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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

Species	Last assessed	2014	2015	2016
IATTC				
Yellowfin	2011 (full); 2013 (update)	Update	Full	Update
Skipjack	2004	Indicators	Indicators	Indicators
Bigeye	2010 (full); 2013 (update)	Update	Full	Update
Striped marlin	2010			Indicators
Swordfish	2011			Indicators
Sailfish	2013			Indicators
Black marlin[1]	Never			Indicators
Silky shark	Never	Indicators/Full	Indicators	Indicators
Dorado	Never	Indicators	Indicators	Indicators
Independent review / Fall workshop		CAPAM workshop (Growth)	CAPAM workshop	Indicators review
COLLABORATIONS				
Bluefin	2012	Update		
Albacore	2011	Full		

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

Blue marlin[1]	2001	Full	
Blue shark	2009	Full	
Swordfish (ISC)	2009		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 2014 with data up to and including 2013. These assessments will involve extensive sensitivity analysis to determine the most appropriate base case model and consider the input from the recent external reviews on the yellowfin and bigeye assessments. The results will be presented at the following SAC in 2015 and the base case model will be presented with all available updated data.
2. **CAPAM stock assessment methodology workshop series (2014)**. Conduct analyses and write working documents related to the workshop topic (growth).
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. The results will be used to structure the new yellowfin and bigeye assessments.
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**. 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.
8. **Pacific-wide bigeye tuna 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. **Longline CPUE and targeting.** IATTC staff will collaborate with NRIFSF staff to determine methods to identify targeting by longline fisheries from fishing records in order to improve standardized CPUE series from Japanese longline fisheries that are used for bigeye and billfish assessments.
11. **Reference Points.** Recommendations for reference points will be developed for blue, black, and striped marlin, sailfish, and swordfish.

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. A special issue of the journal *Fisheries Research* is nearing publication. The second workshop on "Growth in fishery stock assessment models: theory, estimation, and application" will be held in La Jolla, 3-7 November 2014.

2. TAGGING STUDIES

1. Analyses of conventional and archival tag data for bigeye tuna released in the equatorial central Pacific Ocean (ECPO) during 2008-2012, and preparation of a manuscript on movements, dispersion, and mixing of bigeye within the ECPO and between the ECPO and the equatorial eastern and western Pacific Ocean for publication in a peer-reviewed scientific journal.
2. Evaluate bigeye tuna tagging data from the Pacific, in collaboration with scientists from the Oceanic Fisheries Programme of the Secretariat of the Pacific Community, for describing plausible boundaries for putative stocks in the Pacific.
3. Analyses of archival tag data for bigeye released in the ECPO during 2008-2012, and preparation of a manuscript on vertical movements, behavior, and habitat utilization. This will include estimation of residence times and vulnerability of bigeye when associated with drifting fish-aggregating devices in the ECPO.
4. Archival tag data for yellowfin released at several locations throughout the EPO are continuing to be collected and analyzed, for describing the geographic variability in movements, behavior, and habitat utilization. Those results will eventually be incorporated into a manuscript and published in a peer-reviewed scientific journal.
5. Continue to explore potential 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. 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 2014, 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 early-juvenile yellowfin will be stocked in the cages 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, as well as rearing trials in both locations, are planned during 2014. Several joint publications of the study results are being developed.

3. Ocean acidification impacts on tropical tuna (2011-2014)

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. A joint manuscript (principal author, Donald Bromhead) describing the study results is "in press" in the journal Deep Sea Research Part II. A second manuscript describing histological analysis of the physiological effects of ocean acidification on the internal organs of yellowfin larvae was completed in draft form in March 2014 for submission to a peer-reviewed scientific journal.

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 14-26, 2014. This will be the 12th 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 observers aboard purse-seine vessels are continuing, and laboratory analyses of samples are scheduled to begin in 2014.

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 published in early 2014. Classification trees revealed that major changes in the prey communities that support tuna production had transpired during the decade.

A similar analysis of spatial and size covariates explaining predation patterns of 289 silky sharks sampled as bycatch in floating-object sets across the EPO was recently completed, and a manuscript is being prepared for publication in 2014. Classification trees identified a strong spatial shift in diet composition. Foraging patterns were different in the eastern and western regions of the EPO. FAD-related feeding was more common in the west than in the east, where a combination of FAD- and non-FAD-associated prey were consumed, suggesting that FADs may alter trophic interactions. No previous detailed studies of silky shark feeding habits exist for the entire EPO, and the results of this study will facilitate the improvement of ecosystem models for the EPO.

4.1.1. Stable isotopes in ecology

1. A collaborative three-year project, "CAMEO 2009: A novel tool for validating trophic position estimates in ecosystem-based fisheries models" was extended into 2014. 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 2014.
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 2014.

4.1.2. Diet studies

1. Analysis of diet data for skipjack, bigeye, and associated pelagic predators using classification tree models will continue.
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 2014.
3. Publication of a manuscript on the trophic ecology of mesopelagic myctophid fishes in the EPO is planned for 2014.
4. Continued collaboration with the international research program CLIOTOP. A special issue of the journal Deep Sea Research Part II: Topical Studies in Oceanography, entitled "The Role of Squids in Pelagic Ecosystems," co-edited by an IATTC scientist, was published in 2013. 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, which will continue during 2014, is being prepared for publication in 2014.

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 full PSA is nearly completed for the major species and stocks caught by the purse-seine fishery in the EPO, and a report will be prepared in 2014.

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. Activities proposed for an ISSF research cruise on a purse-seine vessel in the equatorial EPO in 2014

The IATTC staff, in collaboration with the ISSF, is proposing to undertake the following research activities aboard a purse-seine vessel in the equatorial EPO in 2014:

1) Evaluate the feasibility of the backdown maneuver as a method for the live release of non-tuna species following sets on FADs.
2) Deploy non-entangling FADs, with shallow appendages, to evaluate their performance, including species composition of associated catches.
3) Acoustic discrimination and validation of the species composition of tunas and other animals within aggregations associated with FADs, using echo-sounder buoys, a scientific echo-sounder, and ultrasonic telemetry.

B. DATA

1. Data collection and database program work plan

At the meeting of the Scientific Advisory Committee (SAC) in 2013, 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 first of the Visual Basic 6 (VB6) computer programs, the Logbook data entry program, has been ported to Visual Basic dot net. This program is based on a new simplified logbook data collection form, which will be implemented in the field after testing is complete. During development, a library of object oriented classes was established, many of which will be used in the other new computer programs. Additionally, a new logbook data editing procedure has been established which will optimize data flow and increase data editing efficiency through implementation of improved computer-driven data checks.

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. Development of the new IATTC website was delayed due to the need to direct limited staff resources to other projects. We are exploring the option to contract a website development specialist to aid staff in the initial setup of the new website. IATTC staff are currently developing an outline of the desired structure and features. Once it is developed, IATTC staff will add content present in the current website and receive training in site maintenance. The new website will give the IATTC a fresh image and improve access to information through ease of navigation.
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 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 outside organizations.
4. Documentation of 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 6 to the Microsoft dot net framework, 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 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 has been postponed pending staff realignment.
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. Length Frequency data management database and application will be modified to make it 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 the improvement of this estimation. This work will be initiated once conversion of VB6 programs to VB dot net 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 Commission 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 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.

2.2. 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.

2.3. 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.

2.4. 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).

2.5. 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.

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 which collects 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.