INTER-AMERICAN TROPICAL TUNA COMMISSION
SCIENTIFIC ADVISORY COMMITTEE
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PLAN FOR FUTURE ACTIVITIES

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	2011	2012	2013
Yellowfin	2009 (full); 2010 (update)	full	update	full
Skipjack	2004		full	
Bigeye	2010	update	full	update
Striped marlin	2010			
Swordfish	2006	full		
Sailfish	never		full	
Black marlin	never			
Blue marlin	???			
Silky shark	never	full		
Independent review / Fall workshop		Workshop	Yellowfin review	Workshop

1.2. Plan of work

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

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 (2011, 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 restratifying the purse-seine length-composition data so that stock assessments can be conducted using spatial structure 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. IATTC staff, in collaboration with South Pacific Commission and the US National Marine Fisheries Service, have 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 at 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. Using oceanography for stock assessment and fisheries management

2. TAGGING STUDIES

1. Analyses of archival tag data for yellowfin from off Baja California, Mexico, during 2002-2010, and preparation of a manuscript on yellowfin movements, behavior, and habitat utilization for publication in a peer-reviewed scientific journal.

2. Analyses of conventional and archival tag data for yellowfin and wahoo from the Revillagigedo Islands, Mexico, during 2006-2010, and preparation of a manuscript on movements, behavior, and habitat utilization, for publication in a peer-reviewed scientific journal.

3. Analyses of archival tag data for yellowfin from off Baja California, the Revillagigedo Islands, the equatorial eastern Pacific Ocean (EPO), and Panama during 2002-2011, and preparation of a manuscript on yellowfin comparative movements, behavior, and habitat utilization, for publication in a peer-reviewed scientific journal.

4. Continuation of the collaborative project among the IATTC, the Instituto Nacional de Pesca of Mexico, and the owners of the sport-fishing vessel *Royal Star* in tagging yellowfin and wahoo at the Revillagigedo Islands in 2011, and potentially beyond.

5. Establish funding sources for, and potentially initiate, the IATTC Regional Tuna Tagging Project for bigeye, yellowfin, and skipjack 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 six 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 (2010-2015)**

    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 has been conditionally approved for funding, and will commence in late 2010. It includes (1) comparative research on the early life history of Pacific bluefin and yellowfin, with experimental work to be 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.

2. **Advancement of hatchery technologies for large-scale production of yellowfin tuna (September 2009-August 2011)**

    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. **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 to aid in the ultimate development of successful aquaculture of yellowfin.

3. **Nutritional studies of early life stages of yellowfin tuna (2010-2011)**

    Funded by IATTC and Texas A&M University (TAMU); collaborators: TAMU

    This project is an ongoing collaborative study of the nutrition of larval and early-juvenile stages of yellowfin. The experimental research is conducted at the Achotines Laboratory, and the analytical studies at TAMU. **Objectives**: (1) describe the general components of nutrition (proximate composition, amino acids, digestive enzymes) of egg, larval, and early-juvenile stages of yellowfin; and (2) utilize the nutritional data to improve understanding of the physiological aspects of the feeding and survival of pre-recruit life stages of yellowfin.

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)

    This project will include experimental research at the Achotines Laboratory and modeling studies conducted at the SPC. **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.

5. **Studies of methods of collection, transport and culture of Indo-Pacific sailfish and wahoo at the Achotines Laboratory (2010-2011)**

   Funded by the Secretaría Nacional de Ciencia, Tecnología e Innovación (SENACYT), Panama; collaborators: University of Miami, Graduate Program in Aquaculture

   This project is currently being conducted at the Achotines Laboratory. **Objectives**: (1) investigate the feasibility of collecting, transporting and rearing Indo-Pacific sailfish and wahoo at the Achotines Laboratory for purposes of research on the biology and physiology of these species; and (2) dissemination of the research results to the public and private sectors to aid in the development of research programs on the resource management of these species.

6. **Development of a reference collection of microalgae at the Achotines Laboratory (2010-2011)**

   Funded by SENACYT

   This project is currently being conducted at the Achotines Laboratory. The objective is to develop a reference collection of microalgae at the Laboratory, which will serve as a regional reference center for microalgae culture to aid researchers requiring pure, isolated cultures of marine algae for research and aquaculture purposes.

3.2. Life history of yellowfin tuna

Investigation of the age, growth, maturity, and fecundity of yellowfin in the EPO. Finalize collection of samples, conduct laboratory analyses, perform statistical analyses of the data sets, and complete the preparation of a manuscript.

4. ECOSYSTEM STUDIES

Ecological research at the IATTC is focused on studies of food-web dynamics and modeling of ecosystem processes, and new studies of ecological risk assessment 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.

4.1.1. Stable isotopes in ecology

1. Initiation, sample collection, sample analysis, and data analysis for a new 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 analyses (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.

2. Publication of yellowfin tuna-dolphin trophic interactions based on stable isotopes and diet analysis.

3. Analysis and publication of stable isotope data for pelagic squid and their prey, for interpreting squids' key ecological role in the EPO ecosystem.

4. Continued analysis and co-authorship of Pacific-wide isotope biogeography study of tropical tunas.

4.1.2. Diet studies

1. Analysis of diet data of yellowfin tuna and associated pelagic predators using classification and

regression tree methods. First publication of series: *Decadal-scale variation of the forage fauna in the diet of yellowfin tuna in the EPO*.

2. Continued collaboration on ecological research with the University of Washington. Co-authorship of publications on 1) predator impact on yellowfin and skipjack and population implications; 2) dietary evidence of increased cephalopod production in the EPO.

3. Collaborative analysis of trophic interactions data of mesopelagic myctophid fishes in the EPO, and publication of the results.

4. Continued collaboration with international research program CLIOTOP (http://web.pml.ac.uk/globec/structure/regional/cliotop/cliotop.htm). Analysis of tropical pelagic predator diet data world-wide to address if latitude can be used as a proxy for climate change in eliciting food-web responses that could affect pelagic fishes. A report will be prepared.

4.2. 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. A version of productivity and susceptibility analysis (PSA) will be tested in a preliminary analysis for measuring vulnerability to overfishing in a subset of species in the EPO purse-seine fishery.

2. PSA or another risk analysis will be conducted for a full complement of species and stocks caught by the major fisheries in the EPO, and a report will be produced.

4.3. Ecosystem modeling

Ecosystem-based fisheries management is facilitated through the development of multi-species ecosystem models that represent ecological interactions among species or guilds.

1. We will 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.

2. Analyses of potential metrics of ecological impact of the tuna fisheries in the EPO. Ecosystem models provide inputs for meta-analyses, the output of which are a range of metrics such as diversity indices, trophic levels of fisheries removals, and replacement time, which have the potential to become decision support tools for management.

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.* 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;

   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).

2. Sea turtles:

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

b. Continue support of OFCF sea turtle program, and publish results of entanglement mitigation experiment and of comparative gear studies.

3. Sharks and rays:

a. Examine spatial options for bycatch mitigation;

b. Analyze data on bycatches of sharks and manta rays in the purse-seine fishery;

c. Develop standardized data collection forms (catch, effort, biological data), and develop sampling designs for landings (and observer programs where available);

d. Produce catch and effort estimates for artisanal fleets;

e. Pending funding, cooperate in the planning of mitigation experiments.

4. Seabirds:

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

b. Conduct research to mitigate bycatch of albatrosses in the southern and northern regions of the EPO, and consider recommendations for effective mitigation measures.

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

c. Workshops on sea turtle bycatches in artisanal longline fisheries

6. REDUCING CATCHES OF BIGEYE TUNA IN SETS ON FLOATING OBJECTS

Undertake a 90-day field study, funded by the International Seafood Sustainability Foundation (ISSF), in the equatorial EPO early in 2011, using a purse-seine vessel and support vessel to investigate the fine-scale spatial and temporal dynamics of tuna aggregations associated with drifting fish-aggregating devices (FADs). Various complementary scientific tools would be used to elucidate behavioral differences between skipjack and bigeye tunas, with the aim of revealing opportunities for maximizing catches of skipjack and minimizing catches and mortality of bigeye and other species associated with drifting FADs.

B. DATA

1. Data collection and database program work plan

The IATTC employs a database server which holds most of the fisheries information gathered or generated during the last 60 years. In general, data are uploaded into a database server, processed and

analyzed, and then disseminated in a number of ways.

1.1. Current data and database systems

Data go through three stages:

1. **Data gathering.** Data reaches IATTC headquarters from several sources*, usually IATTC field offices, and in various formats, on paper and electronic. It is entered into the system and checked for errors. The final product is stored on the database server.

2. **Data processing.** Once the clean data is available, it is further processed to generate a more useful data set for analysis purposes.

3. **Data analysis and reporting.** Processed data is used by the staff to generate regular and special reports, analyses, specific data requests, public domain data, *etc*., many of which are published on the IATTC website. The IATTC also participates in the Fishery Resources Monitoring System (FIRMS).

The content of the databases has increased in quantity and complexity over time. A review of the data systems in 2007 identified structures and processes which could be improved:

1. The current database structure, created in the late 1990s and based on the structure of the previous system, keeps information from the observer program separate from information from other sources, due to the different methods of data collection. This has led to the development of independent applications to maintain and analyze these dual databases, and the resulting individual unconnected parts increase the complexity of maintenance and support.

2. The existing database structure works well for data input and editing, but is not optimized to efficiently retrieve information for analyses. The complexity of the structure, along with limited documentation, means that IATTC scientists depend heavily on the technical staff to prepare datasets for analysis.

3. There are several important internal processes which are costly in terms of time and effort of the data group staff. Creating new computing tools and/or updating the current ones would reduce or eliminate these bottlenecks.

4. The IATTC web site is outdated, which makes updating and maintenance difficult and time-consuming.

1.2. Planned improvements

The following improvements will be undertaken to address the issues identified.

1.2.1. Improved data collection and compilation

1. Review data entry applications and create an integrated web portal to host most of the internal data entry and editing applications.

2. Develop a teamwork environment, using common code libraries to facilitate and optimize the management of the various applications.

3. Create new applications to facilitate management and use of the data system:

   a. Applications to automate repetitive, time-consuming tasks often encountered when processing data sets received from other organizations, as well as data regularly received from IATTC field offices.

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* The sources of the main data sets are: observer data, vessel logbooks, unloading data from canneries, length-frequency data from port sampling, summary longline data provided by countries, and lists of vessels from several sources.

b. Integrated routines for data entry and error checking.

1.2.2. Improved data processing

1. Review data reporting routines to identify those which require manual intervention to process multiple files, in order to reduce the time required to produce reports and to minimize the number of steps in which errors may be introduced into the process.

2. Automate procedures where possible.

1.2.3. Improved data analysis and reporting

1. Specialized analysis and reporting databases, with structures optimized to facilitate retrieval of data. They will be constantly synchronized with the existing IATTC database, which is optimized for ease of data entry and editing.

   a. A dedicated spatial database to facilitate analysis and mapping tasks. Many reports and analyses, *e.g.* analyses of proposed closure times and areas, require compilation and use of data in space-time strata. This database will include all areas used for management of the fishery, environmental datasets, as well as several spatial analysis tools that will facilitate development of future studies.

   b. A stock assessment database, to automatically generate standard datasets used in stock assessments.

   c. Additional specialized analysis databases as needed.

2. A data dictionary (documentation) to aid the scientific staff in identifying the location and access procedures needed to extract data for their analyses. This will reduce the reliance on the technical staff and accelerate access to data.

3. A new internal web site, with new technologies to permit more efficient data retrieval.

4. A new external web site, incorporating newer programming and design techniques, which will also reduce the time and steps required to update and maintain the site. The Vessel Register section of the website will be modified to increase efficiency of updates and ease navigation and extraction of data. Other similar registries, such as a global tuna vessel registry, may also be integrated into the website using the tools and technologies developed for the Vessel Registry. Also, a data request management application will be added to handle the growing number of data requests, including an immediate delivery system for public domain data.

All the activities described above are part of a larger project to transform the heterogeneous data management system composed of applications, forms and databases into an integrated data warehouse. The final structure envisaged for the IATTC system is as follows:
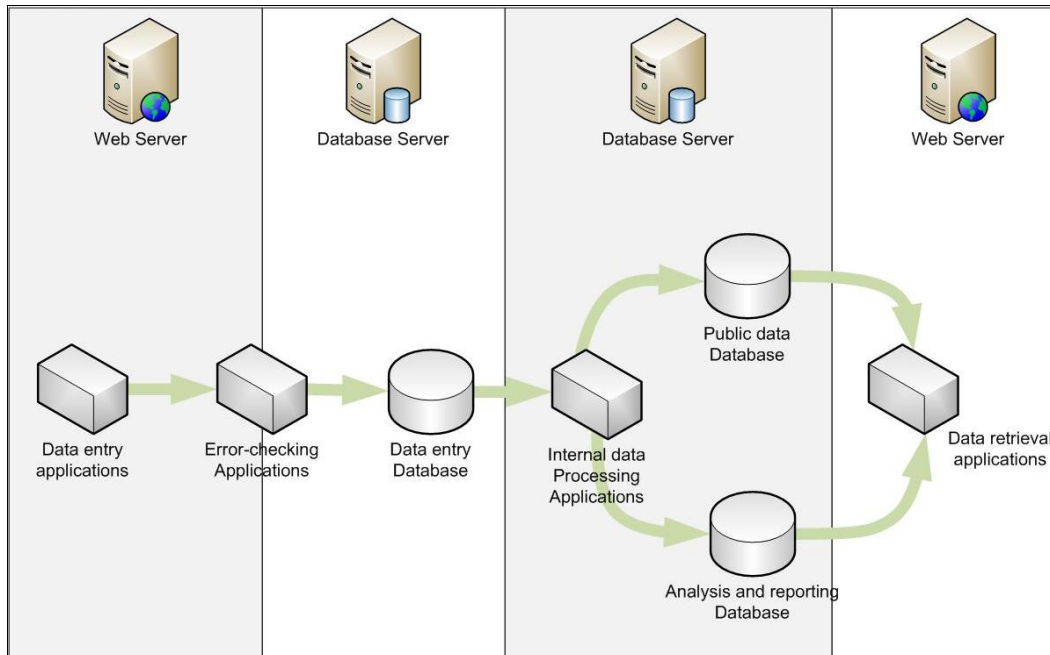
1.3. Reporting and information dissemination

The principal means of dissemination of information is the IATTC website (www.iattc.org). The information available includes descriptions of the Commission's structure and membership; Commission resolutions; the annual Fishery Status Report (FSR), Stock Assessment Reports (SARs), annual, quarterly, and special reports; reports of activity at the IATTC Achotines Laboratory; background and reports of the Agreement on the International Dolphin Conservation Program (AIDCP), for which the IATTC provides the secretariat; the Regional Vessel Register; and public data in various formats for download.

As noted above, the website will be redesigned with the objective of improving accessibility of information, and to make additional information and data available directly to interested parties.

2. FIRMS

The IATTC is making information on the status and trends of fisheries and resources available through its participation in the Fishery Resources Monitoring System (FIRMS). Partnership in FIRMS provides immediate access to the information technology tools and experience developed under FIRMS.

FIRMS, established in 2004, is a subsystem of FIGIS (Fisheries Global Information System), which was established under the FAO Code of Conduct for Responsible Fisheries in recognition of the need to provide the global community with well-documented and consistently-presented information on fisheries. FIRMS was developed by the regional fisheries management organizations (RFMOs) and international organizations to meet needs identified in the Code of Conduct. Its mission is to provide access to a wide range of high-quality information on the global monitoring and management of fisheries and marine resources. This mission is accomplished by defining standards for information and data on fisheries resources, as well as standards for reporting and consistent presentation to the global community. The partners in FIRMS (http://firms.fao.org/firms/partners/en) include the tuna RFMOs (CCSBT, IATTC, ICCAT, and IOTC) and FAO. It also serves as a model for national resource monitoring systems (NatFIRMS).

C. CAPACITY BUILDING

1. Tagging

Provided funds are available, a three-day training course on tagging methodology for large pelagics, with emphasis on tropical tunas, will be held at the Achotines Laboratory in 2011 for up to 10 participants from Latin American member countries. Participants will learn 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 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 CPCs in:

3.1. Sampling

a.   Develop 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.