INTER-AMERICAN TROPICAL TUNA COMMISSION

SCIENTIFIC ADVISORY COMMITTEE

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CURRENT AND PLANNED ACTIVITIES OF THE IATTC STAFF

This document describes the current situation regarding certain aspects of the staff's research, data management, and outreach activities, and outlines future activities and planned improvements.

A. RESEARCH

1. STOCK ASSESSMENT

1.1. Schedule for stock assessments and reviews

Three types of stock assessments are carried out: 1) **full assessments,** in which all the major assumptions are reviewed and improved; 2) **update assessments,** in which new or updated data are analyzed, using the current assumptions; and 3) **exploratory assessments,** in which new assumptions are investigated, but are not used in the assessment that is used for management advice. In years in which exploratory assessments are conducted, management is based on update assessments. A comprehensive description of the Stock Assessment Program activities and achievements can be found in Appendix A, *IATTC Stock Assessment Program: activities and achievements 2014.*

Species	Last assessed	2015	2016	2017
IATTC				
Yellowfin	2011 (full); 2014 (update)	Update	Full	Update
Skipjack	2004	Indicators	Indicators	Indicators
Bigeye	2010 (full); 2014 (update)	Update	Full	Update
Striped marlin	2010		Indicators	Indicators
Swordfish (south EPO)	2011		Indicators	Indicators
Swordfish (north EPO)	Never as a separate stock		Indicators	Indicators

Sailfish	2013		Indicators	Indicators
Black marlin[1]	Never		Indicators	Indicators
Silky shark	Never	Indicators	Indicators	Indicators
Dorado	Never	Indicators	Indicators	Indicators
Independent review / Fall workshop		CAPAM workshop (data weighting)	Indicators review	
COLLABORATIONS				
Bluefin	2012 (full) 2014 (update)			
Albacore	2014			Full
Blue marlin[1]	2013			
Blue shark	2014			
Swordfish (north Pacific)	2014	Update	Full	

1.2. Plan of work

1. **Preparatory work for the stock assessments in the schedule**. Exploratory assessments of yellowfin and bigeye tuna were conducted during 2014 and will continue in 2015. These assessments will involve extensive sensitivity analyses to determine the most appropriate base case model and consider the input from the recent external reviews of the yellowfin and bigeye assessments. The results will be presented at the SAC in 2015, together with recommendations for a base case model to use in 2016.

2. **CAPAM stock assessment methodology workshop series**. Conduct analyses and write working documents related to data weighting, the topic for the 2015 workshop.

3. **Post-stratification of purse-seine length composition data.** Conduct final analyses to define new catch strata within the new bigeye and yellowfin stock and fishery areas, and re-evaluate minimum sample sizes per catch stratum for catch estimation.

4. **Integrating tagging data/information into stock assessment models**. Develop methods for integrating the available tagging data into the stock assessment models to improve the stock assessments.

5. **Forecasting bigeye catch**. Continue development of a forecasting approach to predict the spatial distribution of bigeye tuna catches, based on spatially-explicit weekly report data and environmental covariates. Evaluate the performance of the predictions in reducing bigeye catch.

6. **Stock status indicators**: Conduct research to develop indicators of stock status that can be used for species for which little information is available. Conduct a management strategy evaluation to evaluate the indicators and their use in harvest control rules.

7. **Dolphin assessments.** Review data and methods used to assess the status of the dolphin populations.

8. **Pacific-wide bigeye assessment.** IATTC staff will collaborate with SPC staff to conduct research into a Pacific-wide assessment of bigeye tuna.

9. **Pacific-wide swordfish assessment.** IATTC staff will collaborate with SPC/WCPFC to develop their SEAPODYM model for swordfish and to apply it to evaluate Pacific stocks. The model provides information on habitat as well as trends, and it is expected to provide insight and information on areas with relatively low fishing effort**.**

10. **Reference points.** Develop recommendations for reference points for blue, black, and striped marlin, sailfish, and swordfish.

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[1] These assessments will be carried out in collaboration with other organizations, so dates cannot yet be set.

11. **Management Strategy Evaluation (MSE).** Develop MSEs for tropical tunas, and use to test the interim reference points and candidate harvest control rules (HCRs). Staff will collaborate with ISC to implement MSE for bluefin and albacore tunas. MSE will also be developed for low-information species.

12. **Evaluation of factors affecting bigeye tuna catch on FADs.** Use statistical methods to analyze FAD characteristics and determine what factors increase the catch of bigeye tuna. This work should be part of a more comprehensive bigeye catch reduction research project that involves multiple IATTC programs and different research methods.

1.3. Fall-CAPAM workshops

The IATTC fall workshop series has been integrated into the CAPAM (Center for the Advancement of Population Assessment Methodology) workshop series. CAPAM is a collaboration among Scripps Institution of Oceanography, the United States National Oceanic and Atmospheric Administration, and the IATTC. The first two CAPAM workshops, on "Selectivity: theory, estimation, and application in fishery stock assessment models", and "Growth in fishery stock assessment models: theory, estimation, and application", held 2013 and 2014, each resulted in a special issue of the journal *Fisheries Research*. The third workshop, on "Data conflict and weighting, likelihood functions, and process error", will be held in La Jolla in October 2015.

2. TAGGING STUDIES

1. Further evaluate tagging data for bigeye from throughout the Pacific, in collaboration with scientists from the Oceanic Fisheries Programme of the Secretariat of the Pacific Community, for describing dispersion, mixing, and plausible boundaries for putative stocks in the Pacific.

2. Continue collecting and analyzing archival tag data for yellowfin released at several locations throughout the EPO, for describing the geographic variability in movements, behavior, habitat utilization, and plausible boundaries for putative stocks in the EPO Those results will eventually be published in peer-reviewed scientific journals.

3. Continue to explore potential funding sources for an IATTC Regional Tuna Tagging Project for bigeye, yellowfin, and skipjack tunas throughout the EPO.

3. LIFE HISTORY OF TUNAS

3.1. Early life history

The early life history (ELH) group will be conducting research on the ecology, physiology, and pre-recruit dynamics of tunas. Research activities will be centered around the following five projects, based at the IATTC's Achotines Laboratory in Panama, but also involving collaboration with other research organizations.

1. **Comparative studies of the early life history of Pacific bluefin tuna and yellowfin tuna (2011-2016)**

   Funded by Japan International Cooperation Agency (JICA) and Japan Science and Technology Agency (JST); collaborators: Kinki University and the Autoridad de los Recursos Acuáticos de Panamá (ARAP)

   This project commenced in June 2011 and is ongoing. In November 2013, a mid-term review of the project by a review panel of the funding agencies gave the project a "High" rating for progress to date. The project includes (1) comparative research on the early life history of Pacific bluefin and yellowfin, with experimental work conducted in Japan and at the Achotines Laboratory; (2) studies of the reproductive biology of Pacific bluefin (Japan) and yellowfin (Achotines Laboratory); (3) development of recruitment prediction models for Pacific bluefin and yellowfin, and of forecasting tools for management of those stocks; (4) development of technologies for the cage culture of yellowfin juveniles and to provide research guidelines for the improvement of yellowfin mariculture

in Central America. During 2015, yellowfin juveniles will be reared in sea cages near the Achotines Laboratory for the first time. Two sea cages for juveniles were constructed and moored at sea near the Achotines Laboratory during March 2014, and preliminary transport trials of early-juvenile yellowfin were conducted in June 2014. Publications summarizing the research results from the comparative studies are being developed jointly.

2. **Development of sustainable tuna aquaculture in the United States using yellowfin tuna as a model (2012-2015)**

Funded by the California Sea Grant Program; collaborators: Hubbs Sea World Research Institute

This project is a 3-year joint study to develop optimal larval culture techniques for yellowfin tuna. **Objectives**: (1) to develop refined techniques for long-distance air transport of yellowfin eggs and larvae from the Achotines Laboratory to facilitate rearing experiments in San Diego, as a continuation of previous studies supported by NOAA; (2) to quantify the effects of egg quality and larval nutrition on the successful rearing and survival of yellowfin larvae and early-juveniles; (3) dissemination of research results to the public and private sectors and resource agencies through reports and publications to aid in the development of successful aquaculture of yellowfin. Three air shipments of yellowfin larvae from Panama to San Diego, California, as well as rearing trials in both locations, were conducted during 2014, and the shipment phase of the project was completed in December 2014. A joint publication of the study results is being developed.

3. **Ocean acidification impacts on tropical tuna (2011-2015)**

Funded by the Pelagic Fisheries Research Program (PFRP) of the University of Hawaii; collaborators: Secretariat of the Pacific Community (SPC); Macquarie University, Australia; University of Gothenburg, Sweden; Max Planck Institute for Meteorology, Germany; and Collecte Localisation Satellites (CLS).

This project includes experimental research at the Achotines Laboratory (conducted during 2011) and modeling studies being conducted at the SPC during 2013-2014. **Objectives**: (1) quantify the effects of ocean acidification on egg, larval, and early-juvenile stages of yellowfin; and (2) incorporate the effects of egg and larval mortality associated with ocean acidification into models to forecast the integrated impacts of climate change on tuna population dynamics and distribution in the Pacific Ocean. Efforts are ongoing to secure funding for additional experimental and modeling studies on this topic. A joint manuscript (principal author, Donald Bromhead) describing the study results was published in the journal *Deep Sea Research Part II* in early 2015. A second manuscript (principal author, Andrea Frommel) describing histological analyses of the physiological effects of ocean acidification on the internal organs of yellowfin larvae was completed in draft form in April 2015 for submission to the *Journal of Experimental Biology*.

4. **Joint IATTC-University of Miami workshop on yellowfin tuna**

A workshop entitled "Physiology and Aquaculture of Pelagics, with Emphasis on Reproduction and Early Developmental Stages of Yellowfin Tuna," will be held at the Achotines Laboratory in July 2015. This will be the 13th annual workshop coordinated by the IATTC and the University of Miami at the Achotines Laboratory. Participants include selected tuna researchers and University of Miami graduate students, and a fee paid by participants and students cover the expenses of the workshop.

A draft of a major book chapter entitled "Research on the reproductive biology and early life history of yellowfin tuna *Thunnus albacares* in Panama", co-authored by IATTC scientists, was finished recently, and will be published in a book entitled "Advances in Tuna Aquaculture," published by Elsevier. The chapter summarizes the major research findings from yellowfin research conducted at the Achotines Laboratory during 1993-2014.

3.2. Updating life history parameters for yellowfin tuna

An investigation is in progress on the age, growth, maturity, spawning frequency, and fecundity of yellowfin throughout the EPO. Collection of samples by observers aboard purse-seine vessels is continuing, and laboratory analyses of samples will be underway in 2015.

4. ECOSYSTEM STUDIES

Ecological research at the IATTC is focused on studies of food-web dynamics, the effects of the tuna fisheries on the ecosystem, and modeling of ecosystem processes in the EPO.

4.1. Food-web dynamics

Improving the understanding of food-web dynamics in the pelagic EPO is important, given that accurate depictions of trophic connections and flows are the backbone of ecosystem models of any type.

In early 2014 a manuscript was published summarizing an analysis of spatial, temporal, environmental, and biological covariates explaining the predation patterns of 3,362 yellowfin tuna sampled across the EPO during two 2-year periods occurring a decade apart. Classification trees revealed major changes in the prey communities that support tuna production during the decade.

In early 2015 a similar analysis was published of spatial and size covariates explaining the predation patterns of 289 silky sharks sampled as bycatch in floating-object sets across the EPO. FAD-associated prey (often including skipjack and yellowfin tunas) dominated the diet in all regions. Classification trees identified markedly different foraging patterns in the eastern and western regions of the EPO, with a less diverse diet and more FAD-related feeding in the western offshore region than in the eastern inshore region. This work supports the hypothesis that FADs can alter the trophic interactions of these apex predators, presumably resulting in increased vulnerability of small tunas to predation. No previous studies of silky shark predation exist for the entire EPO, and the results of this study will improve the ecosystem models for the EPO.

4.1.1. Stable isotopes in ecology

A collaborative three-year project, "CAMEO 2009: A novel tool for validating trophic position estimates in ecosystem-based fisheries models" was extended into 2014. Its principal goals are to validate the application of amino acid compound-specific isotopic analysis (AA-CSIA) across multiple marine phyla and across systems with contrasting biogeochemical cycling regimes, and to develop the use of AA-CSIA trophic-position estimates for validating trophic models of exploited ecosystems. Samples of nine species representing a range of trophic positions across a productivity gradient in the EPO were analyzed, using bulk tissue N isotopic analysis, and a subset of samples were analyzed for AA-CSIA. Results showed that AA-CSIA overcomes severe limitations of traditional diet studies, and that amino-acid enrichment factors were not consistent across marine phyla. A Master of Science thesis was developed from this work, and a manuscript is being prepared for publication in 2015.

4.1.2. Diet studies

1. A draft of a major book chapter entitled "Bioenergetics, trophic ecology, and niche separation of tunas" was finished recently, and will be published in 2015 in a book entitled, "Tunas and their Fisheries: Safeguarding Sustainability in the 21st Century". The chapter is a collaboration by eight authors from a variety of countries, led by an IATTC scientist, and includes the principal tuna species from tropical and temperate waters in seven oceans or ocean regions.

2. Analyses of diet data for skipjack, bigeye, and associated pelagic predators, using classification tree models, will continue.

3. Continued collaboration in 2015 with a research ecologist at NOAA's Northwest Fisheries Science Center on the analysis of a hypothesized increase in cephalopod production over a 50-year period in the EPO, based on the diets of generalist predators.

4. A manuscript on the trophic ecology of mesopelagic myctophid fishes in the EPO is being revised and will be submitted to a journal for publication in 2015.

5. Continued collaboration with the international research program CLIOTOP-IMBER. Four workshops organized by CLIOTOP Working Group 3 were conducted between 2009 and 2014 to develop and apply standardized, robust statistical methods for analysis of diet and stable-isotope data for pelagic predators in the world's oceans. During these workshops, held in Sète (France), Hobart (Australia), Adelaide (Australia), and Honolulu (USA), the first attempt to compile and analyze global datasets for large, upper-trophic level pelagic predators was accomplished. A report summarizing this global effort was published in 2015. A global diet analysis of yellowfin, bigeye, and albacore tunas is being conducted in 2015.

4.2. Effects of fisheries on the EPO ecosystem

4.2.1. Ecological Risk Assessment

Long-term ecological sustainability is a requirement of ecosystem-based fisheries management. 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 these stocks.

1. Productivity and susceptibility analysis (PSA) was previously tested for measuring vulnerability to overfishing in a preliminary analysis of a subset of species in the EPO purse-seine fishery.

2. Further revisions of the PSA for the purse-seine fishery are in progress in 2015 for the major species and stocks caught by that fishery in the EPO. The staff also plans to evaluate a variation on the method used by ICCAT[2].

5. BYCATCH STUDIES

In addition to continuing activities under the Agreement on the International Dolphin Conservation Program (AIDCP), the following are planned:

1. **Bycatches on FADs:**

   a. Continue support of research planning activities by industry, NGOs and government organizations (*e.g.* International Seafood Sustainability Foundation (ISSF));

   b. If industry does not provide information on FAD location and drift (with a delay sufficient to obviate concerns about confidentiality), test different systems to identify individual FADs, and implement a FAD marking and tracking program;

   c. Regarding bycatches of smaller individuals of fish species, support sorting grid experiments with scientific designs and analyses, and comparisons of different mesh sizes;

   d. Carry out experiments on alternative FAD designs to mitigate entanglements and reduce marine debris generation;

   e. Subject to availability of funding, carry out experiments with live-capture of tunas and other species to increase selectivity, using pumps or "wet" brailers to transfer the catch from the purse seine to the vessel (Captain R. Stephenson's concepts);

   f. Continue the studies describing the characteristics of the FADs and fishing operations involving FADs;

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[2] Cortés E, F. Arocha, L.R. Beerkircher, F. Carvalho, A. Domingo, M. Heupel, H. Holtzhausen, M.N. Santos, M. Ribera, C. Simpfendorfer. 2010. Ecological risk assessment of pelagic sharks caught in Atlantic pelagic longline fisheries. Aquat Living Resour 23: 25-34

g. Continue studies and communication with other tuna RFMOs to harmonize and improve the quality of the data collected by observers;

h. Cooperate with researchers in oceanographic studies related to productivity of FAD fisheries.

2. Sea turtles:

a. Continue support of the Regional Sea Turtle Program, and publish the results of the first stages;

b. Continue the dissemination of information on techniques to release hooked or entangled sea turtles;

c. Cooperate with researchers in oceanographic studies related to habitat use by sea turtles;

d. Cooperate with the Inter-American Convention for the Protection and Conservation of Sea Turtles in the integrated approach to sea turtle conservation.

3. Sharks and rays:

a. Continue the examination of spatial options for bycatch mitigation;

b. Analyze data on bycatches of sharks and manta rays in the purse-seine fishery, and compare release techniques used by different vessels;

c. Produce catch and effort estimates for artisanal fleets;

d. Pending funding, cooperate in the planning of mitigation experiments;

e. Analyze data on distribution of sets on whale sharks, and review the guidelines available to improve release techniques;

4. Seabirds:

a. Monitor trends for species affected by fisheries in the EPO;

b. Cooperate with the Agreement for the Conservation of Albatrosses and Petrels (ACAP) to maintain up to date the set of mitigation measures adopted, according to the most recent scientific studies and experimental results.

5. Bycatches and diversified harvesting

Pending funding, carry out modeling studies comparing different fisheries/gear selectivity levels, and their impacts on ecosystem properties with academic partners (University of Washington).

6. Workshops for fishers

As part of the research to mitigate bycatches, and of the communication with the fishing fleet to discuss options for gear and operational studies, continue with the workshops that are organized around bycatch issues in the different fisheries.

a. Workshops on the tuna-dolphin issue (AIDCP);

b. Workshops on bycatches on FADs, in collaboration with ISSF;

c. Workshops on sea turtle bycatches in artisanal longline fisheries, in collaboration with World Wildlife Fund offices, national fisheries agencies, and fishers and industry organizations.

7. Proposed activities for joint ISSF-IATTC research cruises on purse-seine vessels in the equatorial EPO in 2015

a. Evaluate the feasibility of the backdown maneuver as a method for the live release of non-tuna species, particularly sharks, in sets on FADs;

b. Simultaneous deployments of non-entangling shallow-draft FADs and normal FADs with echosounder buoys to compare their performance, including the species composition of the tuna

catch and potential reductions in catches of bigeye tuna with the use of shallow draft FADs.

B. DATA

1. Data collection and database program work plan

At the meeting of the Scientific Advisory Committee (SAC) in 2014, a summary was presented of the work completed by the data group during the previous year, and of activities and objectives planned for future years. This report contains an update of the progress of previously proposed activities, as well as new projects that are planned for the near future.

1.1. Completed projects

1. The new simplified logbook abstract form is now being used by IATTC field station staff, and the La Jolla staff are using the corresponding data entry and data management computer programs.

1.2. Ongoing activities

1. As in previous years, additional improvements to the reporting workflow have been identified and are gradually replacing less efficient existing procedures. Automation of repetitive tasks is applied where possible, and refinements to existing procedures are constantly being implemented.

2. Development of the new IATTC website was delayed due to the need to direct limited staff resources to other projects. The staff is currently developing an outline of the desired structure and features of the new website, which will give the IATTC a fresh image and improve access to information by making navigation easier, and is exploring the option of contracting a website development specialist to help with the initial setup. Once it is developed, the staff will add the content present in the current website and receive training in site maintenance.

3. Development of a documentation library is still in progress. All of the processes for creating the Best Scientific Estimate, Length Frequency and Stock Assessment databases have been documented, and have been added to the documentation library. We are also exploring the possibility of incorporating the functionality of the documentation library into the new IATTC website, so that the information is available to outside organizations.

4. Work continues on documenting all internal data processing so that all of the procedures are clear and comprehensive.

5. Porting of existing data entry and editing computer programs from Visual Basic (VB) 6 to the Microsoft dot net framework continues, since VB6 is no longer supported by Microsoft. IATTC programmers are currently developing the new programs as standard Windows applications.

1.3. Planned work

1. A dedicated Vessel Register database and application redesign, proposed at the SAC meeting in 2011, has not been completed, due to limited staff resources. The current design is workable, though it is labor intensive. Work on this project has been postponed pending staff realignment, and the initial development of the redesigned IATTC primary website.

2. Development of a data request management application was not initiated due to limited staff resources. This project has been postponed pending staff realignment.

3. A front-end user interface based on R is planned for use with the Best Scientific Estimate (BSE) program. Most IATTC researchers are very familiar with R as an analysis tool, so this addition will greatly facilitate access to the program by the scientific staff. Once development is complete, these same improvements may be applied to other IATTC programs.

4. The Length Frequency data management database and application will be modified to make them more flexible for temporal changes in area stratification. This will include other algorithms which

interact with the length-frequency program, such as the process of estimation by flag. An analysis of the importance of flag within strata will be useful for improving this process. This work will be initiated once conversion of VB6 programs to the Microsoft dot net framework is complete.

C. CAPACITY BUILDING

1. Bycatches

a. Training courses on bycatch estimation and mitigation;

b. Design of research strategies to address bycatch issues;

c. Management and economic incentives to address bycatch issues.

2. Shark fisheries

The staff will provide appropriate assistance to developing IATTC Members in:

2.1. Sampling

a. Continue the development of, and promote the adoption of, standardized data collection forms (catch, effort, biological data) for sharks and rays, in cooperation with other regional and subregional organizations, member nations and, if possible, with organizations collecting data in the Western Pacific.

b. Develop and disseminate sampling designs for landings of sharks and rays, and for observer programs where available, and support the creation and maintenance of databases.

c. In-port collection of data on shark catches, size distributions, and effort, as well as the development of standardized methods to identify shark species. This assistance should be extended to the proper identification of shark species based on body parts (*e.g.* fins or trunks), or on incomplete specimens.

2.2. Data reporting

Improve the Members' capability to report data on catches and effort by gear type, landings, and shark trade, in accordance with IATTC reporting procedures, including available historical data. This assistance will likely include the development of observer programs covering different fisheries. We plan to have one training course per year, dedicated to the development of standardized national observer programs.

2.3. Biological parameters

Conduct research on stock structure and biological parameters such as age, growth, natural mortality, diet, and reproduction. This assistance will likely include, as part of the general training course on data collection, training in biological sample collection and analysis method.

2.4. Fisheries data studies

Conduct research on the spatial-temporal characteristics of shark catches, including identification of nursery grounds and of specific areas and seasons that contribute to the majority of catches. This assistance will likely include a general training course on quantitative methods in fisheries data analysis, which will also cover methods for estimating fisheries quantities, such as fishing mortality, and inputs for stock assessment (*e.g.*, total catch, standardized trends of CPUE).

2.5. Workshops on stock assessment of sharks

Participation in shark stock assessment workshops, which will include among their research topics stock assessment and management of sharks.

3. Development of landings database in collaboration with OSPESCA

IATTC staff, in collaboration with the Organization for Fishing and Aquaculture in Central America

(OSPESCA), continued assistance in the development of data collection forms for artisanal fleets operating from ports in Central America. The second and final form, for collecting summarized landing and trip data, has been completed, along with the associated user manuals, database, and data entry/editing program. The database features many data entry-friendly features and a comprehensive error checking routine. Potential users of the database include fisheries managers in Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, and the Dominican Republic.

Appendix.

IATTC STOCK ASSESSMENT PROGRAM
ACTIVITIES AND ACHIEVEMENTS 2014

CONTENTS

1. RESPONSIBILITIES

Under the ecosystem approach to fisheries mandated by the Antigua Convention, the IATTC Stock Assessment Program is responsible for developing stock assessments and/or stock status indicators for tunas (principally yellowfin, bigeye, and skipjack) and associated species (such as billfishes, sharks, and dorado) in the eastern Pacific Ocean (EPO), and for providing management advice to the Commission on the basis of these assessments. The program staff also participates in assessments of northern pan-Pacific stocks carried out by the International Scientific Committee (ISC) for Tunas and Tuna-like Species in the North Pacific Ocean, including those for Pacific bluefin and albacore tunas, and for some billfish and shark species. The Program is also responsible for the assessment of dolphin populations associated with the purse–seine fishery for tunas, as a basis for the dolphin mortality limits established by the Agreement on the International Dolphin Conservation Program (AIDCP).

The program staff also carries out educational programs on stock assessments and the analysis of fisheries data for IATTC members. Upon request, the program staff has provided advice and assistance on statistical methods for data analysis (*e.g.* spatial post-stratification and stock status indicators) and on sampling plans for collecting fisheries-dependent data, such as catch rates and size composition data, that serve as the basis for developing stock status indicators and assessments.

2. STAFF

Head of program
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3. TUNA STOCK ASSESSMENTS

3.1. Data

The program staff developed new software to post-stratify the catch and effort and length-composition data of the purse-seine fisheries prior to use in analyses. Stratifications used previously were based on areas that were developed in 1957, long before the purse-seine fishery had reached its current extent. This software provides full flexibility for designating spatial structure, and for defining the stocks and fisheries used in assessments.

The program staff reviewed all the available information on stock and fishery structure for yellowfin and bigeye tunas in the EPO, and developed new stock and fishery definitions, which will be used in the 2015 stock assessments.

The program staff reviewed the most recent tagging information developed by the IATTC Biology and Ecosystem Program. Information from these data will be included in updated estimates of growth rates of bigeye and yellowfin.

3.1.1. Yellowfin (YFT)

The yellowfin stock assessment was updated with new data for the 2014 meeting of the Scientific Advisory Committee (SAC-05). Further research has been carried out to improve the stock and fishery structure and the estimates of natural mortality, growth, and selectivity for use in future assessments.

3.1.2. Bigeye (BET)

The bigeye stock assessment was also updated with new data for SAC-05. As for yellowfin, further research has been carried out to improve the stock and fishery structure and the estimates of natural mortality, growth, and selectivity for use in future assessments.

3.1.3. Skipjack (SKJ)

The skipjack indicators were updated with new data for SAC-05.

3.1.4. Pacific bluefin (PBF)

The program staff contributed to the ISC's assessment of Pacific bluefin, which indicated that the stock is highly depleted and experiencing overfishing, and that urgent management is needed. The program staff conducted an additional analysis that confirmed this conclusion, and also produced a report presenting results of forward projections under different catch scenarios and outlining the issues that need to be addressed when developing management for this species.

3.1.5. North Pacific albacore (ALB)

The program staff participated in a meeting of the ISC's North Pacific Albacore Working Group (ALBWG) in April 2014. The objectives of the meeting were to: (1) complete a new assessment, (2) develop scientific advice and recommendations on current status, future trends, and conservation, and (3) review national fisheries for albacore and to update the catch table maintained by the working group. The stock assessment of albacore was completed in July 2014 and was presented at the 14th meeting of the ISC (16-21 July 2014, Taipei, Taiwan).

4. ASSESSMENT AND MANAGEMENT OF LOW-INFORMATION AND BYCATCH SPECIES

4.1. Stock status indicators and management strategy evaluation

The program staff produced a document that 1) provided background on existing data and sources that may be used to develop stock status (or stability) indicators (SSIs) for species taken in the fisheries for tunas and billfishes in the EPO, 2) described candidate SSIs, and 3) provided a preliminary evaluation of the suitability of each SSI for stocks managed by the IATTC. This information will be used for the basis

of designing a management strategy evaluation (MSE) of SSIs and harvest control rules.

4.1.1. Blue marlin (BUM)

During 2013 and 2014, the program staff participated in an assessment of blue marlin in the Pacific that was initiated during a meeting of the ISC Billfish Working Group. The efforts of the working group were extended by developing a sex-structured assessment model in the Stock Synthesis (SS) general stock assessment program. The results were finalized and published in 2014.

4.1.2. Dolphins

The program staff investigated the use of information on dolphin sightings by observers on commercial fishing vessels to develop indices of abundance for the dolphin populations. They also developed a report on alternative approaches to providing abundance information. A manuscript describing these findings is being prepared for submission as part of a special issue on "Fishing Vessels as Scientific Platforms" of the journal Fisheries Research.

4.1.3. Dorado (DOX)

A research paper was presented at SAC-05 describing the ongoing collaborative research on dorado with scientists of IATTC member countries, which includes the development of stock status indicators. The first IATTC Technical Meeting on dorado was held in October 2014 in Manta, Ecuador.

4.1.4. Silky shark (FAL)

A report was produced for SAC-05 describing the attempt to develop a stock assessment for silky shark in the EPO and the problems encountered. Since it was not possible to conduct a formal stock assessment due to the limitations of the historic catch data, stock status indicators were produced. These were described in a research paper presented at SAC-05.

4.1.5. Swordfish (SWO)

The program staff participated in an ISC Billfish Working Group meeting held in Honolulu, Hawaii, in February 2014, to update its 2009 assessment of swordfish in the north Pacific. The updated assessment was finalized in July 2014. The models used were slight modifications of those used in previous assessments, and the data used were updated to include the most recent information available from the various ISC participants and other sources. The program staff presented a summary of a new manuscript on swordfish stock distribution areas that incorporates the most recent genetic and data analyses. The working group recommended that the issue of stock structure be revisited.

5. RESEARCH

5.1. Methodology development

A framework to combine age-at-length and tag-recapture length increment data to estimate growth was developed, and will be used in future stock assessments.

5.2. Reference points, harvest control rules, and management strategy evaluation

The program staff developed novel biomass- and fishing mortality-based limit reference points based on the expected reduction in recruitment if a conservative (low) steepness value is used for the Beverton-Holt stock-recruitment relationship. These reference points are consistent with the goal of determining limit reference points on biological grounds to protect a stock from serious, slowly reversible, or irreversible fishing impacts. The Commission adopted these limit reference points as interim reference points.

The program staff developed a management strategy evaluation (MSE) procedure that uses the Stock Synthesis (SS) general stock assessment program as the operating model. The MSE procedure can be used for any assessment developed in SS, including those for albacore, bigeye, bluefin, and yellowfin

tunas in the EPO. The procedure was applied to Pacific bluefin tuna, for which the ISC Pacific bluefin tuna working group conducted an SS-based assessment. The MSE contrasted management using simple harvest rates applied to two CPUE-based indices of abundance, one for spawners and one for recruits, with a simple catch-based management procedure similar to that evaluated by the ISC working group.

A novel MSY[3]-seeking harvest control rule was developed based on the concept of surplus production. This rule, and rules based on the same concept, are currently undergoing simulation testing.

6. VISITING SCIENTISTS

Dr. Mihoko Minami, of the Department of Mathematics at Keio University in Tokyo, Japan, spent the period of 4-7 August 2014 at IATTC headquarters in La Jolla, California, where she worked with Drs. Lennert-Cody and Maunder on the evaluation of statistical methods for addressing the challenges of using purse-seine observer data to estimate trends in abundance for dolphin species, and on developing parametric hierarchical mixture models for estimating the age composition of catches of bluefin tuna.

7. CAPACITY BUILDING AND TRAINING

7.1. Courses conducted

7.1.1. Colombia

Dr. Aires-da-Silva taught a course on "Risk analysis methodologies for shark species" in Salvador de Cali, Colombia, in February 2014.

7.1.2. Costa Rica

Drs. Minte-Vera and Aires-da-Silva prepared the course "Introduction to the assessment of fisheries resources". The course was taught in San José, Costa Rica, from 18 to 22 August 2014, by Dr. Minte-Vera, assisted by Juliana Strieder Philippsen, a Ph.D. student at the State University of Maringá. The course was hosted by Dr. Moisés Mug-Villanueva (Habitat Crítico Soluciones), and funded by Conservation International-Costa Rica. The course was attended by one Costa Rican Commissioner to IATTC, five scientists from the Instituto Costarricense de Pesca y Acuicultura (INCOPESCA), one student from the Centro de Investigación en Ciencias del Mar y Limnología (CIMAR) of the Universidad de Costa Rica, and two staff members of Conservation International.

7.1.3. United States

1.1.1.a Southwest Fisheries Science Center, La Jolla

Drs. Minte-Vera and Steve Teo, of the U.S. National Marine Fisheries Service (NMFS), presented a seven-day course entitled to "Introduction to Fisheries Stock Assessment and Stock Synthesis," in La Jolla, California, from 24 June to 1 July 2014. Nine students attended, three from the Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), Mexico, two from the Instituto Nacional de Pesca of Mexico, two from the Universidad Autónoma de Sinaloa, Mexico, one from the Universidad Nacional Autónoma de México, and one from the NMFS Southwest Fisheries Science Center (SWFSC) in La Jolla. Dr. Maunder participated in various laboratory and discussion sections.

1.1.1.b University of Miami, Miami, Florida

Dr. Maunder taught a course titled "Integrated Analysis Using Stock Synthesis: appropriate use of multiple data sets" at the University of Miami in Miami, Florida, on 27-29 January 2014. The course was attended by researchers at the NMFS Southeast Fisheries Science Center and faculty and students of the Rosenstiel School of Marine and Atmospheric Science of the University of Miami.

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[3] Maximum sustainable yield

7.2. Data collection

Drs. Aires-da-Silva and Lennert-Cody spent the period of 19-23 May 2014, in Ecuador, where they visited the main ports where the catches of the artisanal longline fishery for large pelagic species (dorado, tunas, billfishes, and sharks) are landed. These activities are part of current collaborative work between the IATTC staff and staff members of the Instituto Nacional de Pesca of Ecuador and World Wildlife Fund to develop a sampling design for the artisanal longline fisheries of Ecuador.

7.3. Students

Jon López, a Ph.D. student from the Marine Research Division of AZTI-Tecnalia (Spain), worked with Drs. Lennert-Cody and Maunder during June 2014 on the analysis for one of his thesis chapters. His research was directed at estimating the environmental preferences of non-tuna species, and small and large tunas, associated with drifting FADs, determined using fisheries-independent biomass indices derived from acoustic data collected by tuna purse-seine echo-sounder buoys.

Raúl Lara, a Ph.D. student at the Faculty of Marine Sciences of the Universidad Autónoma de Sinaloa, Mexico, spent the period of 3-15 November 2014 at IATTC headquarters in La Jolla, working with Dr. Minte-Vera. His activities included participating in the CAPAM[4] technical workshop on growth, a review of input file syntax for Stock Synthesis models, and the construction of a Stock Synthesis model with thresher shark data from Mexico.

Dr. Aires-da-Silva was a member of the graduate student committees of PhD candidates Frederick Vandepere (University of the Azores, Portugal) and Luz Erandi (CICESE, Mexico).

Drs. Aires-da-Silva and Maunder provided advice and co-authored research publications with PhD student Felipe Carvalho ([University of Florida]).

Dr. Aires da Silva received Luz Erandi (CICESE, Mexico) and Felipe Carvalho (NMFS-Hawaii) for a visiting period in La Jolla in December 2014.

Dr. Hinton provided advice and co-authored research publications with PhD student Chin-Ping Lu (Texas A&M University, Galveston).

Dr. Minte-Vera served on the graduate student committee of M.S. candidate Edgar Argumeno Gillen (Federal University of Rio Grande, Brazil).

8.   CENTER FOR THE ADVANCEMENT OF POPULATION ASSESSMENT METHODOLOGY (CAPAM)

The Center for the Advancement of Population Assessment Methodology (CAPAM), established in February 2013, is a partnership between the IATTC, the US National Oceanic and Atmospheric Administration (NOAA), and the University of California at San Diego's Scripps Institution of Oceanography (SIO). CAPAM's mission involves research and education on animal population dynamics, models, and assessments associated with marine fishery resources. CAPAM Research Scientist Dr. Juan Valero collaborates with IATTC staff on a number of research projects and training courses.

8.1. Workshop

Dr. Maunder chaired a workshop on modeling growth in stock assessments, held on 3-7 November 2014. Papers from the workshop will be published in a special issue of the journal Fisheries Research.

8.2. Special issue of *Fisheries Research*

In October 2014 a special issue of the journal Fisheries Research was published, containing 20 papers from the March 2013 CAPAM workshop on selectivity. Dr. Maunder was the guest managing editor. CAPAM staff and visiting scientists were involved in six of the publications.

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[4] Center for the Advancement of Population Assessment Methodology; see section 8

8.3. Visiting scientists

Dr. Chris Francis, recently retired from New Zealand's National Institute of Water and Atmospheric Research, spent six weeks during February and March 2014 at the SWFSC, conducting research on data weighting in stock assessments. Prof. David Sampson, from Oregon State University, spent three weeks during April and May 2014 at the SWFSC, conducting research on time-varying selectivity (see summary of his visit).

9. EXTERNAL RESPONSIBILITIES

9.1. ISC stock assessment working groups

Dr. Aires-da-Silva was a member of the ISC Bluefin Tuna Working Group (http://isc.ac.affrc.go.jp/).

Dr. Hinton was a member of the ISC Billfish Working Group (http://isc.ac.affrc.go.jp/).

Dr. Minte-Vera was a member of the ISC Albacore Working Group (http://isc.ac.affrc.go.jp/).

9.2. Other

Dr. Maunder served on the editorial board of the ICES Journal of Marine Science, and was Guest Managing Editor of two special issues of Fisheries Research.

Dr. Lennert-Cody was elected President of the San Diego Chapter of the American Statistical Association.

Dr. Aires-da-Silva served as an external reviewer for the ICES hake benchmark assessment in February 2014.

Dr. Hinton served as a member of the United States Argo Science and Implementation Panel (http://www.argo.ucsd.edu/), the Steering Committee of the FAO Fisheries Resource Monitoring System (http://firms.fao.org/firms/en), and the FAO Coordinating Working Party on Fisheries Statistics (http://www.fao.org/fishery/cwp).

10. MEETINGS ATTENDED

Dr. Maunder was a visiting scientist at NMFS Southeast Fisheries Science Center in Miami, Florida, 6-31 January 2014. He worked with NMFS scientists to develop methods for conducting management strategy evaluations using Stock Synthesis and its application to North Pacific bluefin tuna.

Dr. Maunder participated in a Data-Limited Fisheries Workshop on 15-17 January 2014 in Miami. He gave a presentation titled "MSY-seeking decision rules based on surplus production".

Drs. Maunder and Aires-da-Silva participated in a workshop on bluefin tuna of the ISC Bluefin Working Group in La Jolla, California, 17-23 February 2014. Dr. Maunder gave talks titled "Exploratory analysis of PBF longline length composition data" and "Management Strategy Evaluation (MSE) implementation in Stock Synthesis".

Drs. Maunder and Minte-Vera participated in a meeting of the ISC North Pacific Albacore Working Group in La Jolla, California, 14-28 April 2014.

Dr. Lennert-Cody gave a presentation at the International Statistical Ecology Conference in Montpellier, France, on July 1-4 2014, titled "Accounting for selective reporting in occupancy-abundance models for fishery-dependent data on bycatch species".

Dr. Hinton gave a presentation at the 13th INFOFISH World Tuna Trade Conference and Exhibition in Bangkok, Thailand, on 21-23 May 2014, titled "Eastern Pacific tunas: production, management, and outlook for the future".

Dr. Minte-Vera made a presentation at the CAPAM Growth Workshop titled "Guidance for modelling the variability of length-at-age: lessons from datasets with no aging error", research done in collaboration

with Drs. Maunder and Steve Campana, of the Bedford Institute of Oceanography, Canada.

Dr. Aires-da-Silva chaired the 1st IATTC Technical Meeting on Dorado in Manta, Ecuador, in October 2014.

11. JOURNAL PUBLICATIONS

11.1.   In Press/2015

Aires-da-Silva, A., **Maunder, M.N.**, Schaefer, K.M., Fuller, D.W. 2015. Improved growth estimates from integrated analysis of direct aging and tag-recapture data: an illustration with bigeye tuna (*Thunnus obesus*) of the eastern Pacific Ocean with implications for management. Fisheries Research, 163: 119-126.

Duffy, L.M., Olson, R.J., **Lennert-Cody, C.L**., Galván-Magaña, F. Bocanegra-Castillo, N., Kuhnert, P.M. (in press) Foraging ecology of silky sharks, *Carcharhinus falciformis*, captured by the tuna purse-seine fishery in the eastern Pacific Ocean. Marine Biology.

Hinton, M.G., Alvarado-Bremer, A., Lu, C-P. (in press) Stock distribution areas for analysis of status and trends of swordfish in the North Pacific Ocean. Fisheries Research.

Lu, C.-P., Smith, B. L., Alvarado Bremer, J. R., **Hinton, M. G**. (in press). Bayesian analysis of Pacific swordfish (*Xiphias gladius* L.) genetic differentiation using multi-locus single nucleotide polymorphism. Journal of Experimental Marine Biology and Ecology.

Maunder, M.N., Piner, K.R. (in press). Contemporary fisheries stock assessment: many issues still remain. ICES Journal of Marine Science, 72 (1): 7-18. Wang, S. P.,

Maunder, M. N., Nishida, T., Chen, Y. R. 2015. Influence of model misspecification, temporal changes, and data weighting in stock assessment models: Application to swordfish (*Xiphias gladius*) in the Indian Ocean. Fisheries Research, 166: 119-128.

Sippel, T., Eveson, J.P., Galuardi, B., Lam, C., Hoyle, S., **Maunder, M**., Kleiber, P., Carvalho, F., Tsontos, V., Teo, S.L.H., **Aires-da-Silva, A**., Nicol, S. 2015. Using movement data from electronic tags in fisheries stock assessment: a review of models, technology and experimental design. Fisheries Research, 163: 152–160.

Thorson, J. T. , **Minte-Vera, C.V.** (in press). Relative magnitude of cohort, age, and year effects on size at age of exploited marine fishes. Fisheries Research.

11.2.   2014

Bromhead, D., Scholey, V., Nicol, S., Margulies, D., Wexler, J., Stein, M., Hoyle, S., **Lennert-Cody**, C., Williamson, J., Havenhand, J., Ilyina, T., Lehodey, P. 2014. The potential impact of ocean acidification upon eggs and larvae of yellowfin tuna (*Thunnus albacares*). Deep Sea Research II. http://dx.doi.org/10.1016/j.dsr2.2014.03.019

Carvalho, F., Ahrens, R., Murie, D., Ponciano, J.M., **Aires-da-Silva, A., Maunder, M.N**., and Hazin, F. 2014. Incorporating specific change points in catchability in fisheries stock assessment models: An alternative approach applied to the blue shark (*Prionace glauca*) stock in the south Atlantic Ocean. Fisheries Research 154: 135-146.

Lee, H. H., Piner, K. R., Methot, R. D., **Maunder, M. N.** 2014. Use of likelihood profiling over a global scaling parameter to structure the population dynamics model: an example using blue marlin in the Pacific Ocean. Fisheries Research, 158: 138-146.

Lee, H. H., Piner, K.R., **Hinton, M.G.**, Chang, Y.J., Kimoto, A., Kanaiwa, M., Su, N.J., Walsh, W., Sun, C.L., and DiNardo, G. 2014. Sex-structured population dynamics of blue marlin *Makaira nigricans* in the Pacific Ocean. Fish. Sci.,80: 869-878..

Maunder, M. N., Crone, P. R., Valero, J. L., Semmens, B. X. 2014. Selectivity: theory, estimation, and application in fishery stock assessment models. Fisheries Research, 158: 1-4.

Nieto, K., S. McClatchie, E. D. Weber, and **C. E. Lennert-Cody** (2014), Effect of mesoscale eddies and streamers on sardine spawning habitat and recruitment success off Southern and Central California, J. Geophys. Res. Oceans, 119, 6330–6339, doi:10.1002/2014JC010251.

Rosenberg, A.A., Fogarty, M.J., Cooper, A.B., Dickey-Collas, M., Fulton, E.A., Gutiérrez, N.L., Hyde, K.J.W., Kleisner, K.M., Kristiansen, T., Longo, C., **Minte-Vera, C.V.**, Minto, C., Mosqueira, I., Osio, G.C., Ovando, D., Selig, E.R., Thorson, J.T., Ye, Y. Developing new approaches to global stock status assessment and fishery production potential of the seas. Food and Agriculture Organization of the United Nations (FAO). Rome. 2014 FAO Fisheries and Aquaculture Circular No. 1086 FIRF/C1086 (En). ISSN 2070-6065

Wang, S. P., **Maunder, M. N., Aires-da-Silva, A.** 2014. Selectivity's distortion of the production function and its influence on management advice from surplus production models. Fisheries Research, 158: 181-193.

Wang, S. P., **Maunder, M. N.**, Piner, K. R., **Aires-da-Silva, A.,** Lee, H. H. 2014. Evaluation of virgin recruitment profiling as a diagnostic for selectivity curve structure in integrated stock assessment models. Fisheries Research, 158: 158-164.

Waterhouse, L., Sampson, D. B., **Maunder, M**., Semmens, B. X. 2014. Using areas-as-fleets selectivity to model spatial fishing: asymptotic curves are unlikely under equilibrium conditions. Fisheries Research, 158: 15-25.

12. STOCK ASSESSMENT REPORTS

12.1. 2014

The majority of this research was carried out prior to 2014 and presented at the 2013 SAC meeting.

Aires-da-Silva, A. and **Maunder, M.N.** 2014. Status of bigeye tuna in the Eastern Pacific Ocean in 2012 and outlook for the future. IATTC Stock Assessment Report 14: 31-185.

Anonymous (**Minte-Vera, C.V.** *et al*). 2014. Stock assessment of albacore tuna in the North Pacific Ocean in 2014. Report of the albacore working group. International Scientific Committee for Tuna and Tuna-like species in the North Pacific Ocean. 16- 21 July 2014. Taipei, Taiwan.

Hinton, M.G. and **Maunder, M.N.** 2014. Status of sailfish in the eastern Pacific Ocean in 2011 and outlook for the future. IATTC Stock Assessment Report 14: 224-251.

Lennert-Cody, C.E., Maunder, M.N., and **Aires-da-Silva, A.** 2014. Analysis of large-scale spatial patterns in yellowfin tuna catch data from purse-seine and longline fisheries. IATTC Stock Assessment Report 14: 19-30.

Lennert-Cody, C.E., Okamoto, H., and **Maunder, M.N.** 2014. Analysis of Japanese longline operational-level catch and effort data for bigeye tuna in the eastern Pacific Ocean. IATTC Stock Assessment Report 14: 186-216.

Maunder, M.N. 2014. Updated indicators of stock status for skipjack tuna in the eastern Pacific Ocean. IATTC Stock Assessment Report 14: 217-223.

Maunder, M.N. and Deriso, R.B. 2014. Reference points and harvest rate control rules. IATTC Stock Assessment Report 14: 252-258.

Minte-Vera, C.V., Aires-da-Silva, A. and **Maunder, M.N.** 2014. Status of yellowfin tuna in the Eastern Pacific Ocean in 2012 and outlook for the future. IATTC Stock Assessment Report 14: 3-18.

Minte-Vera, C.V., **Maunder, M.N.**, and. **Aires-da-Silva**, **A**. 2014. Kobe II strategy matrix for the bigeye and yellowfin tuna stocks of the eastern Pacific Ocean in 2012. IATTC Stock Assessment Report 14: 259-268.

13. SCIENTIFIC ADVISORY COMMITTEE REPORTS

13.1.   2014

Minte-Vera, C.V., Aires-da-Silva, A. and **Maunder, M.N.** 2014. Status of yellowfin tuna in the Eastern Pacific Ocean in 2013 and outlook for the future. IATTC SAC-05-07, 15 pp.

Aires-da-Silva, A. and **Maunder, M.N.** 2014. Status of bigeye tuna in the eastern Pacific Ocean in 2013 and outlook for the future. IATTC SAC-05-08a, 12 pp.

Maunder, M.N. 2014. Updated indicators of stock status for skipjack tuna in the eastern Pacific Ocean. IATTC SAC-05-09a, 4 pp.

Lennert-Cody, C.E., Ijima, H., Okamoto, H., **Aires-da-Silva, A.**, and **Maunder, M.N.** 2014. Updated Japanese longline standardized trends for bigeye tuna in the eastern Pacific Ocean from operational-level data. IATTC SAC-05-08b, 7 pp.

Maunder, M.N., Piner, K.R., and **Aires-da-Silva, A**. 2014. Stock status of Pacific bluefin tuna and the urgent need for management action. IATTC SAC-05-10a, 22 pp.

Maunder, M.N. 2014. Management strategy evaluation (MSE) implementation in Stock Synthesis: application to Pacific bluefin tuna. IATTC SAC-05-10b, 11 pp.

Aires-da-Silva, A., Lennert-Cody, C., **Maunder, M.N.**, and Román-Verdesoto, M. 2014. Stock status indicators for silky sharks in the eastern Pacific Ocean. IATTC SAC-05-11a, 18 pp.

Aires-da-Silva, A., Lennert-Cody, C.E., Maunder, M.N., Román-Verdesoto, M., **Minte-Vera, C.,** Vogel, N.W., Martínez-Ortiz, J., Carvajal, J.M., Guerrero, P.X., and Sondheimer, F. 2014. Preliminary results from IATTC collaborative research activities on dorado in the eastern Pacific Ocean and future research plan. IATTC SAC-05-11b, 27 pp.

Hinton, M.G., Maunder, M.N., Vogel, N., Olson, R., **Lennert -Cody, C., Aires-da-Silva, A**., and Hall, M. 2014. Stock status indicators for fisheries of the eastern Pacific Ocean. IATTC SAC-05-11c, 26 pp.

Lennert-Cody, C.E. and **Maunder, M.N.** 2014. Progress report on development of an index of abundance for dolphins from purse-seine observer data. IATTC SAC-05-11d, 21 pp.

Maunder, M.N. and Deriso, R.B. 2014. Evaluation of the relationship between active purse-seine fishing capacity and fishing mortality in the eastern Pacific Ocean. IATTC SAC-05-12, 8 pp.

Maunder, M.N. and Deriso, R.B. 2014. Proposal for biomass and fishing mortality limit reference points based on reduction in recruitment. IATTC SAC-05-14, 11 pp.

Anonymous (**Aires-da-Silva, A., Lennert-Cody, C.E., Maunder, M.N.** *et al*.) 2014. A collaborative attempt to conduct a stock assessment for the silky shark in the eastern Pacific Ocean (1993-2010): update report. IATTC SAC-05-INF-F, 28 pp.

14. OTHER REPORTS

14.1.   2014

Anonymous (**Minte-Vera, C. V.** *et al.*) Report of the Albacore Working Group workshop, International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean. 14-28 April 2014. Southwest Fisheries Science Center. La Jolla, California, United States of America.

Anonymous (**Lennert-Cody, C.E., Maunder, M.N., Minte-Vera, C.V.** *et al*.) 2014. Options for assessing the status of dolphin populations in the eastern Pacific Ocean. IATTC MOP-30 INF-A, 9 pp.

Hinton, M.G., Lu, C-P., and Alvarado-Bremer, J. R. 2014. Stock distribution areas for analysis of status and trends of swordfish in the north Pacific Ocean. International Scientific Committee for Tuna and Tuna-like Species in the North Pacific, Billfish Working Group. February, 2014. 4 pp.

Maunder, M.N. and **Aires-da-Silva, A.** 2014. Developing conservation measures for bluefin tuna in the

eastern and western regions of the Pacific Ocean: factors to consider and fishery impact analysis. IATTC-87 INF-B, 20 pp.

15. HONORS

The following paper has been included in an Editor's Choice selection of articles published in the journal Optimization Methods and Software: Fournier, David A., Hans J. Skaug, Johnoel Ancheta, James Ianelli, Arni Magnusson, **Mark N. Maunder**, Anders Nielsen, and John Sibert. 2012. AD Model Builder: using automatic differentiation for statistical inference of highly parameterized complex nonlinear models.

Dr. Lennert-Cody was awarded the honor of Outstanding Reviewer by the Canadian Journal of Fisheries and Aquatic Sciences in 2014.