ANNEX 5

REPORT OF THE SIXTH MEETING OF THE INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC OCEAN

Plenary Session, March 23-27, 2006
La Jolla, California U.S.A.

Report of the Marlin Working Group Meeting (November 15-21, 2005, Honolulu, HI, U.S.A.)

1.0 INTRODUCTION

The Marlin Working Group (MARWG) of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean convened a Striped Marlin Stock Assessment Workshop in Honolulu, Hawaii from November 15-21, 2005. The goal of the workshop was to bring together scientists to review and compile submitted data, and assess the status of striped marlin in the North Pacific. The workshop was a recommendation from the previous intercessional meeting of the MARWG, at which the roles and responsibilities of ISC member countries and institutions to ensure completion of the assessment were defined. Gerard DiNardo, Chairman of the MARWG welcomed participants (Attachment 1) and Robert Humphreys was appointed as rapporteur. Working papers were distributed (Attachment 2) and the meeting agenda adopted (Attachment 3).

2.0 REVIEW OF CATEGORY I, II, AND III DATA

Prior to the workshop each country was asked to provide Category III data, standardized CPUE series (indices of abundance) and documentation describing the methods used to derive the standardized series to the Marlin Working Group chair. ISC member countries that had not provided Category I and II data to the ISC Statistics Working Group (STATWG; originally requested in July 2005), or during the previous intercessional meeting, were also asked to provide these data prior to the workshop. Submitted data were to be compiled in the standard ISC format as defined by the ISC Statistics Working Group.

For the most part the requests were generally ignored, despite numerous follow-up written requests. Given the fact that the ISC has no overarching authority to require data submittals, requests can go unanswered with impunity.

2.1 Category I data

At the workshop, Category I data were submitted for the U.S. Hawaii longline fishery, U.S. California recreational fishery, Mexico recreational fishery (catch in number) , Mexico longline fishery (from IATTC), Japanese longline fisheries (coastal, offshore, and distant), Japanese large mesh high-seas driftnet fishery, and Costa Rica (from the IATTC-fishing type is longline). Chinese-Taipei, China and Korea did not provide Category I data. Submitted data were reviewed and, when possible, corrections applied. The participants voiced concern over the lack of available Category I data, which could hamper the completion of the assessment. It was decided to review the Category II data contained in the ISC Database to estimate the magnitude of deficiency of Category I data.

2.2 Category II data

At the workshop, Category II data were submitted for the U.S. Hawaii longline fishery, Chinese-Taipei distant water longline fishery, Japanese offshore and distant-water longline fisheries, Japanese coastal longline (1994 – 2004) and Japanese large mesh high-seas drift net fishery (1977 – 1993). Japan reported that coverage of the data for the Japanese coastal longline and large mesh drift net fisheries was not 100%, and that these data can only be used for limited purposes, such as estimation of abundance indices and seasonal catch patterns.

Korea was contacted during the course of the meeting and again asked to submit Category II data, which it did by authorized release of information held in IATTC databases. These data were compared to and determined to be in agreement with the effort data series in the ISC North Pacific Albacore Database.

Chinese-Taipei did not submit striped marlin catch statistics for its coastal longline fishery. To estimate the overall impact of total catch from this fishery, workshop participants reviewed the annual strip marlin catch statistics found in the Taiwanese Year Books. The coastal longline fishery has operated since 1965, and the reported catch of striped marlin in this fishery ranged from 500 to 1200 tons for the period before 1993. Since 1993 catch has declined, ranging from 100 to 300 tons. While the overall catch of striped marlin in the North Pacific by Chinese-Taipei was not considered great, participants agreed that catch statistics from the coastal longline should be submitted in an effort to construct an accurate catch table. It was recommended that Chinese-Taipei submit information about this fishery to the STATWG and that the data correspondent be contacted regarding this recommendation.

It was pointed out that Category II data from the Chinese-Taipei distant water longline fishery was significantly different from previously submitted data. For example, catch in recent years was almost doubled compared to previously submitted data. A similar pattern was observed with fishing effort. Changes in reported longline catch and effort was thought to be due to corrected fishing locations that moved fishing catch and effort from the South Pacific to the North Pacific. Because no representative from Chinese-Taipei was present at the assessment workshop, nor did their data correspondent attend the August/September 2005 MARWG Intercessional Meeting, explanations for the change were not provided. The Chair of the MARWG conferred with Al Coan, the U.S. data correspondent of the North Pacific Albacore Working Group (ALBWG), who noted that the ALBWG has had similar concerns and the issue remains unresolved.

Clarke reported the results of a comparison between the total annual catch of striped marlin (in numbers) in the North Pacific provided to the workshop and the public domain longline catch and effort data (monthly 5° x 5°) of Secretariat of the Pacific Community (SPC) (ISC/05/MARWG/01) . The SPC database contains catch and effort statistics from all countries fishing in the North Pacific and such a comparison would provide an approximation of completeness. Because the SPC public domain database does not report the catch of striped marlin in the North Pacific, catch estimates were developed using reported number of hooks in the SPC database and standardized CPUE values for the major fisheries operating in the North Pacific. Results indicate close agreement with nominal reported catch from Japan, Chinese-Taipei, U.S., and estimated total catch for the SPC. While the similarity in catch suggests that substitution may be possible, the public domain database does not contain detailed information, such as name of country and fishery.

A follow-up comparison between Korean longline reported catch statistics and the SPC database detected potential discrepancies. Further analyses are required to fully understand the observed discrepancies. Participants also recommended extending the comparisons to cover all fisheries and various other databases which may be utilized as inputs to stock assessments of the ISC. Participants discussed the merits of detailed data (name of country and fishery) and concluded that the SPC public domain database was not sufficient for our needs. It was decided that the Albacore Database should be examined to determine its utility in filling in the data gaps of submitted category II effort data. The Albacore Database has good information on fishing effort by country and fishery, while the quality of striped marlin catch data is unknown. The STATWG provided the requested data, but the present format of the database made it impossible to use. The ISC Statistics Working Group was made aware of the situation. The data was eventually provided by Al Coan of the ALBWG.

2.3 Category III data

Saito reported on the current conversion factor of striped marlin from processed weight (gilled and guttered) to the eye-fork length, and reviewed the availability of size data from Japanese fisheries (directed and converted length data were combined) (ISC/05/MARWG/02). The availability of size data in the northwest Pacific Ocean for the period between 1970 and 2002 appears to be adequate. Sample sizes in the other area, especially for periods after the 1980's, are likely to be small. There was concern among participants that these limitations could hamper the application of an integrated length-based stock assessment model.

Size data from the U.S. Hawaii longline, eastern Pacific purse seine fisheries, and Chinese-Taipei longline fisheries were submitted at the workshop. The participants expressed a general concern over the lack of size data reported by Chinese-Taipei. Significantly more size information from their offshore and coastal longline fisheries was presented at the recent Intercessional meeting in Shimizu, Japan, and these data do not appear to be included as part of the submitted data set.

3.0 REVIEW OF AREA STRATIFICATION AND ABUNDANCE INDICES

3.1 CPUE standardization of Japanese offshore and distant-water longliners

Shono reported the results of a preliminary study for developing a statistical method to stratify the area used for CPUE standardization using a tree-regression model (TRM) (ISC/05/MARWG/06). Two types of algorithms for tree-regression models (CART and CHAID) were tested, and results compared to those estimated using traditional GLM standardizing methodology. Results suggest that the pattern of partitioning for area stratification is largely dependent on the algorithm used, but reasons for the observed large difference in the patterns of the partitioning between the two algorithms is unclear. In addition, results from both TRM algorithms differed from those estimated using traditional longline CPUE standardization approaches.

Participants support the development of statistical methodologies for delineating fishing zones (boundaries) and recommend further development by the researchers. Applying a more rigorous (statistical) approach is more advantageous than the current approach (expert judgment) used during most North Pacific stock assessments. The group also recommended additional studies to understand the reasons for the observed differences between the two algorithms and the traditional GLM approaches. Because of the premature nature of the TRM results, participants agreed to use the traditional GLM methods to define fishing zones in the current assessment.

Yokawa reported the results of CPUE standardization (number /1000 hooks) studies using a GLM approach for striped marlin caught by Japanese offshore and distant-water longliners in the North Pacific (ISC/05/MARWG/03). Two aggregated databases with varying levels of detail are available for analysis with an overlapping period. Database I contains monthly information starting in 1952 on catch (number) and effort (number of hooks) aggregated by 5° x 5° block. Database II commenced in 1975 and contains geo-referenced catch and effort data similar to Database I, as well as detailed fishing operations information including the number of branch lines between floats that can be used as a proxy for target species. GLMs were developed for each database and a weighting scheme applied to a 5-year overlapping period (1975-1979) in an effort to connect the two databases and assign fishing target to Database I.

The following GLM models were applied for standardization.

Database I:

$$\ln(CPUE_{ijk}+const)=\ln(\mu)+\ln(YR_i)+\ln(QT_j)+\ln(AR_k)+\ln(INTER)+\varepsilon$$

Database II:

$$\ln(CPUE_{ijkl}+const)=\ln(\mu)+\ln(YR_i)+\ln(QT_j)+\ln(AR_k)+\ln(GE_l)+\ln(INTER)+\varepsilon_{ijkl}$$

where ln: natural logarithm, $CPUE_{ijk}$: nominal CPUE (catch in number per 1,000 hooks, in year i, quarter j, area k), const: 1/20 of overall mean, μ: overall mean, YR_i: effect of year i, QT_j: effect of quarter j, AR_k: effect of area k, GE_l: effect of gear configuration l, INTER: interaction terms between YR*AR, YR*QT and AR*QT for Database I, and YR*AR, YR*QT, AR*QT, AR*GE, and GE*QT for Database II, and ε: normal error term.

The results suggest that the GLM model used in this CPUE standardization analysis was not sufficient to assign fishing target (i.e. striped marlin) to Database I. In particular, striped marlin directed fishing effort, which occurred in the eastern Pacific between the 1960's and 1980's, could not be correctly assigned using the present model.

Participants discussed the structure of the GLM models used in the analysis, and though theoretically correct, too many interaction terms in the model reduce our ability to detect true effects. In the worst case scenario, this could result in a standardized CPUE series that is very similar to the nominal CPUE series, when in reality they are very different. Previous comparative studies of the Japanese offshore and distant-water longline fisheries in the North Pacific (ISC/05/MARWG&SWOWG/16) indicated a mix of gear configurations (number of hooks between floats) when targeting the same species in the same area, and also different species in different areas. This suggests that interaction terms among year, area, gear and seasons should be incorporated into the GLM model when standardizing CPUE. The group agreed that further study is necessary to detect striped marlin directed sets.

3.2 CPUE standardization of Japanese coastal longliners

Standardized CPUE of Japanese coastal longliners using a GLM modeling approach was reported by Yokawa (ISC/05/MARWG/04). In this study, Japanese coastal longline vessels are defined as those vessels whose size is less than 20 tons, and operate in the northwest Pacific mainly targeting tunas and swordfish throughout the year. Logbook data was available since 1994 and an abundance index of striped marlin was estimated for the period between 1994 and 2004. The coverage of logbooks is not accurately known, but it is believed to be more than 80%, and set by set data was used for the CPUE analysis. Effects of year, area, quarter and interaction terms were introduced into the model, but the information for the number of hooks between float was not introduced because of the limited coverage in the database. The period analyzed is limited to the most recent 10 years and the operational pattern of Japanese longliners would not change largely within this period. The trend of standardized CPUE of Japanese coastal longliners for 1994 – 2004 showed a similar declining trend to the one of Japanese offshore and distant-water longliners (Fig. 1). The group agreed to consider that this is a strong sign that the stock has declined in the last decade.

3.3 CPUE standardization of the Hawaii-based longliners

Bigelow reported on CPUE standardization of the Hawaii longline fishery (presentation only). Striped marlin CPUE from the Hawaii-based fishery was standardized by an integrated use of fishery observer records, commercial logbooks, and sales records from the United Fishing Agency auction in Honolulu. Briefly, the fishery observer data are used to fit a generalized additive model (GAM) as:

gam(formula = strmar ~ s(date, df = 40) + s(SSTC, df = 5) + s(latitude, df = 10) + s(longitude, df = 10) + s(veslen, df = 5) + s(hooks, df = 5) + s(bstime, df = 5), family = robust(poisson))

where strmar is the number of striped marlin, date is the year and month of the longline set, SSTC is the sea surface temperature (ºC), veslen is the vessel length, and bstime is the time at the beginning of the set.

The model in this case was fitted to 13,737 observed longline sets. This represented 95.3% of observed effort during the first 10 years of the Hawaii Longline Observer Program. GAM coefficients were then applied to the corresponding predictor values in the logbooks (n=104,843 sets) to predict catches.

A standardized CPUE trend was estimated from year and month coefficients of the GAM as applied to the unobserved longline sets (Fig. 2). Mean values of the six explanatory variables other than the time effect were used to generate standardized values for each year and month from March 1994 to February 2004. Standardized CPUE estimates were typically higher than nominal CPUE from 1994 to 1997; thereafter trends were similar. There was no observer program prior to March 1994, thus the GAM model could not be applied. No attempt was made to standardize CPUE prior to March 1994 and standardized CPUE for the 39,792 longline sets were assumed to be the same as nominal values. The entire database contains 158,372 longline sets.

3.4 Mexico Recreational Fishery

Fleischer provided a report describing striped marlin catches by the Mexican recreational fishery (ISC/05/MARWG/07). Striped marlin is the most abundant billfish targeted by the Mexican recreational fishery and all billfish, except for swordfish, are reserved for recreational fisheries. Data on the Mexican striped marlin recreational fishery spans the period between 1985 and 2003 and is collected by the SFMP-INP in Mexico. About 90% of the recreational fishing trips were conducted in Baja California Sur, and the rest in the Mazatlan area. The average total annual catch (by number) of striped marlin from 1990 to 2003 was estimated to be 14,690 fish and approximately 75% are reported to be released alive. Highest catches were consistently reported from the Baja California Sur area. Total number of trips and catch of striped marlin gradually increased from 1990 to 2003. There was no apparent trend in average size and catch ratio of striped marlin in the same period.

3.5 Discussion on Area Stratification and Abundance Indices

A larger area stratification (5 areas), as shown in the lower panel of Fig. 3, was adopted for the current assessments, and stems from the study used to standardize CPUE in Japanese offshore and distant-water longline fisheries (upper panel of Fig. 3). The five areas were developed by grouping similar geo-referenced Japanese offshore and distant water longline CPUEs and area boundaries delineated.

3.6 Data Corrections for the Effect of Striped Marlin Directed Sets

Workshop participants noted that some Japanese longliners operating within Area 5 were actively targeting striped marlin and that this targeting was limited to a small area off Mexico (Fig. 4) from 1964 to 1974 and from 1980 to 1990 (Fig. 5). This area has CPUE values that are typically 20 times greater than the average in other North Pacific areas. The effect of the striped marlin directed sets on the North Pacific CPUE values is illustrated in Figure 6. High nominal CPUE values from 1964 to 1974 result from the directed sets. The group discussed aspects of including the directed fishery given that CPUE trends were heterogeneous in area 5. For the assessments models, it was concluded that the Japanese distant-water fishery in area 5 would be represented by two fisheries: (1) corresponding to the spatial area in Figure 4 and (2) all other areas in Region 5 (Figure 3) which correspond to the east of 125ºW and north of the equator. A more stable overall CPUE series is obtained if CPUE is estimated from the North Pacific with the area near Mexico treated separately.

3.7 Modifications to CPUE Using Statistical Habitat Models

Kanaiwa reported the results of a CPUE standardization study for striped marlin caught by Japanese offshore and distant-water longliners using a statistical habitat model (statHBS) (ISC/05/MARWG/05). The statHBS allows parameter (e.g., habitat preferences and factors modifying the behavior of the gear or species) estimation based on the fit of the model to observed catch, effort and operational data, as well as oceanographic and presumed habitat preference data. Previous data on striped marlin habitat preferences (Hinton and Nakano 1996) were used as priors in the current model within a Bayesian context.

Participants were generally encouraged with the research. The group discussed selection of the area stratification system for statHBS and decided to use the adopted stratification (5 regions) as shown in Figure 3.

3.8 Vertical Distribution of Striped Marlin

In the statHBS, the vertical distribution pattern of striped marlin was used as an input prior. The group discussed selection of the appropriate prior. The results of the electronic tag studies indicated that the vertical distribution pattern of striped marlin is regulated by the relative temperature to the surface, while the result of longline research data analysis suggested the vertical CPUE pattern of striped marlin appeared to be more closely related to absolute depth than to the relative temperature to the surface. The group compared the results of statHBS by vertically distributing striped marlin according to three methods: 1) absolute depth, 2) temperature relative to the surface (delta_T), and 3) absolute temperature. The statHBS model initially fit catch and effort data from 1975 to 2004 (Database II) when hooks between floats was known. Parameter estimates were then applied to data from 1952 to 2004 in a deterministic manner to estimate the year effects for each of the six areas (5 regions in Fig. 3 with region 5 split into two fisheries). The trend in standardized CPUEs based on a vertical distribution of absolute depth was the most optimistic (Fig. 7). The trend with relative temperature was more pessimistic and similar to nominal CPUE. The trend with absolute temperature was intermediate between the absolute depth and relative temperature assumptions. Each standardized CPUE trend showed a dramatic decline during the 1970's and moderate interannual variability thereafter. Each trend has a decline since 1995.

3.9 Data Corrections Within the statHBS Framework for the Effect of Striped Marlin Directed Sets

Ad hoc ways to correct for the effect of striped marlin directed sets within the statHBS framework was also tested. Modified standardized CPUE time series were calculated for each hypothesized factor controlling vertical distribution (i.e., delta T) after excluding data from the main fishing ground for striped marlin within region 5 (see Fig. 4). These series were compared to base case time series computed with all data. The calculated CPUE trends using the *ad hoc* method showed similar trends from the original (Fig. 8). The group agreed that further studies to correct for the effect of the striped marlin directed sets within the statHBS framework was necessary.

3.10 Comparison of the Results Between GLM and the Statistical Habitat Model (statHBS)

The group agreed that the abundance index estimated by the CPUE of Japanese offshore and distant-water longliners is the most appropriate one to assess the stock status of striped marlin in the North Pacific because it has the longest and widest coverage of data submitted to the meeting.

The group discussed the observed differences in the historical trends of the abundance indices estimated by GLM and the statHBS using the data of Japanese offshore and distant-water longliners. The GLM and statHBS with relative temperature represents the most pessimistic trends. Two points were addressed for the time-series; one is the sudden decline in all indices during the 1970's. The group recognized that this declining trend was probably caused by the insufficiency in standardizing the effect of directed sets in the northeastern Pacific in the 1960's, although some standardization methods appeared to remove the effects better than other methods. The group noted that the estimated indices probably overestimate the actual magnitude of stock. The other point is related to the observed difference in the relative level of indices in the 1950's. The GLM results show that the relative level of the stock in the 1950's is roughly the same as in the 1960's, while the results from statHBS with the priors of the absolute depth and ambient temperature hypotheses show the relative level of the stock in the 1950's is roughly the same as the one in the 1970's and there after. The GLM and statHBS based on relative temperature indicate the stock is currently heavily exploited. The statHBS results based on absolute depth would also indicate the stock is currently heavily exploited if the relatively lower level of the abundance indices in the 1950's were attributed to the developing stage of the fishery. However, if the level of the abundance indices in the 1950's was not representative of the unexploited stage, then this trend indicates the stock is currently not seriously exploited.

The group could not decide which is the most reliable standardized CPUE scenario of striped marlin in the North Pacific, and recognized that the true trend of the stock would be in between the range of estimated abundance indices. The group decided to use two estimated abundance indices shown in Fig. 7 for input into the stock assessment model to evaluate the possible range of current stock status. The assessment models could consider the GLM results which represent the most pessimistic scenario and a more optimistic scenario such as the statHBS with ambient temperature or the most optimistic scenario of the statHBS based on absolute depth.

4.0 STOCK ASSESSMENT

4.1 Assessment Models and Model Structure

Prior to the workshop it was decided that three assessment models would be applied to the striped marlin data and, when applicable, would consider a single, spatially-structured, stock across the North Pacific (north of the equator). The assessment models included two integrated modeling platforms (MULTIFAN-CL and Stock Synthesis 2 (SS2)) and a biomass dynamic model (Bayesian surplus production). For the integrated models, a quarterly time step was adopted and the North Pacific divided into 5 regions (see Fig. 3). Japan reported the decadal average CPUE and catch patterns of striped marlin caught by Japanese longliners in the North Pacific (Fig. 9), as well as the quarterly average CPUE patterns in the 1960s and 1970s (Fig. 10). The group agreed these figures were useful in delineating general distribution and migration patterns of striped marlin in the North Pacific.

After reviewing available data, the group was concerned that the quarterly time step may be too fine. Not only would there be less catch and effort data in each quarter/region bin, but our ability to standardize CPUE in each bin regardless of approach methodology (GLM or statHBS) would be questionable, especially for the interaction terms. This was not the case when standardization was conducted at an annual time step. Participants agreed to drop interaction terms from the model, focus only on main effects and standardize using the GLM model reported by Yokawa (ISC/05/MARWG/03).

To facilitate application of the Bayesian surplus production model, estimates of the intrinsic rate of population increase (r) for striped marlin must be known and Clarke reported on the development of an informative prior for r (ISC/05/MARWG/08). The approach was based on demographic methods and draws heavily from the literature on striped marlin and other related species. By defining a range of likely values for r, robust estimation of other parameters (including stock assessment reference points) was facilitated by the proposed Bayesian surplus production model. The group supported to use the results of this study for the Bayesian production model analysis of striped marlin in the North Pacific.

4.2 Model Runs

Stewards for each of the assessment models were able to configure the structure of their models and make test runs using available data. Final model runs could not proceed until all data issues were resolved (confirmation of Category I, II and III data), which did not occur until the final day of the workshop. Participants generally agreed that the failure to complete the assessments resulted from a combination of procedural and operational issues. Because this was the first assessment of striped marlin under the umbrella of ISC it provided a unique opportunity to fully test the abilities of the ISC infrastructure, particularly the STATWG, to support stock assessments. This can not be said for the other ISC species working groups. The delay in the data preparation could be mainly attributed to the following:

1) Lack of data: Prior to the workshop, China, Chinese-Taipei, and Korea did not submit sufficient data, despite repeated requests. Korea did submit data while the meeting was in progress.

2) Inadequate support from the STATWG: The MARWG attempted to access data from the ISC Database but was unsuccessful. Because the ISC Database is not operational, individual data files were provided from the STATWG. When the data finally did arrive, the format of the data was problematic making it impossible to access.

3) Insufficient cooperation from other Pacific organizations/institutions: Despite there being established sharing arrangements between organizations/institutions housing data from the North Pacific, it was difficult to acquire Category II data from WCPFC, IATTC and SPC.

The Chairmen of the MARWG also assumes some responsibility for not meeting the goals of the workshop, perhaps he was to optimistic when setting the schedule. However, the group recognized that if the MARWG had obtained sufficient support for one of the items listed above the goal would have been completed.

5.0 FUTURE WORK

Available information indicates that the amount striped marlin caught by Korea, Chinese-Taipei and China, the main fishing countries which did not submitted the Category I data at the meeting, is minor. This suggests that data currently available to the working group should be enough to conduct a surplus production model analysis to assess stock status. This can be easily confirmed when the updated Albacore Database is available from the STATWG. Participants agreed to entrust this work to the chairman of the working group. The participants also pointed out that at least part of (as we have no information for Korean drift net fishery so far) the missing segments of the historical Chinese-Taipei and Korean striped marlin catch could be estimated using data in the Albacore Database. Though this information is in number of fish caught, it can be converted to the catch in weight using average weight information from Japanese and U.S. longline fisheries. These estimated values can be used for the sensitivity analysis of the surplus production model analysis.

Participants recommended convening a follow-up meeting when the one of three issues (procedural and operational) listed above (section 4.2) is resolved, and to complete the assessment prior to the start of any other billfish assessment. Participants requested the chairmen of the MARWG work with the ISC Chairman to schedule the follow-up meeting.

6.0 ADJOURNMENT

The workshop was adjourned at 4:00 PM on 21 November 2005. The chairman thanked all participants for their cooperation, hard work and patience.

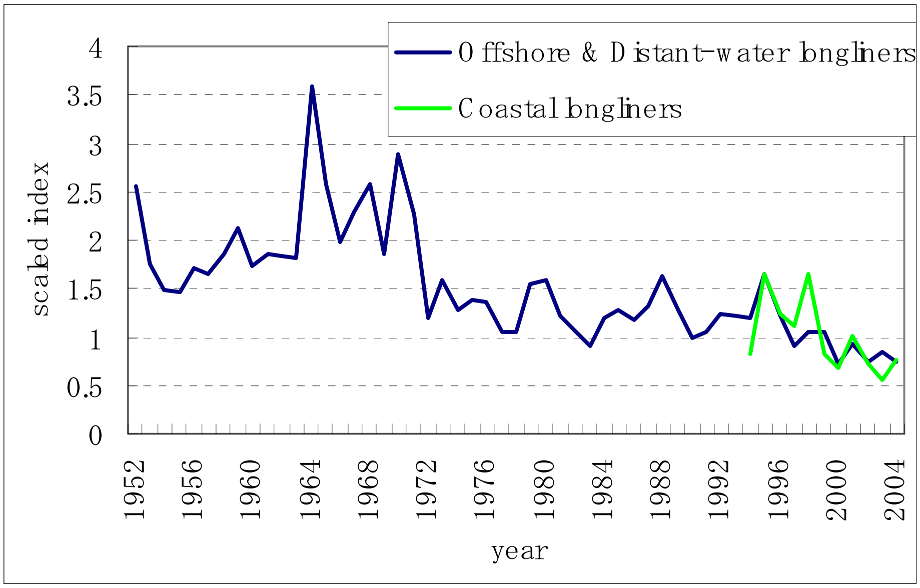

Figure 1. Standardized CPUE of striped marlin caught by Japanese coastal longliners and offshore and distant-water longliners.

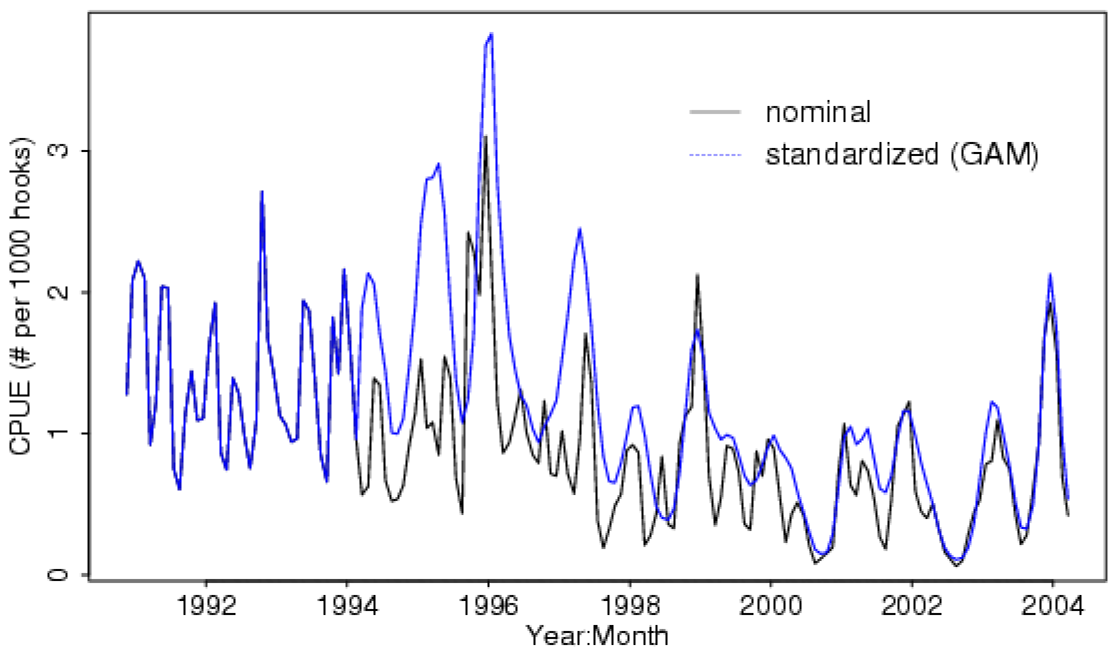

Figure 2. Nominal and standardized striped marlin CPUE for the Hawaii-based longline fleet.

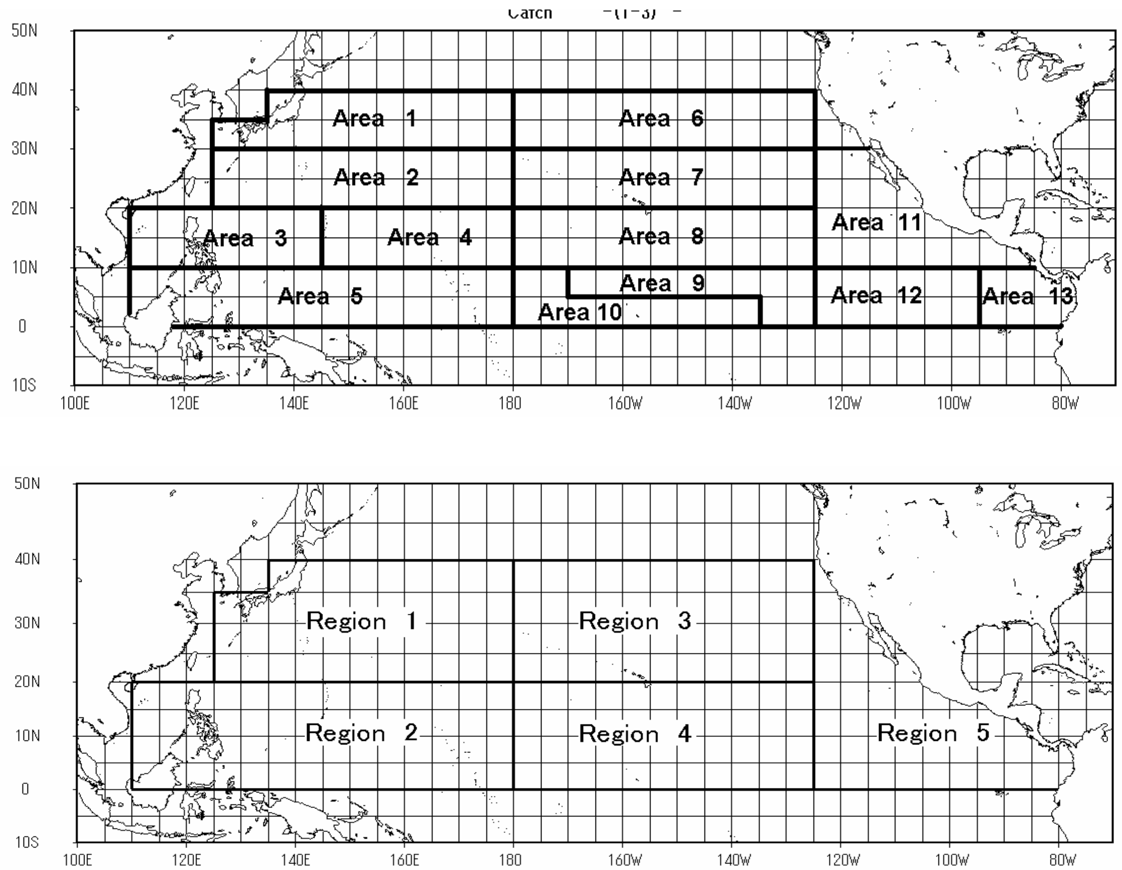

Figure 3. Area stratification used in the standardization of CPUE of striped marlin caught by Japanese offshore and distant-water longliners (upper panel) and area stratification scheme adopted for current assessment (lower panel).

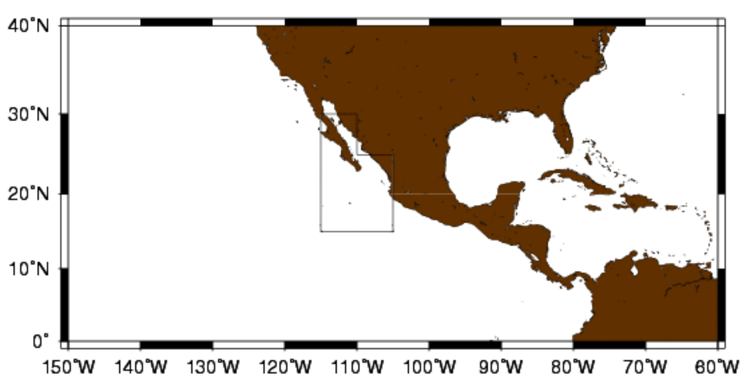

Figure 4. Main fishing ground of the striped marlin directed sets of Japanese offshore and distant-water longliners in the North Pacific.

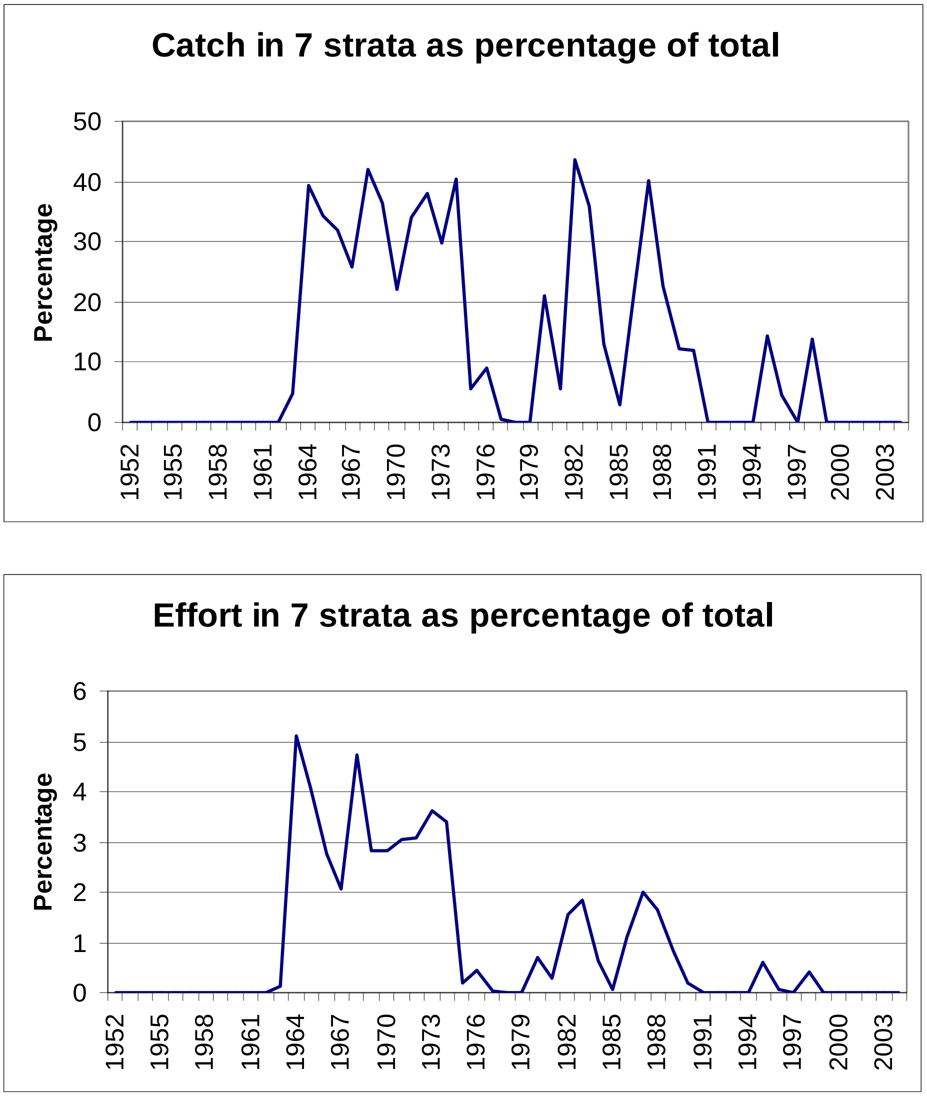

Figure 5. Percentage of the catch (number of striped marlin) (upper panel) and effort (lower panel) of Japanese offshore and distant-water longliners in the main striped marlin fishing ground off Mexico waters shown in Figure 4, to the total North Pacific catch.

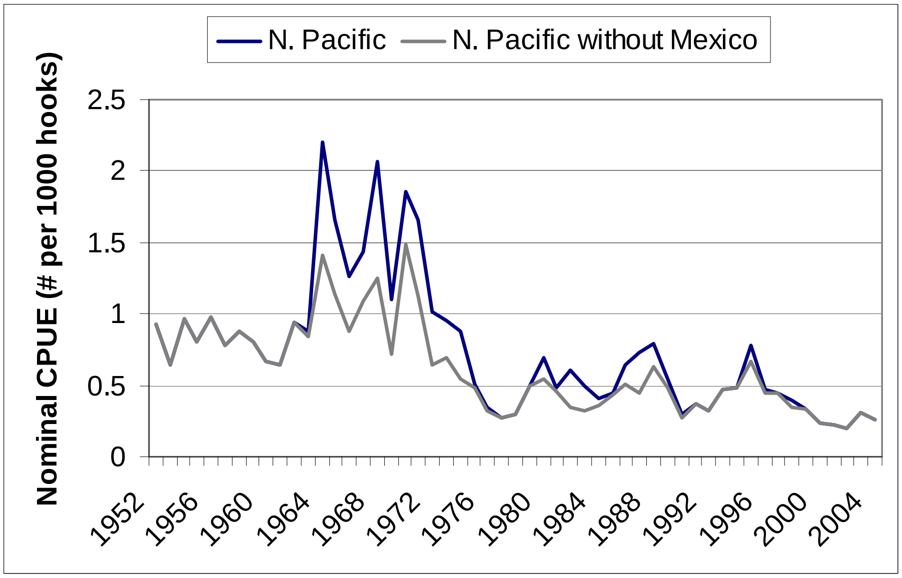

Figure 6. Comparison of nominal CPUE trend of striped marlin caught by Japanese offshore and distant-water longliners in the North Pacific (all strata) and the one without data in the main striped marlin fishing ground in off Mexico waters shown in Figure 4.

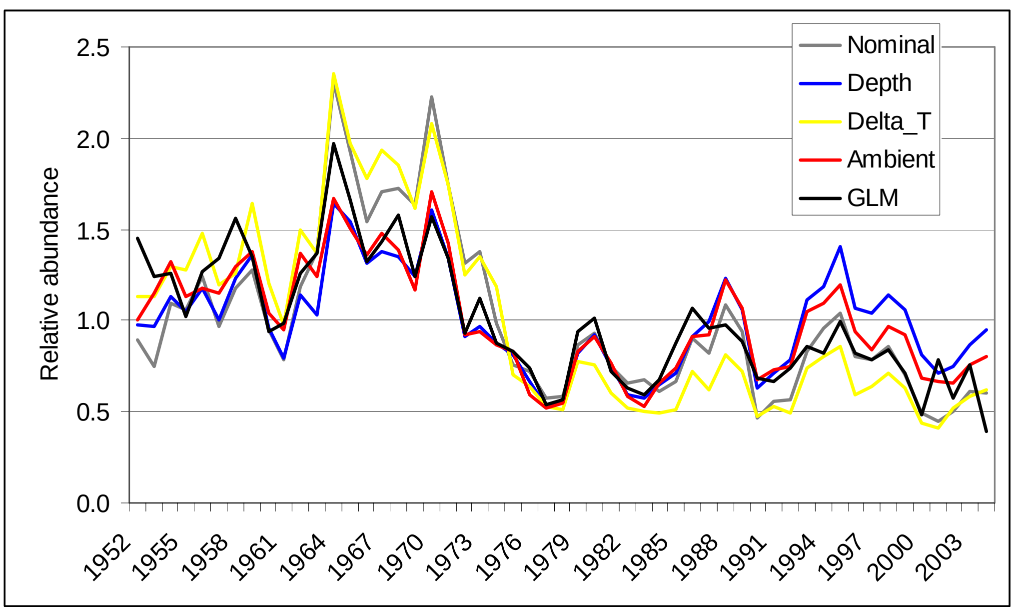

Figure 7. Abundance indices estimated by the GLM and the statistical habitat model using three different priors for the vertical distribution pattern of striped marlin.

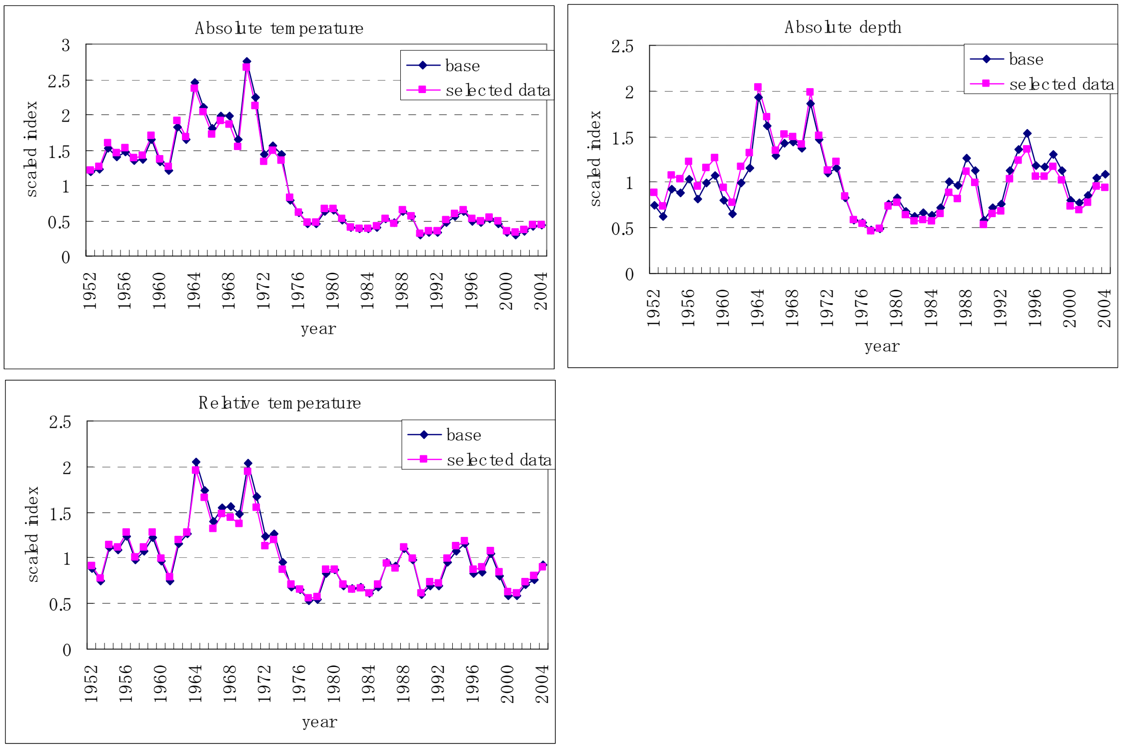

Figure 8. Standardized CPUE of striped marlin caught by Japanese offshore and distant-water longliners in the North Pacific. CPUE was standardized by the statistical habitat model using all data (base) and without data from the main fishing ground in region 5 (selected data). Vertical distribution pattern of striped marlin was assumed to be regulated by the absolute temperature (top left), the absolute depth (top right) and relative temperature (bottom left).

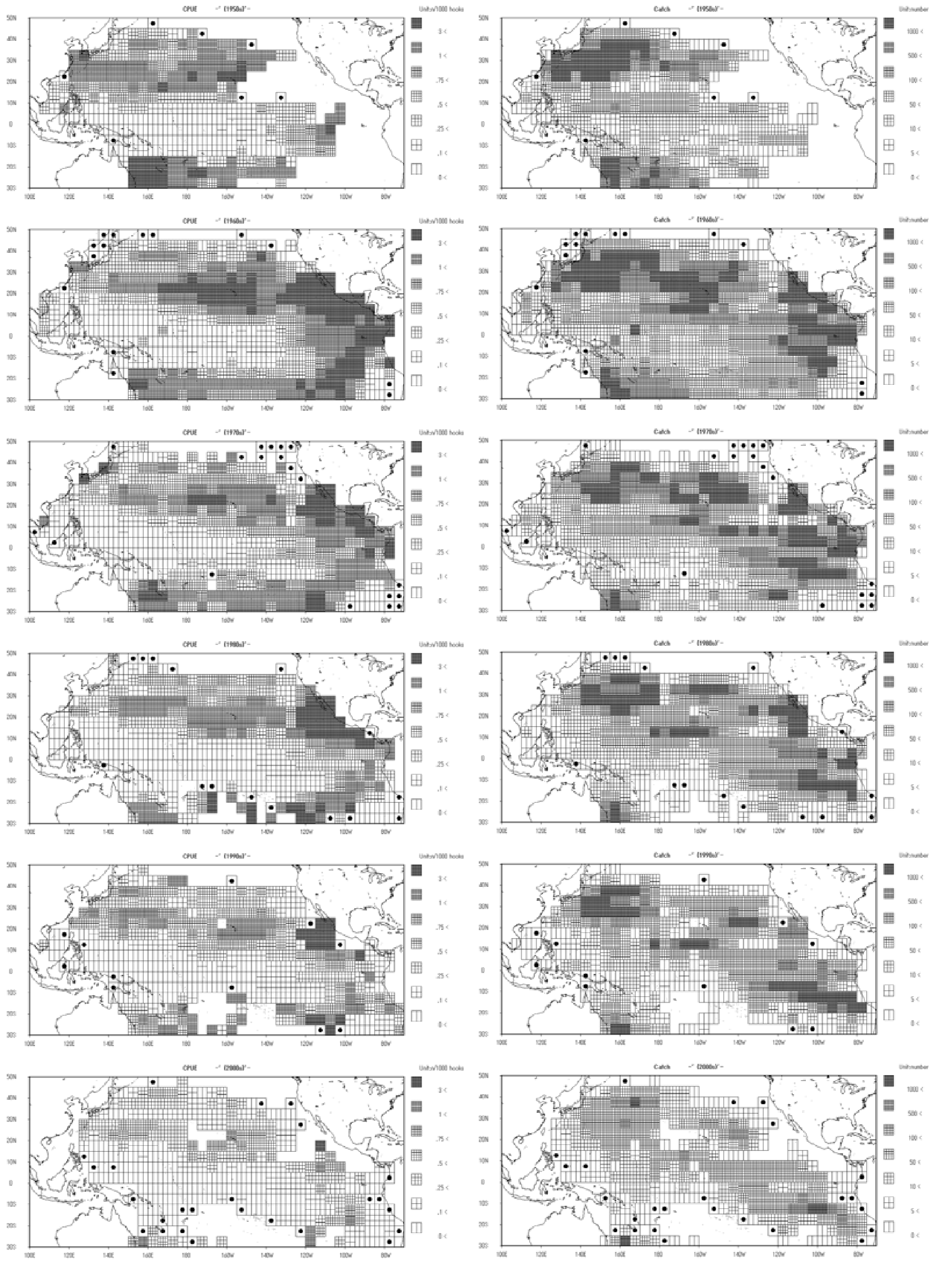

Figure 9. Decadal average distribution pattern of CPUE (left row, number/1000 hooks) and number of striped marlin caught in the North Pacific by Japanese offshore and distant-water longliners for 1951 – 2004.

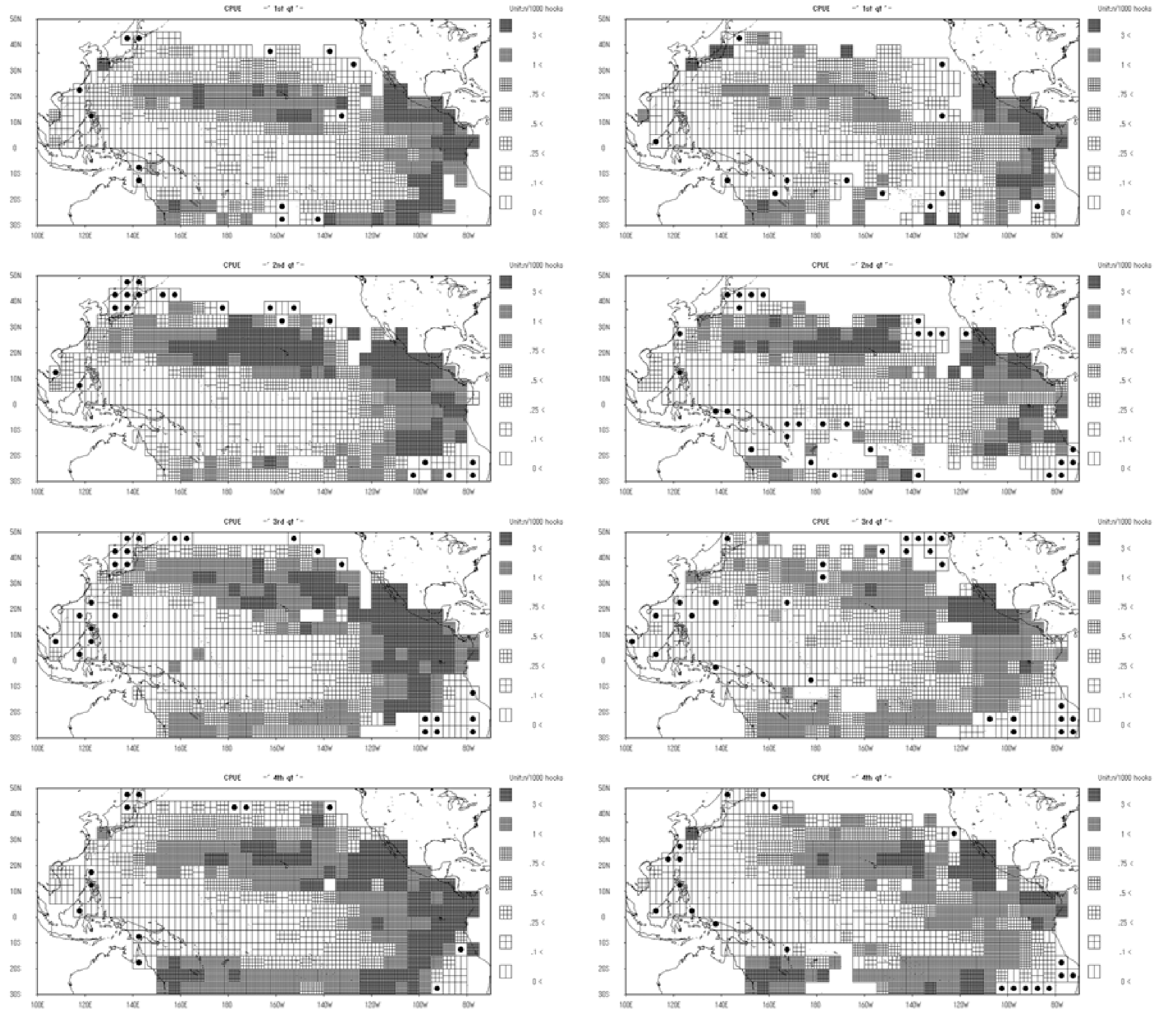

Figure 10. Quarterly average CPUE (number/1000 hooks) of striped marlin caught by Japanese offshore and distant-water longliners in the North Pacific in the 1960s (left column) and the 1970s (right column).

Attachment 1. List of Participants

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Attachment 2. Working Papers Submitted at the November 15-21, 2005 Striped Marlin Stock Assessment Workshop

ISC/05/MARWG/01 Clarke, S., and K. Yokawa: Catch estimates for striped marlin (*Tetrapturus audax*) in the North Pacific, 1952-2004.

ISC/05/MARWG/02 Saito, H., H. Shono, F. Muto and K. Yokawa: An estimation of EFL and processed weight relationships and length frequency distribution for the striped marlin, *Tetrapturus audax*¸caught by the Japanese longliner. 12pp.

ISC/05/MARWG/03 Yokawa, K. and S. Clarke: Standardizations of CPUE of striped marlin caught by Japanese offshore and distant water longliners in the North Pacific. 9pp.

ISC/05/MARWG/04 Yokawa, K.: Standardizations of CPUE of striped marlin caught by Japanese coastal longliners in the northwest Pacific. 8pp.

ISC/05/MARWG/05 Kanaiwa, M. Y. Takeuchi, H. Saito, H. Shono and K. Yokawa: Striped marlin CPUE standardization of Japanese longline fishery in North Pacific Ocean using a statistical habitat model. 34pp.

ISC/05/MARWG/06 Shono, H., K. Yokawa, S. Clarke, Y. Takeuchi, M. Kanaiwa and H. Saito: Preliminary analysis for area stratification and CPUE standardization of striped marlin caught by Japanese longline fishery in the North Pacific using tree regression models (TRM). 8pp.

ISC/05/MARWG/07 Fleischer, L. A.: Mexican progress report on the striped marlin sport fishery. 11pp.

ISC/05/MARWG/08 Clarke, S.: Development of an informative prior for ‘r’ the intrinsic rate of population increase, for striped marlin (*Tetrapturus audax*). 7pp.

Attachment 3. Agenda

Report of the Marlin Working Group Meeting
(November 15-21, 2005, Honolulu, HI, U.S.A.)

November 15 (Tuesday), 0900-1700

1. Opening of Stock Assessment Workshop
    a. Introductions
    b. Welcome Remarks PIFSC Director
2. Review and Adoption of Agenda
3. Computing Facilities
    a. Access
    b. Security Issues
4. Data Confidentiality Protocols
5. Review of model structure (stock structure, stock boundaries, etc.)
6. Data Inventory (Matrix)
7. Review, Rectification, and Construction of Data Input Files
    a. Catch and Effort
    b. Size (length or weight) Data
    c. Abundance Indices

November 16 (Wednesday), 0900-1630

7. Review, Rectification, and Construction of Data Input Files (Continued)
    a. Catch and Effort
    b. Size (length or weight) Data
    c. Abundance Indices

November 17 (Thursday), 0900-1700

7. Review, Rectification, and Construction of Data Input Files (Continued)
    a. Catch and Effort
    b. Size (length or weight) Data
    c. Abundance Indices

November 18 (Friday), 0900-1700

8. Model Runs

November 19 (Saturday), 0900-1630

8. Model Runs (Continued)

November 20 (Sunday), 1000-1700

9. Review of Assessment Results
10. Additional Model Runs
11. Report Preparation

November 21 (Monday), 0900-1600

11. Report Preparation (0900-1230)
12. Review of Report
13. Report Completion Schedule
14. Adjournment