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SCIENTIFIC ADVISORY COMMITTEE**

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CURRENT AND PLANNED ACTIVITIES OF THE IATTC STAFF

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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

Species	Last assessed	2012	2013	2014
Yellowfin	2011 (full)	Update	Full	Update
Skipjack	2004	Full		
Bigeye	2010 (full); 2011 (update)	Update	Update	Full
Striped marlin	2010			
Swordfish	2011			
Sailfish	never		Full	
Black marlin ¹	never			
Blue marlin ¹	2001			Full
Silky shark	never		Full	
Independent review / Fall workshop		Yellowfin review	Workshop	

1.2. Plan of work

1. **Preparatory work for the stock assessments in the schedule.** Some stock assessments are simple

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

updates and require only adding new data to the existing stock assessment model. Other stock assessments are benchmark assessments or assessments of species that have never been assessed, and therefore require substantial work to collate and analyse the data, and to investigate the model assumptions.

2. **Independent review of the yellowfin tuna stock assessment (2012).** Carry out sensitivity analyses to investigate the issues relating to the yellowfin tuna stock assessment.
3. **Fall stock assessment methodology workshop series (2013).** Conduct analyses and write working documents related to the workshop topic.
4. **Post-stratification of purse-seine length composition data.** Evaluate the possibility of re-stratifying the purse-seine length-composition data so that stock assessments can be conducted using spatial structures other than those restricted to the Commission's measurement areas.
5. **Spatially-structured stock assessment models.** Develop a fine-spatial-scale stock assessment model with spatially-correlated random effects for bigeye tuna.
6. **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. The IATTC staff, in collaboration with South Pacific Commission and the US National Marine Fisheries Service, has obtained funding from the Pacific Fisheries Research Programme to investigate this topic.
7. **Forecasting bigeye catch.** Develop a forecasting approach to predict the spatial distribution of bigeye tuna catch based on spatially-explicit weekly report data and environmental covariates. Evaluate the performance of the predictions in reducing bigeye catch.
8. **Shark stock assessment:** Stock assessment modeling research and data collation will be conducted to enable the assessment of one or more shark stocks.

1.3. Potential topics for fall workshops

- a. Including species interactions in stock assessment models
- b. Forecasting fisheries dynamics
- c. Statistical issues in stock assessment
- d. Longline data

2. TAGGING STUDIES

1. Analyses of archival tag data for yellowfin from the Revillagigedo Islands, Mexico, during 2006-2011, and preparation of a manuscript on movements, behavior, and habitat utilization, for publication in a peer-reviewed scientific journal.
2. In collaboration with the Secretariat of the Pacific Community (SPC), a six-week tuna-tagging cruise was undertaken in the equatorial central Pacific Ocean (ECPO), targeting bigeye tuna, during November-December 2011.
3. Analyses of archival tag data for bigeye released in the ECPO during 2008-2011, and preparation of a manuscript on movements, behavior, and habitat utilization, for publication in a peer-reviewed scientific journal.
4. A two-week tuna-tagging cruise to Clipperton Island, to deploy archival tags in yellowfin tuna, was undertaken aboard a San Diego-based long-range sportfishing vessel during February-March 2012.
5. Analyses of available archival tag data for yellowfin from throughout the EPO will be undertaken, to describe and quantify the geographic variability in movements, behavior, and habitat utilization.

6. Continue to seek funding sources for an IATTC Regional Tuna Tagging Project for bigeye, yellowfin, and skipjack tunas throughout the eastern Pacific Ocean (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 four 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 (2011-2015)

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. It 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 (Achoines 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. Publications summarizing the research results will be developed jointly.

2. Advancement of hatchery technologies for large-scale production of yellowfin tuna (September 2009-April 2012)

Funded by Saltonstall-Kennedy Program (S-K), U.S. National Oceanic and Atmospheric Administration (NOAA); collaborators: Hubbs Sea World Research Institute (HSWRI)

This project commenced in September 2009, and the final research activities were completed in April 2012. **Objectives:** (1) demonstrate working techniques for long-distance air transport of yellowfin eggs and larvae from the Achotines Laboratory to facilitate rearing experiments in San Diego, and to serve as a model for transportation of other marine fish species; (2) conduct experiments at the Achotines Laboratory and in San Diego to refine rearing methods used for yellowfin, with the aim of large-scale production of juveniles for research purposes; (3) dissemination of research results to the public and private sectors and resource agencies through reports and publications to aid in the ultimate development of successful aquaculture of yellowfin. Several joint publications of the study results are being prepared.

3. 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. Several joint publications of the study results will be developed.

4. Ocean acidification impacts on tropical tuna (2011-2012)

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 Ashotines Laboratory (conducted during 2011) and modeling studies to be conducted at the SPC during 2012. **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. Joint publications of the research results are being developed.

3.2. Life history of yellowfin tuna

An investigation is in progress on the age, growth, maturity, spawning distribution, and fecundity of yellowfin in the EPO. Collections of samples by tuna vessel observers are nearing completion, and laboratory analyses of samples should begin in 2012.

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.

An analysis of several hypotheses that have been proposed to explain the tuna-dolphin bond in the EPO was published in 2012).

4.1.1. Stable isotopes in ecology

1. Continuation of collaborative three-year project, "CAMEO 2009: A novel tool for validating trophic position estimates in ecosystem-based fisheries models." 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 levels were analyzed in Stage 1 during 2011, and a subset will be analyzed for AA-CSIA in the summer of 2012.
2. Analysis of yellowfin tuna-dolphin trophic interactions based on stable isotopes and diet analysis using newly developed classification tree methodology.
3. Continued analysis and co-authorship of Pacific-wide isotope biogeography study of tropical tunas.

4.1.2. Diet studies

1. Analysis and prediction of yellowfin tuna diet composition using a classification tree model. Draft manuscript will be completed and submitted in 2012 for publication: *Decadal-scale diet composition of yellowfin tuna in the tropical eastern Pacific Ocean*.
2. A classification tree modeling method for investigating complex feeding relationships was published in 2012, principal author P. Kuhnert, CSIRO, Australia.
3. Analysis of diet data for skipjack, bigeye, and associated pelagic predators using classification tree models will continue.

4. Continued collaboration on ecological analyses with researchers at the University of Washington. An [analysis of apex predator diets](#)², to evaluate whether skipjack and yellowfin tunas might be vulnerable to top-down control by large pelagic predators in the tropical EPO, was published in 2012. Preparation of a manuscript on dietary evidence of increased cephalopod production in the EPO over a 50-year period is planned for 2012.
5. Publication of a manuscript on the trophic ecology of mesopelagic myctophid fishes in the EPO is planned for 2012.
6. Continued collaboration with the international research program [CLIOTOP](#). Co-edition of a special issue of the journal Deep Sea Research Part II: Topical Studies in Oceanography, entitled “The Role of Squid in Pelagic Ecosystems.”

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 tested for measuring vulnerability to overfishing in a preliminary analysis of a subset of species in the EPO purse-seine fishery.
2. A complete PSA is being completed in 2012 for the major species and stocks caught by the purse-seine fishery in the EPO, and a report is being prepared.

4.2.2. Ecosystem modeling

Ecosystem-based fisheries management is facilitated through the development of multi-species ecosystem models that represent ecological interactions among species or guilds and provide inferences on the effects of different fishing scenarios and environmental variability on the ecosystem.

1. Continue the development of a second-generation model of the pelagic ecosystem in the tropical EPO based on Ecopath with Ecosim (EwE). The first IATTC model had 38 components and represented 1993-1997, while the second model will represent 2003-2005 based on new diet and stable isotope data. The diet data are being processed for inclusion in the model.
2. Analyses of potential metrics of ecological impact of the tuna fisheries in the EPO. An [analysis based on metrics](#) of diversity, trophic level, and replacement time of fisheries catches has been published³. A second analysis using the EPO ecosystem model to address the ecological state of the ecosystem, as opposed to metrics based on removals alone, is planned.

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 prudent delay to avoid uncertainties about confidentiality), test different systems to identify individual FADs, and implement a FAD marking and tracking program.

² <http://www.int-res.com/articles/meps2011/445/m445p263.pdf>

³ <http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2011.01817.x/pdf>

- c. Support sorting grid experiments with scientific designs and analyses;
- d. Carry out experiments on alternative FAD designs to mitigate entanglements and reduce marine debris generation, and,
- 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 the fishing operations involving them.
- 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 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;
- c. Produce catch and effort estimates for artisanal fleets;
- d. Pending funding, cooperate in the planning of mitigation experiments.

4. Seabirds:

- a. Monitor trends for species affected by fisheries in the EPO.
- b. Cooperate with the Agreement for the Conservation of Albatross 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

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

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 the 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. Reducing catches of small bigeye and yellowfin tunas and sharks in the fishery on FADs

The IATTC, in collaboration with the ISSF, undertook a 72-day research cruise during 11 May-23 July 2011 in the equatorial EPO aboard the chartered purse-seine vessel *Yolanda L.* to conduct field experiments on tunas and sharks within aggregations associated with drifting fish-aggregating devices (FADs). The work focused on exploring solutions to avoid catching small bigeye and yellowfin tunas around FADs, and also evaluating the survivorship of sharks released alive after capture. Various complementary scientific tools were used to elucidate behavioral differences between bigeye, skipjack, and yellowfin tunas, with the aim of revealing opportunities for maximizing catches of skipjack and minimizing catches and mortality of bigeye and other species of concern associated with FADs. Analyses of the resulting data from that cruise are underway, as is the preparation of manuscripts for submission to peer-reviewed scientific journals.

B. DATA

1. Data collection and database program work plan

At the meeting of the IATTC Scientific Advisory Committee (SAC) in 2011, a summary of the organization of the work in the data group and of activities and objectives planned for future years was presented. 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. Activities since the previous report

1. The internal teamwork environment is fully implemented. The IT staff and developers are now working together to use common databases, servers and other resources in a collaborative manner. Now that the migration of servers to a virtualized environment is complete, developers have started using the schema presented in the last SAC report as the framework for the development environment.
2. The new Length Frequency and Species Composition program is fully implemented and currently used for statistics and stock assessments, and the benefits of the automation are noticeable. Nevertheless, we have identified other issues in the algorithm itself, which will be addressed and improved during the coming year. Automation is complete for other tasks identified last year, such as the best scientific estimate (BSE), estimates by flag for bluefin and black skipjack, and longline estimates.
3. The Catch and Effort program is in the final stages of automation, and documentation is underway. This program combines data from the observer program, fishing vessel logbooks and unloading weights into a single dataset, which greatly facilitates analysis by the scientific staff.
4. Development of a Spatial database continues. This database allows researchers to easily determine and group data by areas of interest, such as the EEZ of countries, fishing areas, sampling areas, *etc.* The basic work on this project is complete, however adjustments to increase efficiency continue.
5. The basic Stock Assessment database, which contains surface fishery data needed for stock assessments and optimized for analysis, has been created and documented. All of the processes required by the scientific staff have been developed, however there are continuing adjustments to certain aspects of the program which will be resolved during the coming year.
6. 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 will be added to the documentation library when finalized. We are also exploring the possibility of incorporating the functionality of the documentation library into the new IATTC web site, so that the information is available to organizations outside the IATTC.
7. Development of a new IATTC website is in the final stages. Most of the functionality has been

created and tested. Adding all content to the new website, and training staff in maintaining the site, remain to be done.

8. The Vessel Register database and application redesign have been postponed until next year.
9. Development of a data request management application has been postponed until next year.
10. The reporting workflow has been reviewed, and certain tasks have been automated (quarterly and annual reports graphs and statistics). Additional tasks suitable for automation have been identified and will be incorporated.

1.2. Planned work

1. Length Frequency data management database and application. We will improve the current algorithm to make it more flexible for temporal changes in area stratification. We will also improve 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 the improvement of this estimation.
2. Completion of the Catch and Effort documentation and Spatial database optimization.
3. Documentation of all internal data processing so that all of the procedures are clear and comprehensive.
4. Completion of the new IATTC website, which will give the IATTC a fresh image and improve access to information through ease of navigation.
5. Review and improvement of the IATTC reporting workflow.
6. Automation of more reporting tasks as well as improvements to current reporting tasks.

C. CAPACITY BUILDING

1. Tagging

Funding was not available, for a proposed three-day training course on tagging methodology for large pelagics, with emphasis on tropical tunas, which was intended to be held at the Achotines Laboratory in 2012 for up to 10 participants from Latin American member countries. The intent was to inform participants about the objectives of tagging studies, types of tags, tagging methodologies, data analyses, and potential applications of tagging data in stock assessments, and carry out some yellowfin tuna tagging in waters close to the laboratory.

2. 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.

3. Shark fisheries

The Commission staff will provide appropriate assistance to developing IATTC members in:

3.1. 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 Western Pacific organizations collecting data .
- 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 shark catch, size distribution, and effort data, 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 upon body parts (*e.g.* fins or trunks), or on incomplete specimens.

3.2. Data reporting

Improving their capabilities 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 shall 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.

3.3. Biological parameters

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

3.4. Fisheries data studies

Conducting research on the spatial-temporal characteristics of the catch, including identification of shark nursery grounds and of specific areas and seasons that contribute to the majority of catches. This assistance shall 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).

3.5. Workshops on stock assessment of sharks

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