INTER-AMERICAN TROPICAL TUNA COMMISSION

SCIENTIFIC ADVISORY COMMITTEE

FOURTH MEETING

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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

Species	Last assessed	2013	2014	2015
IATTC				
Yellowfin	2011 (full) 2012 (update)	Update	Full	Update
Skipjack	2004	Indicators	Indicators	Indicators
Bigeye	2010 (full); 2012 (update)	Full	Full	Update
Striped marlin	2010			
Swordfish	2011			
Sailfish	Never	Full		
Black marlin[1]	Never			
Silky shark	Never	Full		
Dolphins				Full
Dorado	Never		Indicators	Indicators

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

Independent review / Fall workshop		CAPAM selectivity	CAPAM workshop	CAPAM workshop
COLLABORATIONS				
Albacore			Full	
Blue marlin[1]	2001		Full	
Blue shark			Full	

1.2. Plan of work

1. **Preparatory work for the stock assessments in the schedule**. Full assessments of yellowfin and bigeye tuna will be conducted during 2013 with data up to and including 2012. These assessments will involve extensive sensitivity analysis to determine the most appropriate base case model. The results will be presented at the following SAC and the base case model will be presented with all available updated data.
2. **CAPAM stock assessment methodology workshop series (2013)**. Conduct analyses and write working documents related to the workshop topic.
3. **Post-stratification of purse-seine length composition data.** Evaluate the possibility of restratifying 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.
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. 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.
5. **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.
6. **Stock status indicators and management strategy evaluation**: Research will be conducted to develop indicators of stock status that can be used for species for which little information is available. Management strategy evaluation will be conducted to evaluate the indicators and their use in harvest control rules.
7. **Dolphin indices of abundance**. Data from the purse seine fishery for yellowfin tuna associated with dolphins will be analyzed to develop an index of abundance for dolphins.

1.3. Fall workshops

The IATTC fall workshop series has been integrated into the Center for the Advancement of Population Assessment Methodology (CAPAM) workshop series. CAPAM is a collaboration between Scripps Institution of Oceanography, the United States National Oceanic and Atmospheric Administration Fisheries, and the IATTC. The first CAPAM workshop, "Selectivity: theory, estimation, and application in fishery stock assessment models", was held in 2013. Workshops are expected to be held on an annual or biannual basis and address topics such as catchability, growth, natural mortality, the stock-recruitment relationship, covariates, spatial structure, data/likelihood weighting, multi-species and ecosystem considerations, and diagnostics.

2. TAGGING STUDIES

1. Analyses of archival tag data for yellowfin from the Revillagigedo Islands, Mexico, during 2006-2013, and preparation of a manuscript on movements, behavior, and habitat utilization, for publication in a peer-reviewed scientific journal.

2. Analyses of conventional and archival tag data for bigeye released in the equatorial central Pacific Ocean (ECPO) during 2008-2011, and preparation of a manuscript on spatial dynamics and mixing of bigeye between the ECPO and the equatorial eastern Pacific Ocean (EPO) for publication in a peer-reviewed scientific journal.
3. Analyses of archival tag data for bigeye released in the ECPO during 2008-2011, and preparation of a manuscript on vertical movements, behavior, and habitat utilization.
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 2013.
5. Archival tag data for yellowfin released at several locations throughout the EPO are continuing to be collected and analyzed. A manuscript will be prepared in the next couple of years on the geographic variability in movements, behavior, and habitat utilization for publication in a peer-reviewed scientific journal.
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 (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 2013, yellowfin juveniles will be reared in sea cages near the Achotines Laboratory for the first time. Publications summarizing the research results 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, as well as rearing trials in both locations, are planned

during 2013. Several joint publications of the study results will be developed.

3. Ocean acidification impacts on tropical tuna (2011-2013)

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. **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. A joint manuscript (principal author, Donald Bromhead) describing the study results has been submitted to the journal Deep Sea Research.

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 from July 8-19, 2013. This will be the 11th 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.

3.2. Life history of yellowfin tuna

An investigation is in progress on the age, growth, maturity, spawning frequency and fecundity of yellowfin throughout the EPO. Collections of samples by tuna vessel observers are continuing, and laboratory analyses of samples are scheduled to begin in 2013.

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.

A manuscript summarizing an analysis of spatial, temporal, environmental, and biological covariates explaining predation patterns of 3,362 yellowfin tuna sampled across the EPO during two 2-year periods occurring a decade apart was recently submitted for publication in 2013. Classification trees revealed that major changes in the prey communities that support tuna production had transpired during the decade.

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 positions across a productivity gradient in the EPO were analyzed, using bulk tissue N isotopic analysis, in Stage 1 during 2011. In stage 2 during 2012, a subset of samples were analyzed for AA-CSIA. Results showed that amino-acid enrichment factors were not consistent across marine phyla. A

manuscript is in preparation during 2013.

2. Analysis of existing data on yellowfin tuna-dolphin trophic interactions based on stable-isotope and diet analyses using recently-developed classification tree methodology will take place in 2013.

4.1.2. Diet studies

1. Analysis of diet data for skipjack, bigeye, and associated pelagic predators using classification tree models will continue. A manuscript on predation habits of silky sharks in the EPO is being prepared in 2013.
2. Continued collaboration on ecological analyses with a researcher currently at the National Center for Ecological Analysis and Synthesis, University of California at Santa Barbara. Finalizing a manuscript on predator dietary evidence of increased cephalopod production in the EPO over a 50-year period is planned for 2013.
3. Publication of a manuscript on the trophic ecology of mesopelagic myctophid fishes in the EPO is planned for 2013.
4. Continued collaboration with the international research program CLIOTOP. Co-edition by an IATTC scientist of a special issue of the journal Deep Sea Research Part II: Topical Studies in Oceanography, entitled "The Role of Squid in Pelagic Ecosystems," being finalized in 2013. A CLIOTOP-sponsored workshop to finalize an analysis of stable-isotope and diet data for pelagic predators in the world's oceans is planned for the fall of 2013 in Australia.

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 will be completed in 2013 for the major species and stocks caught by the purse-seine fishery in the EPO, and a report will be prepared.

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.

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

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, 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 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 Scientific Advisory Committee (SAC) in 2012, 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 Length Frequency program is fully implemented and currently used for automation of graphics and reports. Development of a dedicated database with the design optimized for analysis of length frequency data has been created and put into production. The design incorporates use of native SQL scripts which are run within the database, optimizing performance.
2. The Species Composition program is fully implemented and currently used for statistics and stock assessments. This program is used to generate the best scientific estimate (BSE), and specialized tables. Native SQL scripts are used to increase efficiency. Remaining issues in the algorithm have been addressed and improved during the past year.
3. The optimization of the Catch and Effort program has been completed, along with the documentation. 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. The process was converted from a Microsoft Access database and series of queries, to a dedicated SQL Server database using native SQL scripts to produce automatic updates to the summary tables on a daily basis. The entire process, which took days to complete and verify, now runs in a little over an hour without any staff intervention.
4. Development of a Spatial database is complete, though new functionality is continually added as are improvements as part of normal development and maintenance. This database allows researchers to easily determine and group data by areas of interest, such as the EEZ of countries, fishing areas, sampling areas, distance to shore, *etc*.
5. Adjustments and improvements in efficiency to the Stock Assessment database have been completed. This database contains surface fishery data needed for stock assessments and optimized for analysis.

1.2. Ongoing activities

1. Additional improvements to the reporting workflow have been completed, and additional tasks suitable for automation have been identified and will be addressed.
2. Streamlining of data processing for the fishing vessel logbooks is planned. Changes include optimization of data flow and increasing data editing efficiency through implementation of improved computer data checks.
3. Development of the new IATTC website was delayed due to the need to direct limited staff resources

to other projects. Most of the functionality has been created and tested. The addition of content present in the current website will be a focus of this year, along with staff training in site maintenance. The new website will give the IATTC a fresh image and improve access to information through ease of navigation.

4. 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.
5. Documentation of all internal data processing so that all of the procedures are clear and comprehensive.

1.3. Planned work

1. A dedicated Vessel Register database and application redesign, proposed in the meeting of the IATTC SAC in 2011, was not completed due to limited staff resources. The current design is workable, though it is labor intensive. Work on this project is planned for this year.
2. Development of a data request management application was not initiated due to limited staff resources. This project has been postponed until next year.
3. The front-end user interface based on R will be developed 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. 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.
5. Porting of existing data entry and editing computer programs from Visual Basic 6 to the Microsoft dot net framework. VB6 is no longer supported by Microsoft. IATTC programmers are currently exploring reconfiguration of these programs into web applications which will run in a web browser, vs. development of the programs as standard Windows applications. Both paths have their merits and drawbacks.

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 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.

4. Development of Landings database in collaboration with OSPESCA

IATTC staff, in collaboration with the Organization for Fishing and Aquaculture in Central America (OSPESCA), have assisted in the development of a data collection form for gear characteristics and landings of artisanal fleets operating from ports in Central America. A Microsoft Access database has been developed specifically for use with this form. 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.