INTER-AMERICAN TROPICAL TUNA COMMISSION

SCIENTIFIC MEETING

La Jolla, California (USA)
31 August -3 September 2010

MEETING REPORT

Chairman: Dr. Guillermo Compeán

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The 1st Scientific Advisory Committee Meeting was held in La Jolla, California, USA, on 31 August – 3 September 2010. The attendees are listed in Appendix B.

1. Welcome, introductions, meeting arrangements

The meeting was called to order on 31 August 2010, by the Chairman, Dr. Guillermo Compeán, Director of the IATTC, who thanked the attendees for coming to the meeting. Dr. Compeán explained that the Scientific Advisory Committee (SAC) is established by the Antigua Convention, and that the SAC shall be composed of one representative designated by each member of the Commission. The meeting discussed whether rules of procedures for the SAC should be established. Dr. Compean noted that the Antigua Convention elaborated a fairly explicit set of rules for the operation of the Committee, and that this meeting should be able to proceed with that common understanding. There also was an inconclusive discussion regarding the matter of a quorum. The meeting agreed that the most important thing was to move ahead with the agenda for the meeting .

2. Consideration of agenda

Dr. Compeán reviewed the provisional agenda. A change was made in Item 5: after discussion of the fishery in 2009, a discussion of public domain data was added. The agenda was approved without further changes.

A participant requested that the Director clarify the new procedural aspects specified by the Antigua Convention. Dr. Compeán reviewed the procedural rules in the Convention. Clarification was also requested about the provision that the Commission may invite organizations or persons with recognized scientific experience in matters related to the work of the Commission to participate in the work of the Committee. Dr. Compeán explained that this is to be done through the Commission, and not decided by this Committee. After comments by the participants, the participants agreed to continue the meeting under a format similar to the previous Stock Assessment Review Meetings.

3. Report of the IATTC scientific workshop, November 2009

Dr. Mark Maunder presented a summary of the IATTC Workshop on Modeling Population Processes, held in La Jolla, California (USA), on 3-6 November 2009. The topics discussed included natural mortality, recruitment, growth, and selectivity. The format of the workshop included background information on each topic provided to participants before the workshop, presentations on each topic by participants, and focus questions provided to promote discussions. Each topic started off with Ian Taylor of NMFS summarizing how the process can be modeled in Stock Synthesis, the model used for IATTC assessments.

4. Report of the bigeye tuna assessment methods review.

A review of bigeye tuna assessment methods was made in May of this year. The review was made by panel of four experts on stock assessment methods familiar with the software used in the IATTC assessment. The panel consisted of Drs. John Sibert (University of Hawaii; Chair), Jim Ianelli (NMFS), Andre Punt (University of Washington), and Shelton Harley (Secretariat of the Pacific Community). The report of the panel is at http://iattc.org/PDFFiles2/BET-01-Meeting-report-ENG.pdf.

5. The fishery in 2009

Mr. Ed Everett reviewed the information on the fishery for tunas in the EPO in 2009. He discussed EPO tuna catch statistics for 2009: total catches by species and by flag, purse-seine catch distributions for yellowfin, skipjack and bigeye, and size compositions of the three species. The catches of yellowfin, skipjack, bigeye, and Pacific bluefin tuna by purse seine, pole and line, and recreational gear in 2009 were about 23% less than the record catch in 2003 and about 4% greater than the 15 year average of catches.

Together, Ecuadorian-, Mexican-, Panamanian and Venezuelan-flag vessels caught about 77% of the total catch of yellowfin, skipjack, and bigeye in the EPO during 2009. Mexican, Panamanian and Venezuelan vessels caught about 71% of the yellowfin, and Ecuadorian vessels caught about 57% of the skipjack. The yellowfin catch distributions for 2009 showed an increase in effort on dolphins in the Northern areas, while yellowfin catches were lower in the inshore areas off Ecuador and Peru compared to the five-year

average of catches. Yellowfin catches in 2009 were 11% higher than the five-year average of catches from 2004-2008. Catches of skipjack in 2009 were lower in the areas North of 10° N, and in the inshore areas off Ecuador compared to the five-year average of catches. Slightly higher catches of skipjack were observed in the areas between 5°S and 5°N from 85°W to 100°W, and also in the equatorial offshore area from about 125°W to 150°W. Skipjack catches in 2009 were 23,000 metric tons (9%) lower than the five-year average of catches. Bigeye catches in 2009 were similar to the 2004-2008 average, with the exception of slightly higher catches in the inshore areas off Peru between about 15°S and 25°S. Catches in 2009 were about 7% higher than the five-year average of catches.

Length frequency and species composition sampling areas were shown, and areas defined for stock assessments were described. Of the 854 wells sampled for length frequency and species composition in 2009, 573 contained yellowfin, 547 contained skipjack, and 227 contained bigeye. The average sizes of yellowfin in 2009 were considerably greater than those of the 2004-2008 period. The average sizes of skipjack were less than the average sizes for the previous 5 years, and the average size of bigeye in 2009 were less than in 2008, but greater than those of 2006 and 2007.

Public domain data

Dr. Michael Hinton presented a summary of IATTC's guidelines on public domain data. The policies that have governed release of data held by the Secretariat are based on the Rules of Confidentiality of the Agreement on the International Dolphin Conservation Program (AIDCP), and on Rule XV of the IATTC Rules of Procedure. The basic tenet followed is that the "Records of statistics of individual catches and individual company operations shall be treated as being confidential."

The IATTC has regularly published data on the purse-seine, pole-and-line, and longline fisheries in the EPO in its data report and its scientific bulletin series, and its weekly, quarterly, and annual reports, and in various *ad hoc* reports and documents. Today, all the public domain data for purse-seine are available, but data from longline are considered confidential. Various levels of aggregation can be used to ensure that operations of individual vessels and companies are not revealed, and it has been the general objective to provide the most information possible while meeting the confidentiality requirements.

There is concern that, for longline fisheries, the Secretariat is unable to identify with certainty when there have been more than two vessels operating in a five-degree area during a particular month. Also, various members have stated that the data for their longline fisheries held by the Secretariat is considered confidential and should not be released. Similarly, for the purse-seine fishery, the Secretariat cannot publish catch-by-country data if there are fewer than three vessels or companies operating under the jurisdiction of the country.

The aggregated data for longline fisheries provided to the Secretariat do not generally include the number of vessels operating in a stratum. Some members provide only data that they can make publicly available under their national laws and policies governing release of data to the public.

If a member decides that the data it provides to the Secretariat is of this nature, or is confidential, the Secretariat cannot aggregate data among flags in a manner that would provide the maximum possible public information without violating IATTC or national confidentiality requirements.

These issues are not unique to the IATTC[1], and the Secretariat has brought them to the attention of members, with a view to finding a solution that meets the requirements for full provision of data to accomplish the objectives of the IATTC and for maximum transparency in publicly available data while maintaining confidentiality.

One participant expressed the need for non-Commission scientists to have access to catch and effort data, preferably unfiltered data. This would insure full transparency of the Commission's work. It was also

[1] Lawson and Williams. 2009. Status of public domain catch and effort data at the WCPFC.

pointed out that the international Climate Impacts on Oceanic Top Predators (CLIOTOP) project is attempting worldwide comparisons for large pelagic fishes, and better availability of public domain data from the regional fisheries management organizations is important. This will be an important item for this meeting to recommend to the Commission. Inclusion of the number of longline vessels that corresponds to effort data is also important for meeting current data provision rules. IATTC staff stated that providing data to IATTC staff in a detailed manner is necessary for the work of the Commission.

6. Review of 2009 staff conservation recommendations and resolutions adopted at the 80th Meeting of the IATTC

Dr. Richard Deriso gave a review of the conservation recommendations made by the IATTC staff to the IATTC meeting in 2009 (http://iattc.org/PDFFiles2/IATTC-80-06b-Conservation-recommendations.pdf) and compared them to the conservation resolution passed at that meeting (http://iattc.org/PDFFiles2/C-09-01-Tuna-conservation-2009-2011.pdf).

7. Assessment of bigeye tuna

Dr. Alexandre Aires-da-Silva presented the current stock assessment of bigeye tuna (*Thunnus obesus*) in the eastern Pacific Ocean. This assessment was conducted using Stock Synthesis (Version 3). The assessment is based on the assumption that there is a single stock of bigeye in the EPO, and that there is limited exchange of fish between the EPO and the western and central Pacific Ocean (WCPO).

The assessment assumptions have been modified from the previous assessment based on extensive investigatory analysis and a series of recommendations of the external review of the IATTC staff's assessment of bigeye tuna, held in May 2010. The spatial definitions of the longline fisheries have been re-evaluated and four, rather than two, longline fisheries are assumed in this assessment. With respect to data weighting, the observation error coefficient of variation for the southern longline fishery was pre-specified at a fixed value, rather than being treated as an estimated parameter. Changes to the growth modeling consisted of assuming a Richards model instead of the less flexible von Bertalanffy curve. In addition, the parameters which determine the variance of the length-at-age were estimated rather than fixed, while the average size of the oldest fish (L2 parameter) was pre-specified at a fixed value, as in previous assessments. Changes in the modeling of catchability and selectivity have also been made. In order to reduce the residual patterns of the model fit to the catch length-frequency data of the longline fishery, the assumption of logistic selectivity for the southern longline fishery throughout the entire time period of the assessment was relaxed. In particular, all longline fisheries were split into two periods at 1990, each with its independent catch rate time series, and estimated catchability and selectivity parameters. The size selectivity curves of the pre-1990 longline fisheries were assumed to be dome-shaped, rather than asymptotic as in previous assessments. Dome-shaped size selectivity curves have also been assumed for two of the four longline fisheries during the late period (post-1990).

The stock assessment requires a substantial amount of information. Data on retained catch, discards, catch per unit of effort (CPUE), and age-at-length data and size compositions of the catches from several different fisheries have been analyzed. Several assumptions regarding processes such as growth, recruitment, movement, natural mortality, and fishing mortality, have also been made. Catch and CPUE for the surface fisheries have been updated to include new data for 2009. New or updated longline catch data are available for China (2008), Chinese Taipei (2006-2009), French Polynesia (2008), Japan (2006-2009), Korea (2008) and the United States (2007-2008). New purse-seine length-frequency data are available for 2009. New or updated length-frequency data are available for the Japanese longline fleet (2006-2008). Analyses were carried out to assess the sensitivity of results to: 1) a stock-recruitment relationship with various different assumed values for the steepness parameter; 2) assuming different values for the average size of the oldest fish in the Richards growth curve; 3) assuming lower and higher rates of natural mortality (M) for adult bigeye; and 4) using data only from the late period of the fishery (1995-2009), which best reflects the current mix of tuna fisheries operating in the EPO.

There have been important changes in the amount of fishing mortality caused by the fisheries that catch bigeye tuna in the EPO. On average, since 1993 the fishing mortality of bigeye less than about 15 quarters old has increased substantially, and that of fish more than about 15 quarters old has increased to a much lesser extent. The increase in the fishing mortality of the younger fish was caused by the expansion of the fisheries that catch tuna in association with floating objects. Fishing mortality of fish more than 20 quarters old has also increased significantly since the early 1990s, as larger bigeye became vulnerable to the longline fisheries.

Over the range of spawning biomasses estimated by the base case assessment, the abundance of bigeye recruits appears to be unrelated to the spawning potential of adult females at the time of hatching.

There are several important features in the estimated time series of bigeye recruitment. First, estimates of recruitment before 1993 are very uncertain, as the floating-object fisheries were not catching significant amounts of small bigeye. There was a period of above-average annual recruitment in 1994-1998, followed by a period of below-average recruitment in 1999-2000. The recruitments were above average from 2001 to 2006, and were particularly high in 2005 and 2006. The 2007 recruitment was below average, but the recruitment in 2008 appears to have been particularly high. The most recent annual recruitment estimate (2009) is slightly below average levels. However, this recent estimate is very uncertain and should be regarded with caution, due to the fact that recently-recruited bigeye are represented in only a few length-frequency samples.

The biomass of 3+-quarter-old bigeye increased during 1983-1985, and reached its peak level of about 845 thousand metric tons (t) in 1986, after which it decreased to a historic low of about 347 thousand t at the beginning of 2004. Since then, the biomass of 3+-quarter-old bigeye has shown an increasing trend in the EPO. Spawning biomass has generally followed a trend similar to that for the biomass of 3+-quarter-olds, but with a lag of 1-2 years. There is uncertainty in the estimated biomasses of both 3+-quarter-old bigeye and spawners. Nevertheless, it is apparent that fishing has reduced the total biomass of bigeye in the EPO. The biomasses of both 3+quarter-old fish and spawners are estimated to have been increasing over the last five years. This increasing trend may be partly attributed to the effect of IATTC tuna conservation resolutions during 2004-2009, above-average recruitments, and reduced longline fishing effort in the EPO in recent years.

The estimates of summary biomass are moderately sensitive to the steepness of the stock-recruitment relationship. Specifically, the estimates of biomass are greater than those estimated in the base case assessment, but the trends are similar. The trends in recruitment are similar to those of the base case. The estimated biomass and recruitment time series are very sensitive to the assumed value of the average size of the oldest fish – the L2 parameter – in the growth function. Biomass and recruitment estimates are greater for a lesser value of that parameter. The estimated biomass and recruitment time series are very sensitive to the assumed rate of adult natural mortality for bigeye. Biomass and recruitment estimates increase with higher levels of adult natural mortality.

When data from only the late period of the fishery (1995-2009) are used in the bigeye assessment, and no stock-recruitment relationship is assumed (steepness = 1), the summary biomass estimates are lower than the base case estimates. When a stock-recruitment relationship is assumed (steepness = 0.75), the summary biomass estimates are slightly higher than the base case estimates. These results are partially explained by differences in absolute recruitment, but the relative recruitment trends are very similar.

At the beginning of January 2010, the spawning biomass ratio (the ratio of the spawning biomass at that time to that of the unfished stock; SBR) of bigeye tuna in the EPO had recovered from its historic low level of 0.17 at the start of 2005 to 0.26. This most recent SBR estimate is about 37% higher than the maximum sustainable yield (MSY) level.

Recent catches are estimated to have been 17% greater than those corresponding to the MSY levels. If fishing mortality (F) is proportional to fishing effort, and the current patterns of age-specific selectivity

are maintained, the level of fishing effort corresponding to the MSY is about 13% higher than the current (2007-2009) level of effort. The MSY of bigeye in the EPO could be maximized if the age-specific selectivity pattern were similar to that of the longline fisheries, because they catch larger individuals that are close to the critical weight. Before the expansion of the floating-object fishery that began in 1993, the MSY was greater than the current MSY and the fishing mortality was less than FMSY.

All sensitivity analyses indicate that, at the beginning of 2005, the bigeye spawning biomass (S) had initiated a recovery trend. Although the results from the base case model show that, at the beginning of 2010, the spawning biomass was higher than SMSY (stock not overfished), and the fishing mortality rate was below that corresponding to FMSY (overfishing not occurring), this interpretation is subject to uncertainty and mainly dependent upon the assumptions made on three key biological parameters: the steepness of the stock recruitment relationship, the average size of the older fish in the population, and the levels of adult natural mortality. It also depends on the historic period of the bigeye exploitation used in the assessment.

Recent spikes in recruitment are predicted to sustain, in the short term, the recent increasing trend observed for SBR since 2004. However, high levels of fishing mortality are expected to subsequently reduce and then stabilize SBR under average recruitment conditions. Under current effort levels, the base case assessment estimates that the population is likely to remain above the level corresponding to MSY. These simulations are based on the assumption that selectivity and catchability patterns will not change in the future. Changes in targeting practices or increasing catchability of bigeye as abundance declines (e.g. density-dependent catchability) could result in differences from the outcomes predicted here.

Key results

1. The results of this assessment indicate a recent recovery trend for bigeye tuna in the EPO (2005-2009), subsequent to IATTC tuna conservation resolutions initiated in 2004;
2. There is uncertainty about recent and future recruitment and biomass levels;
3. The recent fishing mortality rates are estimated to be below the level corresponding to MSY, and the recent levels of spawning biomass are estimated to be above that level. However, these interpretations are uncertain and highly sensitive to the assumptions made about the steepness parameter of the stock-recruitment relationship, the average size of the older fish, the assumed levels of natural mortality for adult bigeye, and the historic period of the bigeye exploitation used in the assessment. The results are more pessimistic if a stock-recruitment relationship is assumed, if a higher value is assumed for the average size of the older fish, if lower rates of natural mortality are assumed for adult bigeye, and if only the late period of the fishery (1995-2009) is included in the assessment;
4. The results are more optimistic if a lower value is assumed for the average size of the older fish, and if higher levels of natural mortality are assumed for adult bigeye.

Several participants indicated strong support for the stock assessment of bigeye conducted by Dr. Aires-da-Silva and the staff. They concurred with the observation that there is a trend towards recovery of the bigeye stock in the EPO since 2004. It was also suggested that the bigeye assessment should include more analysis of the effects of environmental factors on the stocks. One participant noted the potential importance of inter-decadal changes in oceanographic conditions, such as ENSO events, on bigeye recruitment. It was noted that the correlation analysis of ENSO strength and bigeye recruitment was fairly good during the period 1992-2000, when ENSO events were common, but that the correlation patterns were not strong after 2000, when La Nina conditions were more common in the EPO. It was suggested that La Nina events may become stronger and more frequent during the period 2010-2030, and that this La Nina dominance could negatively influence recruitment strength of bigeye in the EPO. Dr. Aires-da-Silva agreed with the importance of environmental factors in the bigeye assessment, and indicated that the IATTC staff plans to include environmental variables to a greater degree in future bigeye assessments.

A participant pointed out that the current bigeye assessment showed the advantage of having additional data to conduct the most up-to-date analyses of abundance trends. It was noted that the bigeye assessment continues to be sensitive to factors such as the average size of the oldest fish and how that relates to natural mortality. It was recommended that the assessment would be improved utilizing otolith analyses of larger bigeye.

Another participant offered four comments on the bigeye assessment. It was noted that, in previous Stock Assessment Review Meetings as well as the External Review of IATTC Bigeye Tuna Assessment, a recommendation was made to conduct the bigeye assessment back to 1955, and now it was not clear where the analysis stood regarding historical size data. Dr. Aires-da-Silva pointed out that assessment sensitivity analysis was conducted including catches starting in 1954, and that the staff will continue to develop similar analyses including other data components for the early period (size composition and CPUE data). However, he also pointed out that different historical periods of the fishery have different sensitivities to fishery characteristics, and he suggested that it may be better to concentrate the analyses in recent years when the fishery characteristics were similar.

Second, it was agreed that more spatial stratification of the bigeye assessment area was preferable, and the question was raised as to why past assessments of bigeye included such a large, less-stratified area. Dr. Aires-da-Silva explained that there had been a seasonal fishery for bigeye north of the Equator that was separate from that to the south, but the staff agreed that greater stratification of the assessment area was needed for the current assessment.

Third, it was noted that the increase in CPUE in the longline data may not reflect abundance as much as changes in fishing effort. Dr. Aires-da-Silva agreed that we cannot be sure of the CPUE relationship to abundance without additional explanatory variables, and he also pointed out that the stratification of the southern assessment area had improved the analysis.

Fourth, a question was asked about the use of the 150°W frontier boundary for the bigeye assessment, and whether this boundary was real in a biological sense. Dr. Aires-da-Silva explained that tagging data indicated restricted movements of bigeye in the EPO. Although there is some mixing of bigeye across the 150°W boundary, recent tagging data shows that this mixing occurs in both directions. It is therefore reasonable to assume minimal net mixing across the boundary. Dr. Compean also noted that this question could be addressed more completely with additional tagging studies, and that a proposal for tagging studies would be presented later in this meeting and that support for funding of the proposal would be important. Dr. Deriso also pointed out that assessments of bigeye in the western Pacific by the SPC have not shown an increase in abundance similar to that indicated in the EPO, which is further evidence of limited mixing of the stocks across the 150°W boundary.

It was noted that the increasing trend in estimated abundance was due to a recent increase in Japanese longline catch rates. Participants offered opinions about whether the efficiency of Japanese longline vessels could have been greater for the 2008 and 2009 data than for those of previous years. The 2008 and 2009 data were used in the current stock assessment, but were not available for last year's assessment. It was mentioned by a participant that the declining trend in Japanese longline effort in the EPO has been remarkable since 2004. This trend appeared to be caused by low bigeye CPUE in the EPO, increased oil prices, severe economic conditions, and decreased number of vessels. As a result of these circumstances, it might be assumed that only skillful longline fishermen would be able to fish in the EPO, and in this case it is necessary to interpret the increasing longline CPUE trend for bigeye with care. The Commission staff expressed interest in collaborating with the Japanese on this issue. It was also hypothesized that a decrease in the amount of fishing effort could create a situation of decreased competition among the vessels fishing, and thereby an increase in catch rates.

A participant asked if the staff have considered making stochastic projections of recruitment instead of using average recruitment and the origin of the estimate of 185 cm as the average size of the largest bigeye. Dr. Aires-da-Silva clarified that uncertainty is treated by propagating the estimated standard

deviations for the historical period throughout the projection period. Other estimates of the average largest fish could be equally valid, but estimates of L_{max}, the largest fish on record, should be regarded with caution since they do not represent the average size of the oldest fish.

An issue was raised about whether the resolution calling for specific quotas for the longline fishery depends on fishing mortality remaining at status quo, while there is a possibility that fishing mortality might increase in the near future. The staff explained that status quo assumes the same three-year average fishing rate continues on into the future. In reality, the Japanese longline fleet has reduced in size in recent years instead of staying the same.

A discussion ensued about technical issues of using an estimated steepness value of 0.98, about estimating the L_2 and M parameters inside the stock synthesis model, and about the large effect of steepness and L_2 on the model estimates. Dr. Aires-da-Silva explained that the assumption of no stock-recruitment relationship is used because no defined relationship has been observed within the observed ranges of spawning biomass and recruitment. L_2 and M are fixed because L_2 goes to a very low value if not fixed. The staff has not tried to estimate uncertainty by bootstrap analysis, for example, because model uncertainty is of more concern than parameter uncertainty. A participant expressed the opinion that displaying the "best" estimates on a Kobe plot, *i.e.* omitting the least reliable points, would help portray the science to the managers.

Further discussion followed about using environmental information in bigeye stock assessments. The relationship between recruitment estimates and the southern oscillation index (SOI) might be confounded because the SOI includes compound variables, including sea surface temperature and salinity. Correlations are sometimes inconsistent for different time periods, possibly for this reason. The staff welcomes recommendations about incorporating environmental factors in the stock assessments.

A participant requested a table summarizing the numbers of fish measured from the Japanese longline fishery, due to a concern that rare size classes may be underrepresented due to reduction in the amount of length-frequency samples. The staff agreed that a table could be presented in the future.

Due to a question about whether tagging data were used in the stock assessment model, and if large changes would be expected if tagging data were used, Dr. Aires-da-Silva explained that so far tagging data are not integrated into the model. As more tagging data are obtained, they might be incorporated into the model. It was also explained that the staff has already initiated spatially structured stock assessment analyses for bigeye.

A participant noted that the population projection analysis assumed recent fishing effort (fishing mortality averaged over years 2007-2009), and that the current resolution calls for longer closure times in 2010 and 2011 than occurred in the previous three years. It was clarified that the projection results would be more optimistic if the longer closure times were assumed.

8. Assessment of yellowfin tuna

Dr. Mark Maunder presented the current stock assessment of yellowfin tuna in the eastern Pacific Ocean. An integrated statistical age-structured stock assessment model (Stock Synthesis Version 3) was used in the assessment, which is based on the assumption that there is a single stock of yellowfin in the EPO. This model is the same as that used in the previous assessment. Yellowfin are distributed across the Pacific Ocean, but the bulk of the catch is made in the eastern and western regions. The purse-seine catches of yellowfin are relatively low in the vicinity of the western boundary of the EPO. The movements of tagged yellowfin are generally over hundreds, rather than thousands, of kilometers, and exchange between the eastern and western Pacific Ocean appears to be limited. This is consistent with the fact that longline catch-per-unit-of-effort (CPUE) trends differ among areas. It is likely that there is a continuous stock throughout the Pacific Ocean, with exchange of individuals at a local level, although there is some genetic evidence for local isolation. Movement rates between the EPO and the western Pacific cannot be estimated with currently-available tagging data.

The stock assessment requires substantial amounts of information, including data on retained catches, discards, indices of abundance, and the size compositions of the catches of the various fisheries. Assumptions have been made about processes such as growth, recruitment, movement, natural mortality, fishing mortality, and stock structure. The assessment for 2009 is identical to that of 2008 except for updated and new data. The catch data for the surface fisheries have been updated and new data added for 2009. New or updated longline catch data are available for China (2008), Chinese Taipei (2006-2009), French Polynesia (2008), Korea (2007-2008) and the United States (2007-2008). New surface fishery size composition data for 2009 were added. Surface fishery CPUE data were updated, and new CPUE data added for 2009. No new longline length composition or CPUE data were added.

In general, the recruitment of yellowfin to the fisheries in the EPO is variable, with a seasonal component. This analysis and previous analyses have indicated that the yellowfin population has experienced two, or possibly three, different recruitment productivity regimes (1975-1982, 1983-2002, and 2003-2008). The productivity regimes correspond to regimes in biomass, higher-productivity regimes producing greater biomass levels. A stock-recruitment relationship is also supported by the data from these regimes, but the evidence is weak, and is probably an artifact of the apparent regime shifts.

The average weights of yellowfin taken from the fishery have been fairly consistent over time, but vary substantially among the different fisheries. In general, the floating-object, northern unassociated, and pole-and-line fisheries capture younger, smaller yellowfin than do the southern unassociated, dolphin-associated, and longline fisheries. The longline fisheries and the dolphin-associated fishery in the southern region capture older, larger yellowfin than do the northern and coastal dolphin-associated fisheries.

Significant levels of fishing mortality have been estimated for the yellowfin fishery in the EPO. These levels are highest for middle-aged yellowfin. All three purse-seine set types have had moderate impacts on the spawning biomass of yellowfin, while longline catches and discards of small yellowfin tuna in the purse-seine fishery on floating objects have had minor impacts.

There is a large retrospective pattern of overestimating recent recruitment, due to the size-composition data for the floating-object fishery. This retrospective pattern, in combination with the wide confidence intervals for estimates of recent recruitment, indicates that estimates of recent recruitment and recent biomass are uncertain. The results of the assessment are also particularly sensitive to the level of natural mortality assumed for adult yellowfin.

Historically, the spawning biomass ratio (ratio of the spawning biomass to that of the unfished population; SBR) of yellowfin in the EPO was below the level corresponding to the maximum sustainable yield (MSY) during 1975-1983 corresponding to the low productivity regime, but above that level for most of the following years, except for the recent period (2004-2007). The 1984 increase in the SBR is attributed to the regime change, and the recent decrease may be a reversion to an intermediate productivity regime. The two different productivity regimes may support two different MSY levels and associated SBR levels. The SBR at the start of 2010 is estimated to be above the level corresponding to the MSY. The effort levels are estimated to be less than those that would support the MSY (based on the current distribution of effort among the different fisheries), and recent catches are below MSY.

It is important to note that the curve relating the average sustainable yield to the long-term fishing mortality is very flat around the MSY level. Therefore, changes in the long-term levels of effort will change the long-term catches only marginally, while changing the biomass considerably. Reducing fishing mortality below the level at MSY would provide only a marginal decrease in the long-term average yield, with the benefit of a relatively large increase in the spawning biomass. In addition, if management is based on the base case (which assumes that there is no stock-recruitment relationship), when in fact there is such a relationship, there would be a greater loss in yield than if management is based on assuming a stock-recruitment relationship when in fact there was no relationship.

The MSY calculations indicate that, theoretically at least, catches could be increased if the fishing effort were directed toward longlining and purse-seine sets on yellowfin associated with dolphins. This would also increase the SBR levels.

The MSY has been stable during the assessment period, which suggests that the overall pattern of selectivity has not varied a great deal through time. However, the overall level of fishing effort has varied with respect to the level corresponding to MSY.

If a stock-recruitment relationship is assumed, the outlook is more pessimistic, and current biomass is estimated to be below the level corresponding to the MSY. The status of the stock is sensitive to the value of adult natural mortality and the assumed length of the oldest age modeled (29 quarters).

Under recent levels of fishing mortality (2007-2009), the spawning biomass is predicted to slightly decrease below the level corresponding to MSY, but then increase above it. Fishing at the level of fishing mortality corresponding to MSY (FMSY) is predicted to produce slightly higher catches.

Key Results

1. There is uncertainty about recent and future recruitment and biomass levels, and there are retrospective patterns of overestimating recent recruitment.
2. The recent fishing mortality rates are lower than those corresponding to the MSY.
3. Increasing the average weight of the yellowfin caught could increase the MSY.
4. There have been two, and possibly three, different productivity regimes, and the levels of MSY and the biomasses corresponding to the MSY may differ among the regimes. The population may have recently switched from the high to an intermediate productivity regime.
5. The results are more pessimistic if a stock-recruitment relationship is assumed.
6. The results are sensitive to the natural mortality assumed for adult yellowfin and the length assumed for the oldest fish.

Following Dr. Maunder's presentation, clarification was requested by a participant about the steepness of 0.75, and whether this is an arbitrary value. This person felt that the fact that no stock-recruitment relationship has been observed over the last 30-40 years needed to be clearly communicated. Dr. Maunder explained that the steepness is not totally arbitrary because 0.75 is a value commonly used for other stocks when information on the stock/recruitment relationship is lacking, and has been indicated by meta-analysis.

A participant requested to see a time series of average weights. Staff members explained that this would be done next year, because this assessment was only an update. A full assessment of yellowfin tuna will be done next year.

Another participant asked for more explanation about the reason why the spawning biomass ratio (SBR) prior to 1984 was lower than SBR corresponding to MSY. Dr. Maunder explained that the SBR is dependent on recruitment. Taking the annual variation of recruitment into consideration, the biomass has been above the biomass corresponding to MSY for most of the modeled time period.

Clarification was requested that the assessment update is contingent on assumptions of longline CPUE. If the CPUE is biased in any way, then the results could be biased as well. A bias does not appear likely, however, because the two new years of CPUE data do not change the results from the runs obtained without those data.

The staff's opinion was requested about the apparent autocorrelated effects of favorable oceanographic conditions on yellowfin and bigeye tunas. How much faith should be put on the bigeye stock assessment if we are currently in a favorable period? In response, the staff explained that a number of environmental variables can influence bigeye in different ways. Some increase in recruitment was apparent, but the

influence of management actions appeared stronger than effects of favorable environmental factors on recruitment. The condition of the yellowfin stock is not very good recently. Yellowfin catches recorded since 2006 are the lowest since 1984, while the spawning stock of bigeye seems to have increased and skipjack catches are low this year. So, all three tuna species are not auto-correlated.

9. Assessment of skipjack tuna

Dr. Mark Maunder presented the indicators of stock assessment for skipjack tuna in the EPO. Skipjack tuna is a notoriously difficult species to assess. Due to its high and variable productivity, it is difficult to detect the effect of fishing on the population with standard fisheries data and stock assessment methods. Since the stock assessments and reference points for skipjack in the EPO are so uncertain, developing alternative methods to assess and manage the species that are robust to these uncertainties would be beneficial. Maunder and Deriso (2007) investigated some simple indicators of stock status based on relative quantities. Rather than using reference points based on MSY, they compared current values of indicators to the distribution of indicators observed historically. They also developed a simple stock assessment model to generate indicators for biomass, recruitment, and exploitation rate. We update their results to include data for 2007-2009. To evaluate the current values of the indicators in comparison to historical values, we use reference levels based on the 5th and 95th percentiles, as the distributions of the indicators are somewhat asymmetric. The purse-seine catch has been increasing since 1985, and has fluctuated around the upper reference level since 2003. Except for a large peak in 1999, the floating-object CPUE has generally fluctuated around an average level since 1990. The unassociated CPUE has been higher than average since about 2003 and was at its highest level in 2008. The standardized effort indicator of exploitation rate has been increasing since about 1991 and has been above the upper reference level in recent years, but dropped below it in 2009. The average weight of skipjack has been declining since 2000, and in 2009 was below the lower reference level. Ignoring the peak in 2000, average length has been declining since 1985. The biomass, recruitment, and exploitation rate have been increasing over the past 20 years, and have fluctuated at high levels since 2003.

The main concern with the skipjack stock is the constantly increasing exploitation rate. However, the data- and model-based indicators have yet to detect any adverse consequence of this increase. The average weight is below its lower reference level, which can be a consequence of overexploitation, but it can also be caused by recent recruitments being greater than past recruitments. The continued decline in average length is a concern and, combined with leveling off of catch and CPUE, may indicate that the exploitation rate is approaching or above the level associated with MSY.

Following Dr. Maunder's presentation, a participant noted that effort data used for CPUE analysis of skipjack is taken from the FAD fishery, and that effort in the FAD fishery is not well measured, thus possibly introducing uncertainty into the abundance estimates. Dr. Maunder explained that the IATTC presents CPUE data from both the floating object fishery and unassociated fishery, although CPUE from the unassociated fishery is probably more reliable. He also mentioned that the IATTC has received recent recommendations from workshops to gather more information on FADs.

Another participant recommended the use of the size of the area fished for skipjack as part of the assessment. He also pointed out that the spatial distribution of the fishery effort could be important, citing, for example, the fact that in 2009 the effort was extremely concentrated in a 5 x 5° area off of Ecuador. The staff agreed that this could be important. He noted that in recent years there has been a decrease in the average weight of skipjack, which could be related to an offshore movement of the fishery.

One participant observed that the decrease in the average size of skipjack was probably due to natural fluctuations associated with changes in oceanographic conditions (small scale - ENSO, and medium-scale - interdecadal periods), because during the period 1975-1980 the decrease of average size was practically the same as that during 2005-2009. Based on this comparison, it seems likely that the decline in 2005-2009 was due to environmental variability. Dr. Maunder indicated that past analyses examining effects of

environmental factors did not explain many of these trends in skipjack abundance, although he noted that such studies are still useful.

Another participant expressed concern about the wording of the final conclusion of the skipjack assessment indicating that the exploitation rate is approaching or above the level associated with MSY. It was felt that some groups might interpret this statement to mean that skipjack are being overfished. Dr. Maunder indicated that the wording of the conclusion was based on a general interpretation of indicators by the staff, but not the results of a quantitative evaluation. Dr. Compean added that, in any case, it is important to inform Commission members that further increases in fishing capacity of the fleet may not be sustainable for this stock.

Finally, a question was asked about future assessments of skipjack in the EPO, and whether analyses such as Stock Synthesis 3 would be used. Dr. Maunder indicated that the problem with skipjack is that we do not have a good estimate of abundance and we do not have catch-at-age data. He suggested that assessments could produce management decisions for skipjack based on relative estimates of abundance.

10. Assesment of striped marlin

Dr. Michael Hinton presented the assessment of the stock of striped marlin [*Kajakia audax*] (Philippi, 1887) in the northeast Pacific Ocean (NEPO). A review of the results of previous (2003-2009) stock assessments and the most recent (2009) analyses of stock structure of striped marlin in the Pacific Ocean were presented to give a perspective to the results from this assessment. The results of this (2010) assessment are consistent with the previous results.

The analyses of stock structure indicate that the geographical region of this stock extends from 145°W to the coast of the Americas and lies north of about 10°S. That analysis also found that seasonally there may be a presence of low numbers of juvenile striped marlin from the Hawaii\Japan stock in the region. This assessment was conducted using Stock Synthesis (Version 3.10b). The model was not a spatially structured model (there is no substructure within the model with parameters governing movement among subareas), however three subareas were identified for data compilation and development of catch rate (CPUE) indices based on regression-tree analyses of size frequency data from the longline fisheries of Japan. These three areas were (1) those waters lying east of 145°W, north of 5°S, and south of 10°N; (2) those waters lying east of 145°W, west of 120°E, and north of 10°N; and (3) those waters lying east of 120°W and north of 10°N.

Key results of the assessment and the sensitivity analyses conducted by varying the values of fixed model parameters were:

1. The stock is not overfished;
2. Overfishing is not occurring;
3. Stock biomass has increased from a low of about 750 t in 2003 to an estimated 3,600 t in 2009.
4. Catch in recent years has been on the order of 800 t, significantly lower than the estimated maximum-sustained-yield (MSY) of slightly over 2,000 t. The estimated MSY was relatively insensitive to changes in parameters, data, or model structure, falling within a range of about 1,800 to 2,075 t. The maximum estimate of MSY (~ 3,900 t) was observed in the sensitivity analyses with a natural mortality rate of 0.7.
5. The spawning biomass ratio (SBR: the ratio of observed spawning biomass to spawning biomass in the unexploited stock) in 2003 is estimated to have been about 0.16. The SBR estimate for 2009 is about 0.31. The SBR exhibited sensitivity to changes in M and K, but was less sensitive to other changes in parameter estimates, data, and model structure. The lowest estimates were observed in runs with M = 0.3 (SBR = 0.13) or K = 0.4 (SBR = 0.07), neither of which are parameter values thought reasonable for striped marlin. Results from other sensitivity runs fell between about 0.21 and 0.33.

6. The estimated ratio of spawning biomass in 2009 (S_{2009}) to the spawning biomass expected on average to support annual catch at MSY levels (S_{MSY}) is 1.2. As with SBR, the lowest levels were observed with runs with M = 0.3 or K = 0.4, and otherwise was on the order of 0.95, with a maximum observation of about 5.3 when M = 0.7.

7. The estimated fishing mortality multiplier (F_{mult}) [the factor by which the current level of F must be multiplied to bring fishing mortality to the level expected to provide annual harvests at the level of MSY] was 6.4, indicating that current F is significantly below levels expected to produce MSY catch. In sensitivity analyses, observations of F_{mult} were generally between about 2 and 5, with extremes of 1.2 observed when M = 0.3, and 50 observed when M = 0.7.

8. If fishing effort and harvests continue at levels near current observed levels, then it is expected that the biomass of the stock will continue to increase over the near term.

Following the presentation, a participant noted that this assessment of striped marlin is quite different from the ISC assessment, which indicates the stock is overfished and overfishing is taking place. He requested ideas as to why these results would be markedly different. Dr. Hinton explained that the ISC assessment was based on catch and effort data from the north Pacific region west of 140°W, and included only the total catch estimates from the area east of 140°W, since there were problems trying to get the model to converge when it included the catch rate series from the eastern Pacific, which were not consistent with those in the western Pacific. The working group recognized at that point that this needed to be handled using assessments done for the eastern and the western Pacific, which has been the direction taken since by the ISC working group. A participant asked about the growth rate estimate used in the base case, and it was clarified that base case growth rate was not based on work done off New Zealand, but rather after considering studies from the eastern Pacific cited in a paper (by C. Boggs) from the 1988 Billfish Symposium and from the limited number of studies done since. Dr. Hinton noted that in studies of age and growth of striped marlin, the maximum age has been estimated to be about 10-11 years and that striped marlin reach about 50 percent of their maximum size by the end of their first year of life.

According to a participant, information from the Mexican sport fishery, as reported in the SAC-01-10, was not used accurately in the striped marlin assessment. He noted that in Mexico, the marlins are designated for sport fishing, and that the IATTC report does not make it clear that no commercial data exist in Mexico for this species. He also thought that the wrong report was cited for the Mexican data and that the average number of trips reported was in error. He also pointed out that not all trips catch one marlin. He thought that the numbers in the IATTC report converted to biomass show much larger annual catches than in the Mexican report. The catch and release rate was 80% in recent years, with 25% survival, while the IATTC base case assessment assumed no survival. Dr. Hinton said he used the data from the report for 2007 and the preliminary data for 2008, but that if the values used were incorrect or more recent data were available, then they could be updated and the report revised, agreeing to fully cooperate to update the pertinent data for a revision. The assumption that 100% of released fish die was a precautionary choice in terms of indicating the maximum impact, and it was not considered that this was the actual mortality rate, which is why a sensitivity analysis was run assuming a 25 percent mortality rate that had been reported (M. Domeier) in the literature. Dr. Hinton noted that in any case, the assessment shows that the stock is not in a bad state. The participant expressed concern that document SAC-01-10 does not reflect the actual situation in the fisheries of México, and suggested it should be treated as preliminary. The staff will take these comments into account and include them in the document submitted to the Commission. It is important to have a striped marlin assessment, because the Commission members have been asking for one.

Another participant noted the major drop in CPUE of striped marlin observed in the Pacific and other oceans before 1974, and wanted to know if this early period was incorporated in the assessment. Dr. Hinton pointed out that a number of the sensitivity analyses had included the full period of the longline fisheries, which began expanding into the eastern Pacific in about 1954, and which targeted billfish in the

late 1960's to early 1970's. It was explained that starting the model in 1954 resulted in the generation of unrealistically high recruitments in order to explain the high catches in the target fishery. In previous assessments this problem had been solved by estimating two catchability coefficients, one for the target period and another for after. In this (SS3) model, that approach would have resulted in separate fisheries, one for the early period and one for the latter gives results essentially the same as those from a model with a single series for the latter period, so it was decided to start the model in 1975, consistent with the approach taken in tuna assessments, and to include the influence of the target fishery period by including recruitment deviates starting in 1970. In previous assessments, which were not done using SS3, the solution was approached using two catchabilities in the catch rate standardization, one for the early period, and one for the latter.

A suggestion was made to use survey and size data collected by the Southeast Fisheries Science Center recreational billfish tagging and survey programs. It will be included in the near future. Dr. Kohin, SWFSC, extended an offer to work with Dr. Hinton on this. Another suggestion was made to show selectivity, likelihood profiles, and size frequency data for the assessment.

Results of the IATTC striped marlin stock assessment were generally consistent with a study by Olaf Jensen. Jensen did not find striped marlin in coastal fisheries south of Mexico, only sailfish. Small fisheries along the coast were not expected to have contributed to the catch.

11. Review of IATTC port sampling program

Dr. Cleridy Lennert-Cody of the staff explained that the objective of the IATTC port-sampling program is to sample the tuna catches from the surface fishery (purse-seine, pole-and-line) in the eastern Pacific Ocean for length-frequencies and species composition. Samples are collected during vessel unloading in the ports of Ecuador, Mexico, Panama and Venezuela. To obtain a representative collection of samples, the surface fishery is divided into categories ('strata'): 13 areas, 12 months and 7 modes of fishing. Modes of fishing are defined by the overall fishing gear of the vessel (purse-seine versus pole-and-line), the type of purse-seine sets made to catch the fish and the size category of the vessel. The same sampling protocol is used to collect samples from each stratum. A stratified two-stage sampling protocol is used. Vessel wells are the first stage, and the second stage is the fish within a well. Logistics dictate that vessel wells be sampled opportunistically as time and availability permit. Observer data or vessel logbooks are used to determine which wells can be sampled. A well is only sampled if all the fish in the well were caught in the same area, month, and by the same fishing mode (i.e., all sets in the well were from the same stratum). Individual fish within a well are sampled as the catch is unloaded. A number of fish of each species (ideally 50) are measured for length. Independent of the measured fish, several hundred fish are counted for species composition. Samplers are instructed not to sample fish from the top 10% or bottom 10% of the well in order to obtain a more representative sample of fish in the well. Individual fish are sampled from an opportunistically established starting point, as circumstances permit; a truly random sample of fish in the well is not logistically feasible. The details of sampling fish (measuring, counting) from a well depend on the stratum characteristics, the assumed (and actual) catch composition of the well, and any sorting of fish by species and/or weight category that may have occurred prior to the point where the sampler has access to the fish.

Following Dr. Lennert-Cody's presentation, a participant asked about the possibility of beginning experimental on-board sampling. Dr. Lennert-Cody explained that currently the IATTC samples the landed catch, and has no detailed length data on the discards (although observers do record the amount of discards at sea by weight category). The staff presented analyses of the representativeness of the IATTC port-sampling data at last year's stock assessment meeting in May. The staff plans to finish further analysis of data from previous exhaustive well-sampling studies to continue to assess the representativeness of the samples collected in port. The results of these analyses could be combined with simulations to determine the extent to which any shortcomings of the in-port sampling might affect stock assessment results. This work should be completed before considering experimental on-board sampling

because on-board sampling is not without its own challenges. It might be useful to add at-sea efforts if this contributes to increased precision of stock assessments.

Another participant asked about sampling of other species of fish such as dolphinfish. Mr. Everett explained that other tuna species, such as Pacific bluefin and black skipjack, are sampled, but not dolphinfish. A question was asked regarding possible port sampling for biological samples. Some biological sampling is conducted currently, including gonad and otolith collections. Mr. Schaefer added that, in the past, the IATTC has utilized observers at sea to collect biological samples such as otoliths (for aging studies), gonads (for reproductive biology studies), and stomach contents (for diet studies).

A discussion developed contrasting the systems for sampling the catches of tunas in the western and eastern Pacific. It was noted that in the western Pacific, observers were sampling the catch at sea as part of a pilot study of the feasibility of at-sea sampling. Some of the data collected by this pilot study and potential problems with at-sea sampling were discussed in a workshop at IRD in Sête in June 2009. It is not known if these problems have been resolved nor what fraction of the total samples in the western Pacific is presently being collected by their at-sea sampling program. The IATTC system in the eastern Pacific is based on port sampling and appears to be working well. Dr. Compean noted that there would be difficulties in transferring our sampling system to the western Pacific, but that the IATTC has good cooperation with the WCPFC, and that some discussion has taken place about collaborative analysis of vessels that cross over the boundary line of the management areas.

A participant asked about the possible use of newer technology systems to determine species composition of the longline catch, which could reduce the lag time of incorporating this information into the stock assessments. Dr. Deriso indicated that incorporating the newer technology systems, such as camera systems, into the sampling protocols would not be difficult, but there might be concerns about privacy in having cameras aboard vessels. Dr. Hall reviewed the IATTC's experience with camera systems, and indicated that privacy is probably not a big issue as long as camera systems were used in association with the well deck. It was agreed that future efforts should continue to incorporate cameras and newer technology systems into the sampling protocols of the IATTC.

There was some discussion regarding the best use of resources for the IATTC sampling program. Dr. Lennert-Cody explained that the IATTC's analysis presented at the stock assessment meeting last May indicated that if extra resources were available, it would be better to allocate those resources towards sampling more wells rather than to sample more extensively within a well. She indicated that the IATTC likely samples a small percentage of possible wells. Based on a rough calculation of number of trips and vessel wells per trip, Mr. Vogel reported that the IATTC may have sampled roughly 5-10% of available wells during 2009; more accurate estimates of sampling coverage will be made in the future. Dr. Compean added that the IATTC system of port sampling works well for sampling in the EPO, since the IATTC has field offices in the ports of landing, which produces good sampling of strata in time and space.

12. Update on proposal for EPO tuna tagging project

A proposal for the creation of a large-scale Regional Tuna Tagging Program (RTTP) (IATTC document SAC-01-12) for bigeye, skipjack, and yellowfin tunas in the eastern Pacific Ocean (EPO) was presented by Mr. Kurt Schaefer. The proposal calls for conducting tagging operations throughout the region for a period of three years. The proposed budget is about US$1.5 million per year. An international Steering Committee of outside experts has been formed, and comments were solicited from the committee members on the proposal. The project would be implemented and managed by the IATTC, in consultation with the Steering Committee.

The goal of the program is to improve the scientific foundations, and reduce uncertainties, in the stock assessments for these three commercially important species of tunas. The methods to be employed include chartering commercial pole-and-line vessels, with about 10 months of total charter time per year,

to enable adequate spatial and temporal tag deployments throughout the region. Both conventional plastic dart tags and archival tags would be deployed with all three species. Adequate measures to maximize the return of tags from recaptured fish are crucial to the success of the project.

Justifications for initiating such a large-scale RTTP in the EPO were presented and included the fact that tagging data have the most merit in providing estimates of home range distributions and delineation of stock structure, diffusion rates, and the extent of mixing between regions. Furthermore, tagging data are essential for estimation of growth and natural mortality rates for which the results of the current assessment models have been demonstrated to be highly sensitive.

Following the presentation, the meeting participants expressed support for a comprehensive tagging project, and underscored the importance of the information that tagging can provide for assessing the stocks. A participant noted that there was also strong support for large scale tagging at the Kobe meeting in Barcelona this year. The participants requested that the meeting report reflect a consensus for continuing tagging efforts and requests for funding be taken to the Commission. Dr. Compeán explained that a consensus for continued tagging has always existed, but the staff has continued tagging efforts scaled to a small budget. The hope continues for increased financial support enough to meet the needs of stock assessments.

Some participants underscored the need for an effective tag recovery program targeting all significant fisheries, and especially longliners, a gear that one participant said has shown poor reporting rates of tag recoveries. Recovery of tagged fish caught by longliners is essential to study the movement patterns and growth of bigeye. Mr. Schaefer discussed the need for better tag seeding studies for estimating tag reporting rates, and tag seeding experiments are planned. Reporting rates for longline vessels are difficult to measure because tag seeding experiments cannot be done due to methods of operation on longline vessels. Reporting rates have been lower for dart tags than for archival tags, which have a greater reward for their return, on longline vessels.

A participant asked about the preferred method of tagging on pole-and-line vessels, noting that an age-and-growth study of bigeye tuna by Schaefer and Fuller involved fish up to about 4 years of age, while studies in the western Pacific reported maximum age beyond 10 years. Is this discrepancy because of the pole-and-line sampling method? Mr. Schaefer explained that survival of the fish is best for pole-and-line fishing due to the way fish are handled. Samples for the bigeye growth study originated from purse-seine vessels, and sampling was limited to smaller fish because the daily rings on the otoliths of larger bigeye are compressed and difficult to count.

13. Sharks: Review of workshop, November 2009

A workshop on Shark Stock Assessment was held in La Jolla on the 2nd of November 2009, preceding the Modeling Population Processes workshop. This workshop focused on using Stock Synthesis to assess shark stocks, in particular the silky shark (*Carcharhinus falciformis*). The agenda was flexible to accommodate discussion and was webcast using GotoMeeting.

The workshop started with a brief review of methods used in shark (and other elasmobranch) stock assessment by Dr. Enric Cortes. This was followed by several Stock Synthesis application and methodology presentations. The meeting finished with a discussion of desired developments of Stock Synthesis. Two of particular interest for shark assessments are the inclusion of a more appropriate stock-recruitment curve and methods to estimate catch.

14. Fisheries oceanography: preliminary results on oceanographic factors affecting tuna recruitment

Dr. Michael Hinton presented a summary of ongoing IATTC work to develop a method to estimate recruitment to bigeye, skipjack, and yellowfin tuna fisheries that are independent of stock assessment models. This is being pursued in part by active collaboration in an ongoing project to develop a decision

support tool (PHAM: the Physical Habitat Analysis Module) that integrates and makes available real-time satellite data and habitat analysis to fisheries scientists and managers. Included in the tool is an interface that may be used to deliver the data in formats suitable for use in R or SPlus. It is intended that PHAM be applicable across a wide range of fisheries, which requires that a number of applications be used in development and testing, and among these is the estimation of tuna-recruitment. Dr. Hinton presented examples of results of preliminary analyses, including a number comparing trends in recruitment of tunas obtained from assessment models to new indices of oceanographic conditions. This three-year project has just completed one year of work, and a preliminary version of the tool, "PHAM Lite", may be downloaded (http://phamlite.com) for individual use, and to provide scientists the opportunity to provide feedback which may be useful to guide development during the next two years.

Following Dr. Hinton's presentation, a participant pointed out that the analysis of ENSO variability and skipjack abundance was not matched spatially. It was also suggested that long-range, inter-decadal changes in environmental factors could influence food abundance and trophic relationships, and that this could have significant effects on skipjack abundance. It was suggested that instead of inter-annual comparisons, the staff could conduct inter-decadal or longer duration analyses on the data series. Dr. Hinton pointed out that these examples were used to illustrate the kinds of problems that are frequently seen with the use of environmental data in analyses, which are that the data sets are sometimes compared even though they are not matched spatially and/or temporally. He concurred with the suggestion that a decadal analysis of the data would be informative.

15. Ecosystem considerations

a. Effects of the tuna fisheries on the ecosystem of the EPO

Dr. Robert Olson presented an overview of ecosystem considerations for tuna fishing in the EPO, focusing on studies of trophodynamics, ecosystem metrics, and contemporary signs of ecosystem changes. The Antigua Convention specifies the conservation and management of species belonging to the same ecosystem and that are dependent on or associated with the fish stocks covered by the Convention. Species dependencies are only understood by continued studies of the structure and function of the food web in the EPO. Bottom-up forces caused by environmental variability and top-down effects of fisheries removals act in concert through the food web. A greater understanding of the trophic links and biomass flows in the food web is necessary.

Brief reviews of diet studies of tuna and dolphin captured when associated, of many components of the predator community, of mesopelagic myctophid fishes, of intra-guild predation on tunas, and of broad-scale comparisons of diet data from other regions and oceans were provided. This was followed by brief reviews of stable-isotope studies of yellowfin tuna, and a relative new methodology of analyzing the nitrogen isotope values of individual amino acids. The STAR Project of the SWFSC has been instrumental in ecosystem studies of the EPO, and the STAR cruises have provided samples for studies of stable isotope ecology and trophic interactions. Collaborations with researchers of other organizations and students have contributed much to the IATTC's studies of trophodynamics.

An ecosystem approach is a widely recognized goal of fisheries management, but describing and measuring the effects of a fishery on an ecosystem is not a simple task. A study in progress used data from the purse-seine fishery for tunas in the EPO to compare the removals (not just bycatch) of each of the methods of fishing by weight, number, trophic level, replacement time, and diversity. The three methods of purse-seine fishing have different ecological consequences, which are illustrated by using a suite of indicators. A clear statement of ecosystem-level management objectives is needed.

Brief mention was made of the large range expansion undergone by jumbo squid (*Dosidicus gigas*) in recent years. These squid, and other ommastrephid squids, are considered key components of the ecosystem in the EPO. Large individuals have expanded the normal limits of their range (southern Baja California and Peru) north into waters off the Pacific Northwest of the United States and south into waters

off Chile. This has sparked considerable speculation about the cause of the range expansion: a. expansion of suitable habitats, and/or b. decreased predation by reduced stocks of large predatory fishes. The concept that jumbo squid might serve as an indicator of ecosystem change was mentioned.

Following the presentation, a participant commented on the potential influence of giant squid on trophic systems, since they are documented as predators on both pelagic and demersal fishes. The question was raised as to whether giant squid could impact tuna populations through predation on juvenile or early-adult tunas. Dr. Olson reported that giant squid are significant predators on numerous species of fish, and that the metabolism of giant squid is quite high and requires large daily rations of food. Anecdotal evidence from purse seine catches indicates that giant squid can consume large proportions of tuna co-occurring in the nets. Thus, giant squid have the potential to significantly influence the trophic dynamics of an ecosystem, most likely via predation on forage items shared by the tunas (*i.e.* competition).

A participant asked if there are comparative studies of trophic dynamics of tunas or dolphins between the EPO and areas outside the EPO. Dr. Olson indicated that there are similarities and differences in trophic structure between oceanic regions. This is due, in some part, to the fact that tunas are opportunistic predators, and that the diversity of prey is different among oceanic systems. For example, in the EPO small *Auxis* spp. are abundant and make up a significant proportion of tuna diets, while in the western Pacific the diet of tunas is much more diverse due to the presence of reef-associated taxa. In the Atlantic, tunas feed extensively at a lower trophic level on mesopelagic fishes.

b. Productivity and Susceptibility Assessment (PSA) of key species

Dr. Robert Olson presented information on a preliminary Productivity and Susceptibility Assessment for the purse-seine fishery of the EPO. The vulnerability to overfishing of many of the stocks incidentally caught in the EPO tuna fisheries is unknown, and biological and fisheries data are severely limited for most of those stocks. The IATTC staff is evaluating established methods for determining the vulnerability of data-poor, non-target species. A version of productivity and susceptibility analysis (PSA), used to evaluate other fisheries in recent years, considers a stock's vulnerability as a combination of its productivity and its susceptibility to the fishery. Details on the analysis procedure are given in document SAR-01-15.

In general, some of the sharks, the giant manta ray, and the dolphins had the lowest productivity scores. The tunas and some of the "large fishes" scored the highest in productivity. The olive Ridley turtle, great hammerhead, and bigeye thresher shark in floating-object sets scored lowest in susceptibility, while bigeye trevally, yellowtail amberjack in unassociated sets, and black marlin in floating-object sets had the highest susceptibility scores. In terms of overall vulnerability to overfishing (equation above), some of the sharks and the giant manta in dolphin sets scored the highest. However, precaution was advised in interpretation of this preliminary PSA for silky and oceanic whitetip sharks. The analysis indicates that silky sharks are more vulnerable to overfishing in dolphin and unassociated sets, and oceanic whitetip sharks are more vulnerable in dolphin sets, than in floating-object sets. This is due to higher susceptibility scores for those sharks in the index of areal overlap-geographical concentration and the percent retention of the bycatch ("Desirability/value of catch," for dolphin sets than for the other fisheries. This is a misleading result because only 3% and 8% of the cumulative bycatch (in numbers of individuals) of silky and whitetip sharks, respectively, recorded during 2005-2009 was caught in dolphin sets.

Following Dr. Olson's presentation, a discussion took place regarding both presentations on ecosystem considerations. A participant noted that the PSA analysis is based on productivity, or a stock's ability to recover, but that recovery can be measured in different ways. It was also noted that recovery is a relative term, and that it is important that the relative boundaries of possible recovery in the analysis are defined (*e.g.* recovery to a virgin stock size, or to a different level, etc.). Dr. Olson suggested that the definition of productivity, as used in this analysis, could be improved, since the productivity indicators in the PSA analysis are basic life history and biological information. A participant pointed out that the PSA analyses

may not appropriately capture the vulnerability of a species if there have been changes in relative species abundance over time. For example, recent catch levels of oceanic whitetip sharks are low and may suggest a lower vulnerability. It was also noted that trying to apportion historical aggregate catches to species based on current relative proportions is quite likely misleading, since the different shark species may have different trends (positive, negative or zero), or they may change at different rates, biasing the figures. However, apportioning historical aggregate catches is not required for PSA, and catch trends for 1993-2009 comprise one of the susceptibility attributes in this preliminary PSA (SAC-01-15, Table 3).

A participant noted that the analysis includes a lot of data, and inquired as to how the analysis accounted for uncertainty. Dr. Olson indicated that uncertainty is addressed through a data quality index that is assigned to each productivity and susceptibility score for the 17 attributes corresponding to a given species, and this is a subjective characterization. There are also methods for weighting particular attributes, depending on how informative an attribute is for describing the productivity and susceptibility of the stocks in question, although this preliminary analysis used the default attribute weightings.

A participant noted that the analysis is focused on purse seine data, but that longline fisheries often produce large quantities of bycatch of turtles, billfishes and other taxa. It was suggested that the analysis should be expanded to include longline data and that the bycatch data from both types of fishery could be integrated. Dr. Olson agreed that it would be helpful to integrate longline data into the analysis, but that there are problems with data availability, and that certain bycatch groups are often not broken down by species. An inquiry was also made about FAD-associated, cryptic accidental mortality of sharks, turtles and other taxa, and whether this mortality is estimated in this analysis. Dr. Olson yielded to Dr. Hall to address the issue of cryptic mortality associated with FADs. Dr. Hall reported that the IATTC had estimated that about 1% of FADs analyzed contained entangled olive Ridley turtles, which converted to approximately 100 olive Ridley turtles entangled (though not necessarily assumed to have died).

16. Pacific bluefin working group

Dr. Mark Maunder presented information about the Pacific bluefin working group (PBFWG). In July 2010, the PBFWG met, updated the stock assessment for Pacific bluefin, and provided scientific advice. Dr. Maunder mentioned that developing management reference points for Pacific bluefin tuna is problematic because absolute levels of biomass and fishing mortality, and reference points based on maximum sustainable yield (MSY), are hypersensitive to the value of natural mortality. Relative trends in biomass and fishing mortality levels are more robust to model assumptions. Therefore, management reference points based on relative biomass or fishing mortality should be considered for managing Pacific bluefin tuna. We develop a management "indicator" that is based on integrating multiple years of fishing mortality and takes the age structure of the fishing mortality into consideration. The indicator is based on calculating the impact of fisheries on the stock of fish. The fisheries are grouped into those in the eastern Pacific Ocean (EPO) and those in the western and central Pacific Ocean (WCPO) because setting management guidelines for the EPO is the goal of this analysis. The base case assessment developed by the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) is used as the stock assessment model. The sensitivity of the fishery impact and its use as a management indicator to the different natural mortality assumptions are evaluated.

The estimated impact of the fisheries on the Pacific bluefin population for the whole time period modeled (1952-2006) is substantial. The impact is highly sensitive to the assumed values for natural mortality. The WCPO fisheries have had a greater impact than the EPO fisheries, and their rate of increase in recent years is higher. The temporal trend in the impact is robust to the assumed level of natural mortality. The impact of the EPO fisheries was substantially lower during 1994-2007 than it was during 1970-1993, when the stocks were depleted to a much lower relative size; however, the impact has been increasing recently. The average catch in the EPO fisheries during 1994-2007, the period of low fishery impact, is 4,221 metric tons (inter-quartile range 2,416-4,704 tons). The estimated status of the stock is uncertain, and is sensitive to model assumptions. Catch levels should be set based on those years when the impact

was low until the uncertainty in the assessment is reduced. This management measure should ensure that the fishery is sustainable as long as similar measures are taken in the WCPO.

Following Dr. Maunder's presentation, a participant expressed that this study is interesting and supplements the ISC's work. However, the results of the ISC analysis are needed to determine the status of Pacific bluefin tuna. The situation is complicated by the fact that bluefin move from the WCPO to the EPO and then return to the west. The ISC study is for the entire Pacific. Dr. Maunder pointed out that the analysis presented today was based on the ISC analysis. IATTC staff has been colloborating on the ISC analysis, and they have focused on special issues, such as the high sensitivity to adult mortality. Recommendations for the EPO have to be made by the IATTC. The bluefin workshop of the ISC recommended that levels of *F* be reduced below 2004-2006 levels, and the participant requested that the IATTC endorse the resolution because the stock is in both areas. The IATTC staff took the ISC recommendation into consideration, but the Director is required to take the recommendation of the IATTC scientific staff to the Commission. The IATTC staff did not disregard the scientific work and advice of the ISC in the analysis presented. In fact, the analysis is based upon the PBF base case model developed by the ISC-PBG WG and takes into consideration the work that the ISC has done on developing reference points, to which IATTC staff has contributed. The advice of the staff is consistent with that of the ISC.

A participant pointed out that Mexico participates in the PBFWG of the ISC along with Dr. Aires-da-Silva, and recognizes his great contribution to the work of this group. Together they have worked to produce analyses for the assessment of bluefin in the EPO. The Commission has taken into account the analysis of the ISC, but management recommendations for the EPO must be made by the IATTC staff, acccording to established procedures. The preliminary proposal to limit the catch in the EPO is consistent with the scientific recommendation of the ISC. The participants underscored the importance to establish tangible conservation measures that are equivalent in both regions, and that special attention be placed on the mortality of age-0 bluefin. IATTC staff noted that their conservation proposal should be viewed as an interim measure and that the next ISC assessment for bluefin tuna in 2012 could result in a different recommendation.

17. Northern albacore working group

Dr. Richard Deriso presented a summary of the work of the Northern Albacore Working Group. There has not been a new assessment of northern albacore but there are plans for a new one by the ISC working group in March 2011. At the request of one of the IATTC Commissioners there will be a small meeting in the margins of the next annual meeting to try and reach agreement on what is meant in resolution C-05-02 by the word "current" in the context of the requirement to keep fishing effort from exceeding current levels. A data summary was explained that showed that the aggregate fishing effort of the US and Canada. Troll days fished for 2002-2004 (the ISC recommended "current" time period) was close to the 1998-2007 ten-year average.

A participant asked about the inclusion of information on southern albacore in the IATTC convention. Dr. Compean replied that southern albacore are included in the convention, but that little information was available. Dr. Deriso indicated that in the past, the IATTC has invited SPC scientists conducting assessments of southern albacore to these meetings, but that they have been unable to attend. He indicated that the IATTC will continue to invite participation of SPC scientists to review the assessments done on Southern albacore.

18. Plan for future activities

Dr. Compean explained that under the Antigua Convention, the IATTC staff is to present a 3-year plan for future research activities. This plan is to be brought to the SAC according to the Convention. Dr. Deriso noted that the staff would not cover the details of the 3-year plan, except for presentations by Mr. Nick Vogel and Mr. Alejandro Perez on database activities.

Mr. Vogel presented a brief overview of datasets currently maintained by the IATTC. A timeline of notable occurrences in the history of IATTC was displayed, with the collection of the first length frequency measurements in 1954. This was followed by the implementation of the Observer program in 1979, with its emphasis on marine mammals' involvement in the purse-seine fishery. The first iteration of the Observer database was completely independent from the previously established Tuna database. This situation was improved in 2000 with the conversion of the existing VAX database system to a Structured Query Language database using Microsoft SQL Server. In 2010 the IATTC staff reorganized the Tuna and Observer database groups into a single Data Collection and Database group.

Major historical and current datasets collected by the IATTC staff for the purse-seine fishery in the EPO were described, including vessel logbooks, cannery unloading, tuna length frequency and observer data, along with details of data items collected in each dataset. Mention was made of summarized data provided for other gear types, including longline and pole and line fisheries.

Observer sampling of trips by vessels of >363 MT carrying capacity by observers was discussed. When the observer program was established, about 20% of the trips carried observers, and this percentage reached 50% by 1991. By 1993 100% of the trips were sampled by observers. This change in coverage was due to the assignment of individual yearly Dolphin Mortality Limits to each vessel, which necessitated 100% observer coverage since the dolphin mortality for a trip could not be estimated.

National observer programs have been established by Colombia, Ecuador, the European Union, Mexico, Nicaragua, Panama and Venezuela. IATTC observers sample no less than 50% of the trips of vessels of these nations. All of the observer programs use an identical data collection, processing and storage system so that complete datasets of equal quality data are produced and regularly exchanged. This is a win-win situation as both the IATTC and national observer programs have access to twice the quantity of data than they would have if they only had data from their own trips. Over time observers began collecting additional data at sea, which includes information on floating objects and sea turtles, including sightings of these, and bycatch information on non-tuna species.

The IATTC also maintains datasets on other topics of interest, including trophic ecology studies, fishing compliance information, YFT spawning investigations, tuna tagging programs, dolphin-safe certification, lists of vessels authorized to fish in the EPO, and high seas transshipments of catch in the EPO.

Mr. Perez presented a summary of the data life cycle, which includes data gathering, data processing and data analysis and reporting. He then presented areas of these processes targeted for improvement. The database was built with independent tables designed for data entry but not optimized for analysis. This will be improved by creating separate databases oriented to each subject, with each database a different representation of the existing data, optimized for analysis purposes. The Data Collection and Databases Group was created to implement a unified team work environment to share code and libraries so that custom applications may be more easily and efficiently maintained. Most of the data entry and data processing applications will be hosted on the internal IATTC website, which will improve the security and ease of maintenance. There is limited database documentation, so a centralized repository of information describing data available, such as meaning, relationships to other data, origin, usage and format will be created. Many common data processing tasks are time consuming under the present system, so new applications will be created to automate these processes where possible. The IATTC web site has become difficult to manage with the original authoring tools still in use. A completely new website based on new technology will be developed so that information produced by the organization will be released more efficiently.

Following the presentations by Mr. Vogel and Mr. Perez, a participant asked about the utilization of older tagging data at the IATTC. Mr. Vogel indicated that older tagging data, dating back to the early 1950's, are maintained. A participant also noted that the data from large commercial fisheries are well covered by the IATTC, but inquired about artisanal fishery databases. Dr. Compean explained that there are few artisanal fisheries for tuna in the EPO, but the IATTC has some data, but no specific monitoring of those

fisheries. Some non-governmental groups maintain databases from artisanal fisheries for specific projects, but these usually do not include tunas. He also indicated that the 3-year plan included some analyses of artisanal fisheries.

Dr. Compean prefaced the discussion of the data life cycle. He indicated that the intention of this presentation was to demonstrate the large amount of work done behind the scenes by the IATTC staff in support of the stock assessments and other research programs. Several participants praised the efforts of the IATTC staff to develop transparency in the database development.

A participant made a general suggestion that the IATTC website could be improved, and that perhaps the ICCAT website could be followed as a model. Mr. Perez indicated that the IATTC staff will give high priority to improving the efficiency of the website, and will also investigate methods for sharing data through the website.

A participant recommended data mining of old data in the assessments. Dr. Hall pointed out that for all of the tuna commissions, their databases are different. He recommended the development of a common database format, as well as standardization of data gathering procedures.

Discussion of three-year staff research plan:

A participant requested discussion of specific details of the three-year staff research plan. Dr. Compean indicated that the SAC could discuss any specific topics of the plan, since the Antigua Convention specifies that the staff should propose research plans. Dr. Compean recommended that Dr. Hall present results of the IATTC's continuing monitoring studies of the fishery on fish-aggregating devices (FADs).

Following discussion on database activities, Dr. Hall reviewed information on the IATTC's research on FADs and bycatch, and mentioned future research ideas.

Following Dr. Hall's presentation, a participant briefly discussed work being done by ACAP (Agreement on Conservation of Albatross and Petrels) stressing branch-line weighting as the most effective mitigation measure. He also highlighted the joint research conducted by Washington Sea Grant and Japan. Most of the mitigation measures refer to the industrial fishery, and there is work to be done for smaller vessels. ACAP looks forward to cooperating with the IATTC. Endemic species in the Galapagos Islands, 16-17 species listed by ACAP, occur in the IATTC region. Another participant recalled the May 2009 IATTC technical meeting on seabirds. During that meeting, a resolution on seabirds was prepared to submit to the Commission. Several items were planned but not carried out, including a second workshop. A participant recommended that the activities that had been called for should be carried out. Dr. Compeán said last year's recommendation on seabirds and the draft resolution that emerged from the Commission meeting would be resubmitted for consideration by the Commission.

Another participant stated that efforts to reduce the catch of small fish are stronger now. The use of sorting grids by Ecuadorean vessels reduces bycatch in general. He requested that the staff provide support in the form of a scientific design to test the effectiveness. The staff is following up by requiring the observers to record information about sets in which sorting grids are used. The staff is prepared to cooperate further. Another participant congratulated Dr. Hall on a comprehensive presentation, and wants to know what information is needed in respect to FADs and how to transfer it to the staff.

Biol. Jimmy Martínez gave a short presentation about the sorting grids being used in Ecuador. Six models have been tested, and the devices constructed from netting material have had the best results. Up to 1.6% of the catch of yellowfin, bigeye, and skipjack stratified < 2.5 and >2.5 kg escaped through the grid. Large number of bycatch species, such as *Coryphaena hippurus* and *Acanthocybium solandri* also went through the grid. There was discussion about the widths and depths of the grid cells, which were 11 x 11 cm.

A recommendation to develop a network for information about the effect of sorting grids, similar to the network used to measure the effect of circle hooks, was put forth. The Director offered full support of the

Commission staff for this and a statistical design.

19. Other business

A participant made a number of recommendations, which are listed in Item 20. Another participant suggested that the staff should prepare a document outlining a set of rules for the Scientific Advisory Committee, using the Convention as background. The Director thought this was an excellent suggestion, and would like further suggestions on the topics to include in the draft.

Another participant requested information about the effect of last year's management measures. The need is for actual catch and effort data of the purse-seine and longline fisheries, to understand how much those items decreased. Was effort allocated to other areas? The staff will prepare this information.

Dr. Compeán presented a brief discussion of Resolution C-05-03 on sharks. As part of the 3-year future research plan presented to the SAC, the IATTC staff has included an emphasis on the study of sharks, through improved data collection and development of measures to assess bycatch and the status of shark stocks. Several recommendations are being proposed by the staff to strengthen the existing resolution on sharks. One recommendation is that all sharks not targeted by a fishery should be released alive, and that the monitoring of the oceanic longline fishery should begin immediately through the observer program, up to 5% coverage. It is also recommended that funding be provided in the new proposed budget to the Commission that would support the work on sharks. A third recommendation is for timely reporting of shark catch, by country, as part of this effort. Of particular concern are catch data for species such as silky sharks and oceanic white tip sharks, which appear to be decreasing in abundance. It is anticipated that the shark assessments would be a collaborative effort involving the IATTC, governmental organizations and non-governmental organizations.

The meeting was in agreement that the staff prepare a proposal for clarification of the measure adopted on sharks.

20. Recommendations

There was discussion of the draft staff Conservation Recommendations for the 81st Meeting of the IATTC, presented in Appendix A. The staff's final recommendations will be submitted to the IATTC members through the Director, and are separate from any recommendations of the SAC. The opinions of everybody, however, are taken into account

Dr. Compeán reviewed the changes in the draft from previous years. A participant recalled that the staff's recommendation for the last few years was for an 84-day closure to reduce fishing mortality, but closures of 59, 62, and 73 days, for the years 2009, 2010, and 2011, respectively, were agreed upon by the members. He requested an explanation for a recommendation of fewer days this year. Dr. Compeán said it was due to three factors that have improved the situation: 1. There was a strong decrease in fishing effort by longline vessels. 2. There was a likely effect from management measures. 3. Average recruitment was good overall for yellowfin and bigeye. The fishery is considered a single fishery, so the measures apply to yellowfin as well as bigeye. Dr. Deriso added that in the base case analysis, the F multiplier was greater than 1, which would indicate that fishing mortality could be increased and still not exceed F_{MSY}. However, only a small change in assumptions calls for a reduction in fishing mortality, such as if steepness is 0.9. The capacity at the beginning of 2010 was less than that at the beginning of 2009. He noted that the staff did not recommend a reduction in the closure time period for precautionary reasons.

A participant pointed out that the current resolution contains some provisions which are not in these conservation recommendations from the staff. Dr. Compeán said that additional appropriate provisions would be included before any new conservation resolution was finalized.

It was also noted that, in the bigeye assessment, a sensitivity analysis was done for L_2. A participant asked if the maximum observed size of bigeye (estimated from weight records) caught by sportfishermen

falls within the confidence intervals around the fixed L_2 of 185 cm assumed in the base case model. Dr. Aires-da-Silva has not looked at this factor, but this suggestion was taken into consideration.

A recommendation for management measures for Pacific bluefin tuna was introduced by IATTC staff. A participant expressed concern about specifying actual catch limits due to the uncertainties in the assessment and because the assessment is continuing. He was reluctant to have a very different regulation in the EPO, given that the recommendation based on the assessment by the ISC working group for Pacific bluefin tuna was to control *F*. He offered to provide text for a revision specifying controls by nations rather than for the entire EPO. Another participant recommended basing the fishing effort control for the sport fishery using the same years as used as the basis of the commercial fishery recommendation. A participant indicated that a quota system would be the surest way to meet the objectives of bluefin conservation.

Dr. Compeán noted that the staff will carefully consider the comments provided on the conservation recommendations for Pacific bluefin tuna in determining its final recommendations to the members. A participant asked Dr. Compeán, in his capacity as Director, to communicate to the WCPFC the need to develop equivalent management measures in both regions.

There was a question about the possibility of including a recommendation on bycatch among the management resolutions. Dr. Compeán replied that the recommendation on seabirds will be included again, but not as a management matter. While there was support by the meeting for submitting the same recommendations on seabirds this year, it was also noted that at last year's meeting there was extensive discussion on the proposal. At the end of the meeting a broadly agreed draft resolution was developed, although it was not adopted. One participant raised the matter of not yet having held a second workshop, which could produce additional relevant information on seabirds.

The following are recommendations made by individual participants at the Scientific Advisory Committee meeting, in no particular order. The participants understand that some are more important than others.

1. Consider indicators, such as size of area fished, for all species, especially skipjack tuna.
2. Change the title of the striped marlin assessment to be a preliminary assessment due to a need to review the data sources.
3. To support tuna tagging experiments, and request funding from the Commission.
4. A suggestion that the IATTC website could be improved, with one participant suggesting that perhaps the ICCAT website could be followed as a model.
5. To conduct data mining for the preservation of old data.
6. Encourage all the Commissions to work toward a common database format, and to standardize data and data gathering procedures.
7. Make the necessary efforts to accomplish pending items in last year's seabird resolution, including holding a second workshop.
8. That initiatives on seabirds in other RFMOs might be similarly adopted by IATTC, including information about which species are more at risk in which fisheries.
9. Develop a network for information about the effect of sorting grids, similar to the network used to measure the effect of circle hooks.
10. That the rule of quorum needs to be clarified, as well as what action to take if a quorum is not achieved for scientific meetings. Fewer participants also provide valuable review.
11. More data transparency. Access to basic data should be eased for members of the Scientific Advisory Committee.

12. Establish a clear policy for scientific documents, including standardization and availability. Recommendation that IATTC members encourage their scientists to conduct and submit analysis on subjects of interest to the Scientific Advisory Committee.
13. That the attendees select a rapporteur for each meeting of the Scientific Advisory Committee.
14. That the IATTC staff prepare a document outlining a set of rules for the Scientific Advisory Committee, using the Antigua Convention as background. The document might include such items as: what constitutes a quorum, limits on the number of advisors to be present, who can speak and how that is controlled, how non-members are invited, small ad hoc working groups, and whether to allow submission of all types of papers or just those invited or pertinent to a topic.

21. Meeting report

The meeting report was adopted.

22. Adjournment

The meeting was adjourned at 2:10 pm on 3 September 2010.

Appendix A.

CONSERVATION RECOMMENDATIONS FOR THE 81ST MEETING OF THE IATTC

The staff recommends the following measures for the conservation of tunas in the EPO:

23. YELLOWFIN AND BIGEYE TUNAS:

a. This recommendation is applicable in the years 2011-2013 to all purse-seine vessels of IATTC capacity classes 4 to 6 (more than 182 metric tons carrying capacity), and to all longline vessels over 24 meters length overall, that fish for yellowfin, bigeye, and skipjack tunas in the EPO.

b. Pole-and-line, troll, and sportfishing vessels, and purse-seine vessels of IATTC capacity classes 1-3 (less than 182 metric tons carrying capacity) are not subject to this recommendation.

23.1. Purse-seine vessels

a. All purse-seine vessels covered by this recommendation must stop fishing in the EPO for a period of 62 days in each of the years 2011-2013. These closures shall be effected in one of two periods in each year: 29 July to 28 September, or 18 November to 18 January of the following year.

For 2012 and 2013, the results of the conservation measures and the status of the bigeye and yellowfin stocks shall be evaluated, and the duration of the closures for those years may be adjusted.

b. Notwithstanding the provisions requiring closures of the fisheries, purse-seine vessels of IATTC capacity class 4 (between 182 and 272 metric tons carrying capacity) will be able to make only one single fishing trip of up to 30 days' duration during the specified closure periods, provided that any such vessel carries an observer of the IATTC Observer Program.

c. For each of the years 2011-2013, the fishery for yellowfin, bigeye, and skipjack tunas by purse-seine vessels within the area of 96º and 110ºW and between 4°N and 3°S illustrated in Figure 1 be closed from 0000 hours on 29 September to 2400 hours on 29 October.

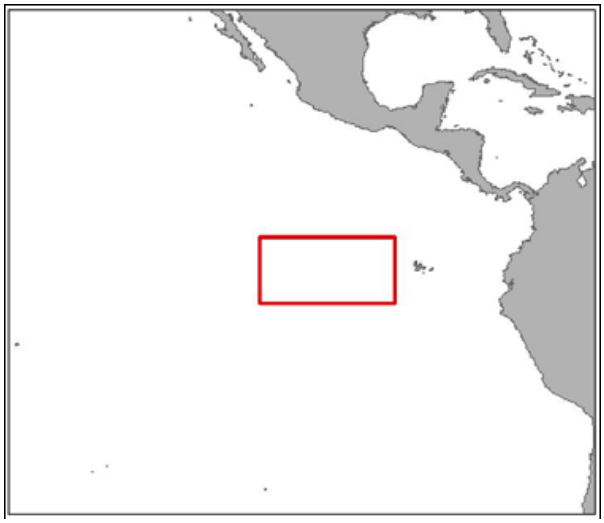

Figure 1. Closure area

d. In each one of the years covered by this recommendation, and for each one of the two closure periods, each member of the IATTC shall notify the Director, by 15 April, of the names of all the vessels that will observe each closure period. As soon as practicable after this date, the Director shall publish on the Commission website the names of the vessels and the closure period applicable to each vessel for that year.

Each vessel that fishes during 2011-2013, regardless of the flag under which it operates or whether it

changes flag or the jurisdiction under which it operates during the year, must observe the closure period to which it was committed for that year. Any vessel that is added to the Regional Vessel Register during the course of a given year must observe one of the two closures during that year.

e. Each member shall, for purse-seine fisheries:

   i. Before the date of entry into force of the closure, take the legal and administrative measures necessary to implement the closure;

   ii. Inform all interested parties in its national tuna industry of the closure;

   iii. Inform the Director that these steps have been taken;

   iv. Ensure that at the time a closure period begins, and for the entire duration of that period, all the purse-seine vessels fishing for yellowfin, bigeye, or skipjack tunas that are committed to observing that closure period and that fly its flag, or operate under its jurisdiction, in the EPO are in port, except that vessels carrying an observer from the IATTC Observer Program may remain at sea, provided they do not fish in the EPO. The only other exception to this provision shall be that vessels carrying an observer from the IATTC Observer Program may leave port during the closure, provided they do not fish in the EPO.

23.2. Longline vessels:

a. Each member shall take the measures necessary to control the total annual catch of bigeye tuna in the EPO during each of the years 2011-2013 by longline tuna vessels fishing under its jurisdiction.

b. China, Japan, Korea, and Chinese Taipei shall take the measures necessary to ensure that their total annual longline catches of bigeye tuna in the IATTC Convention Area during 2011-2013 do not exceed the following levels:

Metric tons	
China	2,507
Japan	32,372
Korea	11,947
Chinese Taipei	7,555

For 2012 and 2013, the above limits on longline catches may be adjusted based on any adjustments to the conservation measures for purse-seine vessels adopted for those years. Other members shall take the measures necessary to ensure that their total annual longline catches of bigeye tuna in the EPO during 2011-2013 do not exceed the greater of 500 metric tons or their respective catches of bigeye tuna in 2001.

Members whose annual catches of bigeye have exceeded 500 metric tons during any of the years 2006-2010 shall provide monthly catch reports to the Director.

24. PACIFIC BLUEFIN TUNA:

Each member with flag vessels that catch Pacific bluefin tuna shall take the measures necessary to:

a. Control the total annual catches of Pacific bluefin tuna by commercial tuna vessels fishing under its jurisdiction during each one of the years 2011-2012 to ensure that the aggregate annual catches by the commercial vessels of all members in the IATTC Convention Area does not exceed 4,200 metric tons.

All members shall provide weekly reports of such catches to the Director. On the basis of these reports and/or reports from observers from the IATTC Observer Program, the Director shall determine whether the commercial fishery for Pacific bluefin tuna shall be closed in order to ensure that the annual catch limit of 4,200 metric tons is not exceeded. The Director shall inform the

members of the date of any such closure, with at least two weeks' notice.

b. Ensure that the total annual effort for Pacific bluefin tuna by sportfishing vessels fishing under its jurisdiction does not exceed the maximum annual level of fishing effort during 2006-2010.

All members shall provide monthly reports of sportfishing catches to the Director.

25. NORTHERN ALBACORE TUNA:

a. As discussed during the 80th meeting of the IATTC, form an *ad hoc* working group to develop an operational definition of the "current levels" of effort specified in paragraph 1 of Resolution C-05-02;

b. Amend Resolution C-05-02 to require that the required six-monthly reports include information on effort as well as catch;

c. Amend Resolution C-05-02 to clarify that data provided should be for the IATTC Convention Area only.

26. FULL RETENTION OF TUNA CAUGHT BY PURSE SEINES

Renew, for each of the years 2011-2013, the program to require all purse-seine vessels to first retain on board and then land all bigeye, skipjack, and yellowfin tuna caught, except fish considered unfit for human consumption for reasons other than size. A single exception shall be the final set of a trip, when there may be insufficient well space remaining to accommodate all the tuna caught in that set.

Appendix B.

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