%}$ =0.052 using model 2) values bracketed the natural mortality rate (M=0.075 per quarter) of striped marlin. In this case, it has been reasonably argued (see, for example, Walters and Martell 2003) that the fishing mortality that produces the maximum sustainable yield from a teleost stock is likely bounded above by the natural mortality rate. In this case, the WG believed that using the $F_{20\%}$ and $F_{40\%}$ values for striped marlin would account for uncertainty in the life history characteristics used to calculate these reference points.

The WG also considered the F_{MAX} value as a potential reference point for striped marlin. In this case, although fishing at the F_{MAX} value would produce the maximum yield per recruit (YPR) in theory, the WG observed that using this reference would diminish SPR values to less than 1% of the maximum spawning potential (Figures 1 and 2). 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 given the model results.

The WG also considered the current fishing mortality rate for striped marlin as a potential reference. In this case, the current fishing mortality rate was defined as the average fishing mortality during 2001-2003, i.e. under Model 1, $F_{CURRENT}$=0.18 and under Model 2, $F_{CURRENT}$=0.16. Thus, the current fishing mortality rate exceeds the $F_{20\%}$ and $F_{40\%}$ reference points by approximately 65% and 200%, respectively.

The WG compared the relative benefits of the $F_{CURRENT}$, $F_{20\%}$ and $F_{40\%}$ reference points in terms of increasing spawning potential and maintaining yield per recruit for Models 1 and 2 (Table 3). This comparison highlights the intrinsic tradeoff between biological conservation and fishery yield benefits of the alternative reference points. The WG observed that under either modeling scenario, the $F_{20\%}$ reference point would lead to over a 2-fold increase in SPR and about a 12% decrease in YPR relative to the current fishing mortality rate. In comparison, the $F_{40\%}$ reference point would lead to over a 4-fold increase in SPR and about a 33% decrease in YPR relative to the current fishing mortality rate. Overall, the key judgment for the comparison of the alternative reference points is whether one believes that the striped marlin stock can be sustainably fished at the current SPR of roughly 9%.

The WG also noted that the declining trend in recruitment is another important factor in considering the relative merits of increasing spawning potential versus maintaining yield per recruit of the striped marlin stock. Recent average recruitment (1996-2003) is less than one-half of the long-term average recruitment (1965-2003). Assuming that recent average recruitment and recruitment variability persists; it is not likely that recent average yields (1996-2003) of striped marlin could be sustained under Model 1 (Figure 3). This suggests that maintaining the recent average effective fishing effort for striped marlin in future years will cause further declines in striped marlin stock abundance, and subsequently yield. In comparison, it is possible that recent average yields of striped marlin could be sustained under Model 2 (Figure 4). However, this might require an increase in fishing mortality rate, since the average equilibrium yield at the current average fishing mortality rate (0.16) is about 500 mt below the recent average yield. It is noted, however, that the 80% confidence interval of potential yield does include this value. This suggests that maintaining the recent average yield in future years may be possible, but only if there are no further declines in recruitment or decreases in effective fishing effort for striped marlin.

Table 3. Striped marlin percent of maximum yield-per recruit and spawning potential using $F_{CURRENT}$, $F_{20\%}$ and $F_{40\%}$ reference points under assessment Model 1 or Model 2.

Model 1 Reference Points	Percentage of Maximum Yield Per Recruit	Percentage of Maximum Spawning Potential
$F_{CURRENT} = 0.18$	90%	9%
$F_{20\%} = 0.11$	79%	20%
$F_{40\%} = 0.06$	59%	40%
Model 2 Reference Points	Percentage of Maximum Yield Per Recruit	Percentage of Maximum Spawning Potential
$F_{CURRENT} = 0.16$	91%	9%
$F_{20\%} = 0.10$	80%	20%
$F_{40\%} = 0.05$	60%	40%

Figure 1. Striped Marlin Yield and Spawning Biomass per Recruit Using Fishery Selectivity from Model 1

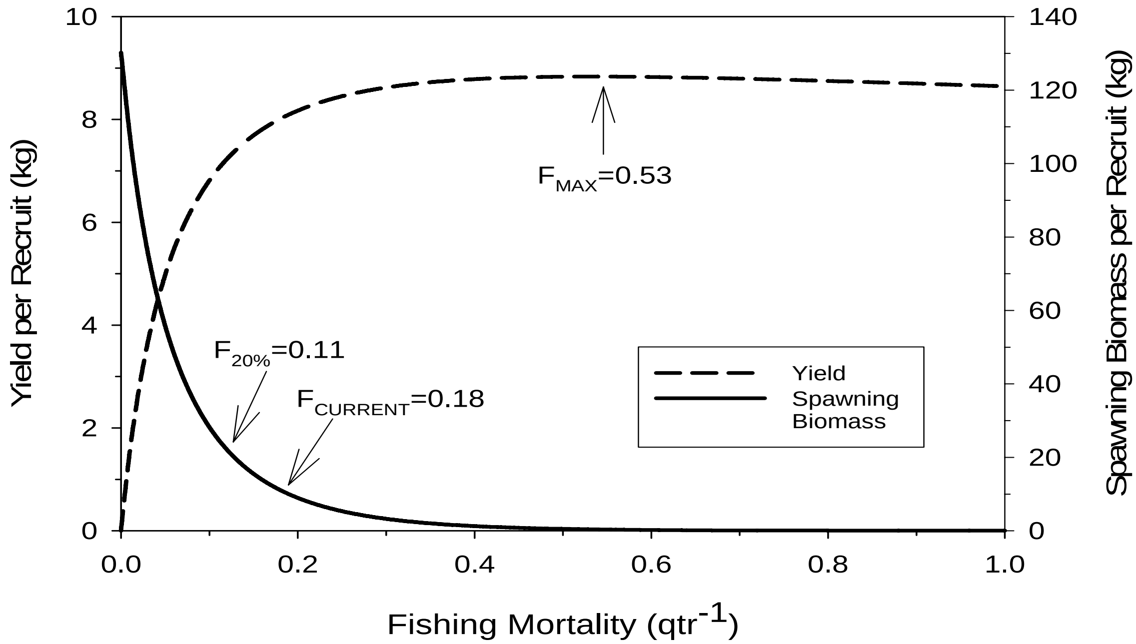


Figure 2. Striped Marlin Yield and Spawning Biomass per Recruit Using Fishery Selectivity from Model 2

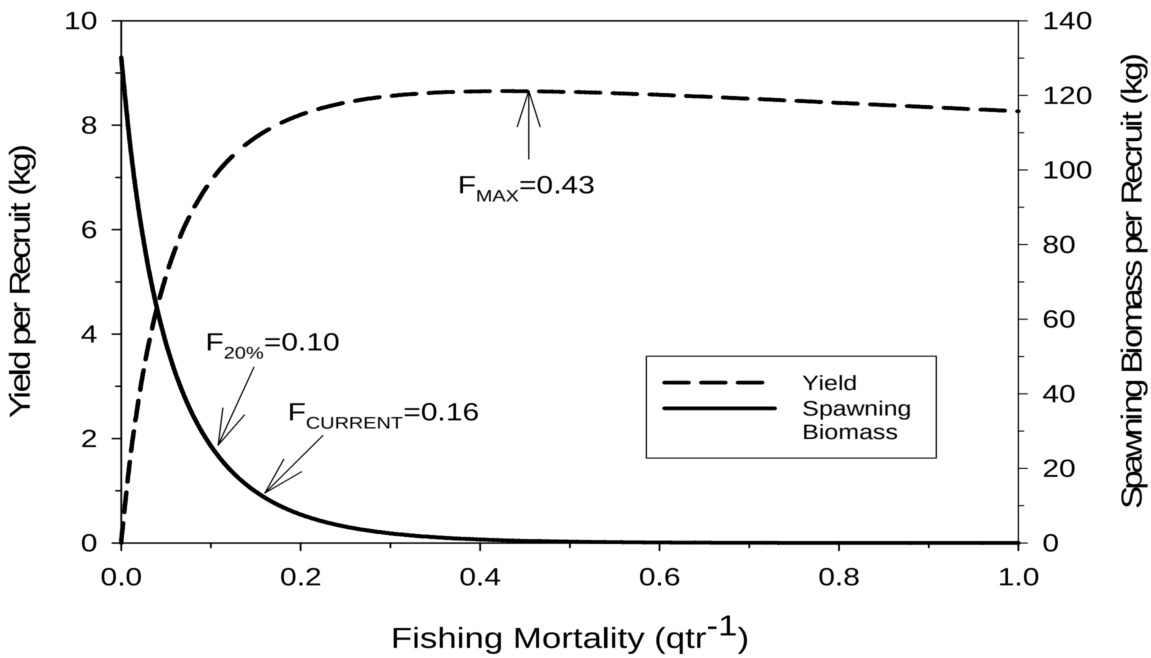


Figure 3. Striped Marlin Equilibrium Yields (mt) Using Model 1
Assuming Recent Average Recruitment
in Comparison to Recent Average Yield

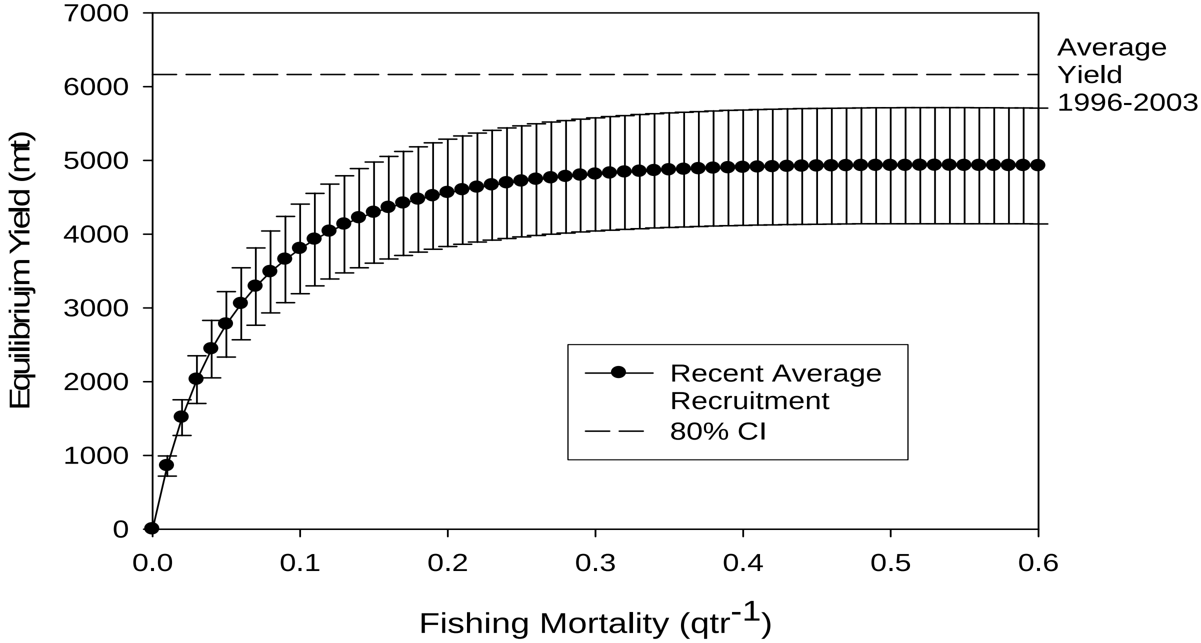
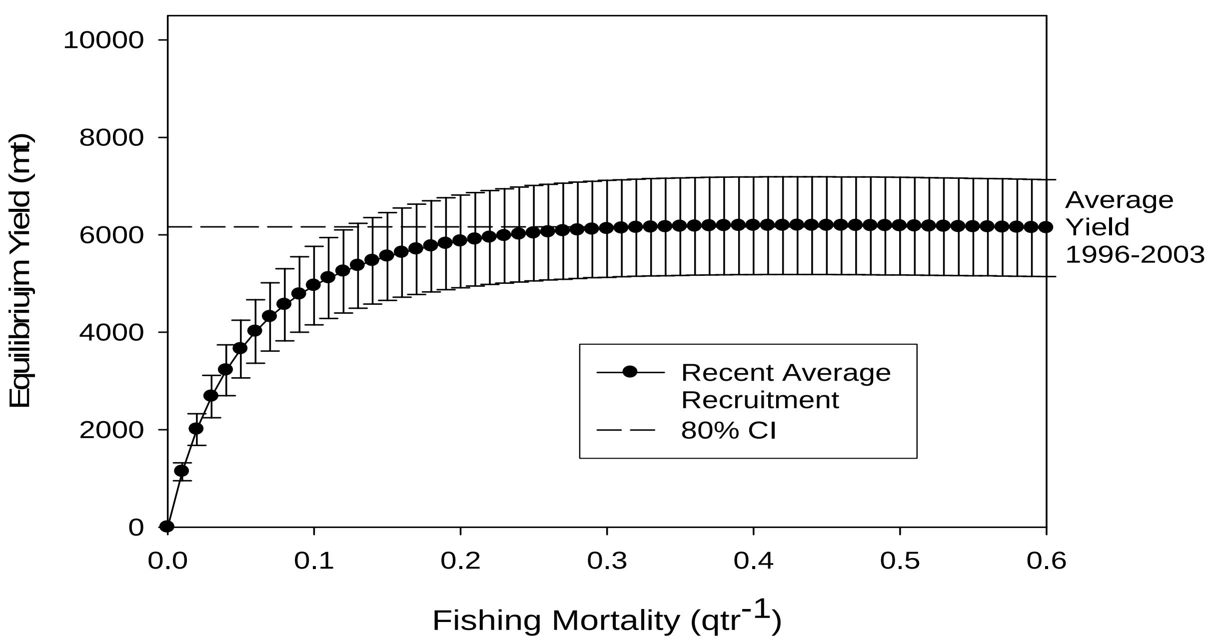


Figure 4. Striped Marlin Equilibrium Yields (mt) Using Model 2
Assuming Recent Average Recruitment
in Comparison to Recent Average Yield



6.2 Assessment results

6.2.2 ISC/07/MARWG&SWOWG-2/04

Kevin Piner presented a stock assessment of striped marlin in the North Pacific Ocean at the March 2007 Intercessional workshop of the ISC MARWG and SWOWG. A series of model investigations were completed after the meeting to test the performance of the assessment models. It was noted that the size composition of the driftnet fishery was not consistent with the growth curve assumed in the model. However, further evaluations of the model to discount or eliminate this inconsistency were conducted and do not show marked differences in results relative to the assessment produced during the March 2007 meeting. Other assumptions in the model also appear to be reasonable and small changes would not unduly affect assessment results. Our results support the use of Spawner/Recruit steepness as the axis of uncertainty. This work also supports the use of the stock assessment as a basis for making management recommendations.

Discussion. These analyses investigate the sensitivity of the striped marlin stock assessment model to three technical issues that could not be addressed at the March intercessional meeting due to time constraints. The first issue was whether model results were sensitive to fishing mortality estimates in several years during the 1970s when model estimates of F for one fishing fleet were constrained by the assumed upper bound of feasible harvest rates. The second issue was whether model results were sensitive to the assumed amount of variability in predicted size at age for the striped marlin growth curve. The third issue was whether model results would be affected by freely estimating the stock-recruitment steepness instead of using the baseline assumption of a steepness value of h=0.7.

The baseline striped marlin stock assessment model included a constraint that no more than 90% of the available biomass could be harvested in the Japanese driftnet fishery in any year. This F-penalty constraint was applied to ensure that estimates of exploitable biomass were sufficient to explain the observed catches of the Japanese driftnet fishing fleet. Sensitivity analyses suggested that application of the F penalty helped to resolve the inconsistency between the length composition of the Japanese driftnet fishery catches and the asymptotic size of the striped marlin growth curve. Results indicated that the application of the F penalty had a minimal affect on stock status. Further, using different approaches to setting the F penalty constraint did not significantly change model estimates of trends in striped marlin biomass.

The baseline striped marlin stock assessment model included the assumption that the coefficient of variation (CV) of length at age was approximately 7.5%. Sensitivity analyses using a CV of 5% and 10% indicated that the scaling of estimated biomass was sensitive to the assumed CV with a CV of 10% implying a lower absolute biomass and a CV of 5% implying a higher absolute biomass. However, the relative trend in biomass was not sensitive to the assumed CV of length at age for the striped marlin growth curve.

The baseline striped marlin assessment model included the assumption that the stock-recruitment steepness parameter was reasonably approximated at h=0.7. The alternative model of environmentally-forced recruitment variation about a mean recruitment level had an assumed steepness of h=1.0. The sensitivity of model results to fixing steepness at a constant value were evaluated by freely estimating the steepness parameter within the model fitting process. The results of this sensitivity analysis showed that the estimated steepness value of h=0.73 was not significantly different from the assumed baseline value of h=0.7. Furthermore, estimated trends in striped marlin biomass from 1970-2002 were nearly identical across steepness values of 0.7, 0.73, and 1.0. Overall, this sensitivity analysis indicated that the baseline value of h=0.7 was consistent with the observed data and that biomass trends were similar across a range of steepness values from 0.7 to 1.0.

6.3 Assessment Concerns

The WG concluded that there was a clear decline in striped marlin abundance since the 1970s. However the actual magnitude of decline may be under-, or over-estimated given the noted uncertainties in assessment data and model structure. Additionally:

- The WG concluded that the stock-recruitment steepness parameter appeared to be the most important axis of uncertainty for evaluating stock status of striped marlin. In general, higher steepness values implied relatively lower stock depletion while lower steepness values implied greater stock depletion.

- The WG expressed concern that almost all of the CPUE data in the assessment, especially in the most recent years was from the western Pacific. The relatively short time series of CPUE values from the eastern Pacific was a limiting factor for assessing biomass trends in this region. In particular, the stock assessment model includes the implicit assumption that biomass trends in the eastern and western Pacific are similar during periods in which there is no relative abundance information for the eastern Pacific. To address the concern that the western Pacific data could be unduly influencing stock assessment results, it was suggested that a split area assessment could be conducted.

- The WG noted that there was limited empirical information on striped marlin life history characteristics across the species range in the north Pacific. In particular, the relatively larger sizes evident in the eastern growth curve were not apparent in the fishery length composition data. This suggests that spatial variation in striped marlin growth may not be adequately approximated in the assessment model, primarily due to a lack of size at age observations over the species range.

- The WG noted that the lack of total enumeration of striped marlin catch, including discards and unreported landings, was a source of concern.

- The WG suggested that there should be further investigation of the use of aggregated fishery length frequency data for stock assessment. In particular, the WG felt that it was important to determine the best way to construct length compositions for individual fisheries by region.

6.4 Research needs

The research needs outlined below are provided as potential solutions to some of the uncertainties outlined in the previous section.

One research need is to conduct two separate assessments, one for the eastern Pacific and one for the western. It was noted that the western Pacific has a longer time series of data than the eastern Pacific. It was asked if there was a recreational fishery which might provide an index of abundance in the eastern Pacific region and Hinton indicated that the local recreational areas of Mexico provide a measure of local depletion, and possibly for a larger area. He referenced previous work presented at the 1988 Billfish Symposium as a starting point. These would be areas adjacent to available longline data outside the recreational management zone of Mexico.

Future research topics:

- Stock assessment: Increase reliability of standardized CPUE time series in all areas, especially in the EPO. Investigate effective area delimitations for optimizing CPUE standardizations and stock assessments;

- Age and growth: Growth curves for the western and central North Pacific are lacking and collaborative age & growth studies need to be initiated in both. In the eastern Pacific off Mexico, the previous age & growth study by Melo-Barerra et al. (2003) did not have access to the largest sized striped marlin taken only in the purse seine fishery. It was recommended to check whether CICMAR and/or CICESE (Mexico) has on-going research on striped marlin age and growth, and if so, whether results are available or coordination with INP, IATTC, and others in the region, in a new sampling program to collect these large sized specimens would be possible; and

- Assess the accuracy and reliability of available striped marlin size data and CPUE metrics, including the underlying experimental designs implemented to collect such data.

6.5 Conservation Advice

The WG discussed how to characterize the status of the striped marlin stock that reflected our concerns about the health of the population but also the uncertainty of the data and indices used in the stock assessment. It was noted that declines in catch and declines in CPUE from several different fisheries support the conclusion that the marlin population has declined, but the precise extent of the decline is uncertain.

The WG discussed what the objectives and responsibilities of the WG were with respect to describing management implications. It was noted that the WG will need to know the management objectives to provide specific guidance. It was decided that a range of reference points and resulting stock status would be presented, along with impacts to the stock and yield if that reference point is adopted. The WG recommended that projections be provided to the plenary if possible to clarify the impacts.

After reviewing results from the reanalysis of biological reference points and striped marlin assessment, the following management implications are proffered:

- Catches are at record low levels due to declines in effort, and decreases in stock abundance. We cannot discern between the two factors;

- If $F_{20\%}$ were an appropriate reference point, then the stock is experiencing excessive fishing mortality; and

- If the recent (2001-2003) fishing mortality ($F_{9\%}$) rate were to continue, projections indicate that both the spawning population and yield would decline below the initial (2004) levels over the next 3 years. If harvest rates correspond to $F_{20\%}$ or $F_{40\%}$, then both spawning biomass and yield would increase over the next 3 years to levels above the beginning levels.

It is important to keep in mind that uncertainty persists with the catch time series. Modifications to the catch time series have not been incorporated, and may change the stock determination. Research to address this uncertainty has been identified in section 6.4.

7.0 FUTURE ASSESSMENT & MEETING SCHEDULE

7.1 Meeting schedule

Gerard DiNardo discussed upcoming meetings of the ISC (WG and Plenary) and other HMS RFMOs over the period 2007-2009. To avoid conflict with other meetings, the next two intercessional WG meetings have been scheduled outside of the normal time periods. The next two intercessional meetings have been scheduled in mid-January and early June of 2008. Other dates for 2007-2008 were not available due to scheduling conflicts. The Chairman also proposed that WG meetings no longer be scheduled immediately prior to the plenary session.

After considerable deliberations, the WG settled on specific dates and venues for the next two intercessional meetings, including:

- January 15-23, 2008, most likely in Hawaii, USA

- June 3-10, 2008 in Hokkaido, Japan

The WG would resume the October and March schedule for intercessional meetings after the ISC Plenary meeting in July 2008.

7.2 Future assessments

Completion of the swordfish stock assessment was pushed back one year to July, 2009, at the request of the Plenary Committee. This will provide the WG enough time to collect requisite catch and effort data, and the plenary time to thoroughly review assessments and craft effective management advice. The WG agreed to a target completion date of 2010 for the blue marlin assessment. The WG also agreed to hold off on determining a completion date for a black marlin assessment.

8.0 ADJOURNMENT

The workshop was adjourned at 16:47 on July 21, 2007. The Chairmen expressed their appreciation to the rapporteurs and to all participants for their contributions and cooperation in completing a successful meeting.

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	Other2	Total	Distant-water Longline	High seas Drift Gillnet	Offshore Longline	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					-		-		0			0				59	59	7,360
1959	4,152		156	0	2	3,191	7,501					-		-		0			0				65	65	7,566
1960	3,862		101	0	4	1,937	5,905					-		-		0			0				30	30	5,935
1961	4,420		169	0	2	1,797	6,388					-		-		0			0				24	24	6,412
1962	5,739		110	0	8	1,912	7,770					-		-		0			0				5	5	7,775
1963	6,135		62	0	17	1,910	8,124					-		-		0			0				68	68	8,192
1964	14,304		42	0	2	2,344	16,691			560	199	759		-		0			0				58	58	17,508
1965	11,602		19	0	1	2,796	14,418			392	175	567		-		0			0				23	23	15,008
1966	8,419		112	0	2	1,573	10,106			356	157	513		-		0			0				36	36	10,655
1967	11,698		127	0	3	1,551	13,379	2		385	204	591		-		0			0				49	49	14,018
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	11,660
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	8,766
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	8,960
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	7,373
1984	3,335	386	9	76	2,257	719	6,782	0		965	339	1,304		-		0			0				36	36	8,122
1985	3,698	711	24	40	2,323	732	7,528	0		513	181	694		-		0			0				42	42	8,263
1986	5,178	901	33	48	3,536	571	10,267	0		179	148	327		-		0	-		0				19	19	10,614
1987	5,439	1,187	6	32	1,856	513	9,033	31		383	151	565		-		0	-		0	272	30	1	28	331	9,928
1988	5,768	752	7	54	2,157	668	9,406	7		457	169	633		-		0	-		0	504	54	1	30	589	10,628

Table 1. Continued

Year	Japan: Distant-water and Offshore Longline	Japan: Coastal Longline	Japan: Other Longline	Japan: Small Mesh Gillnet	Japan: Large Mesh Gillnet	Japan: Other[3]	Japan: Total	Chinese Taipei[1]: Distant-water Longline	Chinese Taipei[1]: High seas Drift Gillnet	Chinese Taipei[1]: Offshore Longline	Chinese Taipei[1]: Other	Chinese Taipei[1]: Total	Costa Rica[1]: Sport	Korea: Longline	Korea: High-seas Drift Gillnet	Korea: Total	Mexico: Longline	Mexico: Sport[1]	Mexico: Total	United States: Longline	United States: Troll	United States: Handline	United States: Sport[1]	United States: Total	Grand Total
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	7,079
1991	2,677	1,197	3	27	1,302	506	5,712	36		254	286	576	106	-		0	-	75	75	663	40	0	12	715	7,184
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	6,884
1993	3,286	1,723	1	0	828	443	6,281	5		221	142	368	438	-		0	-	159	159	471	68	1	11	551	7,796
1994	2,911	1,284	1	0	1,443	383	6,022	1		137	196	334	521	-		0	-	179	179	326	34	0	17	377	7,433
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	47	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	47	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	50	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	42	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	55	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	51	301	151	206		206	-	237	237	351	42	2		395	4,926
2002	764	795	5	0	1,264	291	3,119	251		226	29	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	43	375	79	172		172	-	322	322	538	28	0		566	4,618
2004	(761)	(964)	(2)	(0)	(1,339)	(90)	(3,066)	261		95	24	380	(19)	(75)		(75)	-	-	0	(384)	(56)	(2)		(442)	(3,768)
2005	(803)						(803)	176		76	32	284	-	(115)		(115)	-	-	0	(377)	-	-		(377)	(1,465)

[1]Estimated from catch in number of fish.

[2]Contains 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]						Grand
															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	Other	Total	Longline	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	-	-		-	-	-	-	-	-	-	-	-	18,268
1960	20,058	51	1	1,191	23	67	7	21,400	-	-		-	-	-	-	-	-	-	-	-	21,400
1961	19,715	51	2	1,335	19	15	11	21,147	-	-		-	-	-	-	-	-	-	-	-	21,147
1962	10,607	78	0	1,371	26	15	18	12,115	-	-		-	-	-	-	-	-	-	-	-	12,115
1963	10,322	98	0	747	43	17	16	11,243	-	-		-	-	-	-	-	-	-	-	-	11,243
1964	7,669	91	4	1,006	42	17	28	8,858	-	343	18	361	-	-	-	-	-	-	-	-	9,219
1965	8,742	119	0	1,908	26	14	182	10,991	-	358	10	368	-	-	-	-	-	-	-	-	11,359
1966	9,866	113	0	1,728	41	11	4	11,764	-	331	27	358	-	-	-	-	-	-	-	-	12,122
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	1	461	267	20	752	12,822
1982	6,064	874	1,257	195	58	7	0	8,546	1	855	49	905	-	1,365	5	2	911	156	43	1,117	11,933
1983	7,692	999	1,033	166	30	9	2	9,931	0	783	166	949	-	120	5	1	1,321	58	378	1,763	12,763
1984	7,177	1,177	1,053	117	98	13	0	9,635	-	733	264	997	-	47	3	14	2,101	96	678	2,892	13,571
1985	9,335	999	1,133	191	69	10	0	11,737	-	566	259	825	-	18	2	46	2,368	211	792	3,419	15,999
1986	8,721	1,037	1,264	123	47	9	0	11,201	-	456	211	667	-	422	2	4	1,594	236	696	2,532	14,822
1987	9,495	860	1,051	87	45	11	0	11,549	3	1328	190	1,521	-	550	24	4	1,287	211	300	1,826	15,446
1988	8,574	678	1,234	173	19	8	0	10,686	-	777	263	1,040	-	613	24	19	1,092	180	344	1,659	13,998

Table 2. Continued

	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	Other	Total	Longline	All Gears	Longline	Longline	Gill Net	Harpoon	Unknown[7]	Total	Grand Total
1989	6,690	752	1,596	362	21	10	0	9,431	50	1,491	38	1,579	-	690	218	29	1,050	54	224	1,575	13,275
1990	5,833	690	1,074	128	13	4	0	7,742	143	1,309	154	1,606	-	2,650	2,436	18	1,028	50	137	3,669	15,667
1991	4,809	807	498	153	20	5	0	6,292	40	1,390	180	1,610	-	861	4,508	39	836	16	137	5,536	14,299
1992	7,234	1,181	887	381	16	6	0	9,705	21	1,473	243	1,737	-	1,160	5,700	95	1,332	74	44	7,245	19,847
1993	8,298	1,394	292	309	43	4	1	10,341	54	1,174	310	1,538	-	812	5,909	165	1,400	169	36	7,679	20,370
1994	7,366	1,357	421	308	37	4	0	9,493	-	1,155	219	1,374	-	581	3,176	740	799	153	8	4,876	16,324
1995	6,422	1,387	561	440	17	7	0	8,834	50	1,135	225	1,410	-	437	2,713	279	755	96	31	3,874	14,555
1996	6,916	1,067	428	633	9	4	0	9,057	9	701	31	741	12	439	2,502	347	752	81	10	3,692	13,941
1997	7,002	1,214	365	396	11	5	0	8,993	15	1,358	61	1,434	246	2,365	2,881	664	707	84	3	4,339	17,377
1998	6,233	1,190	471	535	9	2	0	8,441	20	1,178	41	1,239	123	3,603	3,263	422	924	48	13	4,670	18,076
1999	5,557	1,049	724	461	2	5	0	7,798	70	1,385	61	1,516	104	1,136	3,100	1,333	606	81	2	5,122	15,676
2000	6,180	1,121	808	539	7	5	1	8,661	325	1,531	86	1,942	161	2,216	2,949	1,908	646	90	9	5,602	18,582
2001	6,932	908	732	255	5	15	0	8,848	1,039	1,691	91	2,821	349	780	220	1,763	375	52	5	2,415	15,213
2002	6,230	965	1,164	222	8	11	0	8,600	1,633	1,557	27	3,217	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	11	3,291	311	671	147	1,812	216	107	0	2,282	14,325
2004	(6165)	1,454	1,339	33	33	23	1	(9,048)	884	1,828	16	2,728	(350)	270.1	(213)	(898)	182	89	(37)	(1,419)	(14,883)
2005	(6972)							(6,972)	437	1,813	26	2,276	(407)	234.5	(1,360)	-	219	73	(0)	(1,652)	(13,506)
2006														347.2							

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

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

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

[4]For 1952-1970 "Other" refers to catches by other baitfishing methods, trap nets, and various upspecified 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…(Al Coan to provide footnote)

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Attachment 2. Working Papers

ISC/07/MARWG&SWOWG-2/01	Some information on the Japanese billfish catches in the north Pacific. K. Yokawa. (yokawa@fra.affrc.go.jp)
ISC/07/MARWG&SWOWG-2/02	Area stratification using the tree-glm algorithm: A new method for standardizing CPUE of swordfish in the North Pacific. M. Ichinokawa & J. Brodziak. (ichimomo@fra.affrc.go.jp)
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, & J. Brodziak. (Kevin.Piner@noaa.gov)

Attachment 3. Agenda

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

MARLIN AND SWORDFISH WORKING GROUP WORKSHOP

Pusan National University
Sangnam International House
Geumjeong-gu
Busan 609-735, Korea

July 19-20, 2007

July 19 (Thursday), 0930-1000 – Registration

July 19 (Thursday), 1000-1700

1. Opening of Joint Intercessional MARWG&SWOWG Meeting
    a. Welcome remarks
    b. Introductions

2. Adoption of agenda and assignment of rapporteurs

3. Administrative Activities
    a. Consolidation of ISC Marlin and Swordfish Working Groups
        - ISC Billfish Working Group
    b. Chairman elections
    c. Establishment of blue marlin assessment “steering committee”

4. Progress of previous work assignments
    a. Data requests

5. Swordfish
    a. Data catalogues
        - (Category I, II, and III)
        - CPUE
    b. Area stratification
    c. Research needs or plans to address data gaps

6. Marlin and Sailfish
    a. Data catalogues
        - (Category I, II, and III)

7. Striped Marlin
    a. Biological reference points
    b. Assessment results & craft stock status statement
    c. Management implications
        - Assess impacts from fishing (based on reference points)
        - Craft management implications (include projections if possible)
    d. Assessment concerns-significant uncertainties and deficiencies
    e. Research needs or plans to address assessment uncertainties and deficiencies (e.g., Japanese CPUE standardization proposal; WCPO & EPO assessments; rigorous analysis of size data; international biological sampling program)

Reception for ISC Working Groups, 1730

July 20 (Friday), 1100-1700

7. Striped Marlin
    c. Management implications (cont.)

July 21 (Saturday), 1300-1700

8. Future assessment & meeting schedules

9. Finalize Report

10. Adjournment

Reception for ISC Working Groups, 1730