SCIENTIFIC COMMITTEE
SECOND REGULAR SESSION

7-18 August 2006
Manila, Philippines

DRAFT RESEARCH PLAN

WCPFC/SC2/2006/GN WP-4

Paper prepared by the Secretariat

Introduction

1. The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC) was established by the *Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (the Convention)*. The objective of the Convention is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean.

2. The Commission is tasked with developing and adopting specific measures to promote these objectives, as detailed in Articles 5 and 6 of the Convention. Fundamental duties of the Commission necessary to promote conservation, sustainability and optimal utilization that are supported by science-based information include:

- assessing the impact of fishing on marine resources and the WCPO ecosystem;
- protecting biodiversity and promoting ecosystem-based approaches to management;
- minimizing waste, pollution and impacts on both target and non-target or associated or dependent species (NTADs);
- preventing or eliminating over-fishing and excess fishing capacity;
- promoting the collection, compilation and dissemination of complete and accurate fisheries data and information from national and international research programmes.

To implement and enforce these goals, the Commission is required to utilize the best scientific evidence available. This evidence must be incorporated into a fishery management regime consistent with the principles of the precautionary approach and in consideration of target species, NTADs, environmental factors and habitats of special concern.

3. Article 11 of the Convention establishes a Scientific Committee, the functions of which are described in Article 12. They include reviewing the results of research, analysis and status

assessments of target stocks or NTADs in the Convention Area and to assist development and assess information resulting from a regional observer programme[1]. To support this the Convention requires that the Scientific Committee recommend a research plan to the Commission[2].

Research priorities and associated Research Plan

4. The draft Research Plan presented at **Appendix A** has been prepared for consideration and refinement, as appropriate, by the Scientific Committee. It is based on the following research priorities:

- collection and validation of data from the fishery;
- monitoring and assessment of stocks, and
- monitoring and assessment of the ecosystem.

5. These priorities flow directly from the Convention and the mandate of the Commission. They provide a fundamental basis [useful guide] for developing and updating research priorities. The specific research priorities presented in the Draft Research Plan are also general and follow from consideration of the primary factors that mediate demographic processes.

6. Producing robust, credible stock assessments at appropriate scales is a primary research objective of the Scientific Committee and is the activity around which most of the draft Science Plan is organized. When basin-scale assessments prove necessary, full cooperation at the international level and between regional fisheries management organisations (RFMOs) will be required. Tagging studies remain the best way to refine, test and validate stock assessment. Conventional tagging is the closest approximation to "fishery independent" data available to improve the assessment of highly migratory fish stocks and includes truly fishery independent data through the use of data archiving and transmitting technology. Data from previous tagging experiments in the Convention area have provided invaluable insights into the movement and mortality of tunas and are critical for developing current stock assessments. Therefore tagging should be accorded the same priority in support of HMS management as scientific surveys are accorded in support of demersal fishery management. In 1984, a distinguished international group of tuna scientists noted:[3]

> "The movements of tuna and their resulting distributions are two of the key biological problems in the management of tuna fisheries Changes in distribution and exchange rates of tuna among fishing areas affects not only availability to the tuna fisheries of the world, but also affects the fundamental assumptions underlying most of the fishery models used to manage these stocks. These problems are so large that resources of a single organization are insufficient to make rapid progress in solving them It is recommended that cooperating international programs be established to identify the causal mechanisms regulating the movement and distribution of tunas."

7. The Research Plan, once adopted by the Commission, is proposed to serve for an initial period of [5] years from 2007. As there will be an on-going need for adaptive research to support the Scientific Committee's objective of providing the best available scientific advice, the Plan will be periodically reviewed to ensure it remains responsive to the Commission's needs.

---

[1] Including work undertaken by scientific experts engaged by the Commission under Article 13, and for the observer programme, in conjunction with the Technical and Compliance Committee

[2] Article 12(2)(a)

[3] Joseph, J and A. Wild. 1984. "Considerations for tuna research to the year 2000."

8. The Scientific Committee is invited to:

- Consider the research priorities for the Scientific Committee;
- Review and refine, as appropriate, the draft Research Plan (Appendix A);
- Propose any additional work to complete the Research Plan for subsequent recommendation to the Commission; and
- Provide advice and recommendations in relation to the implementation of the Plan including funding support options.

Appendix A

WESTERN AND CENTRAL PACIFIC FISHERIES COMMISSION

DRAFT RESEARCH PLAN
2007-[2011]

INTRODUCTION

The Convention and the Commission

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (W
CPFC) was established by the *Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (the Convention)*. The objective of the Convention is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean.

The Commission is tasked with developing and adopting specific measures to promote these objectives, as detailed in Articles 5 and 6 of the Convention. Fundamental duties of the Commission necessary to promote conservation, sustainability and optimal utilization that are supported by science-based information include:

- assessing the impact of fishing on marine resources and the WCPO ecosystem;
- protecting biodiversity and promoting ecosystem-based approaches to management;
- minimizing waste, pollution and impacts on both target and non-target or associated or dependent species (NTADs);
- preventing or eliminating over-fishing and excess fishing capacity;
- promoting the collection, compilation and dissemination of complete and accurate fisheries data and information from national and international research programmes.

To implement and enforce these goals, the Commission is required to utilize the best scientific evidence available. This evidence must be incorporated into a fishery management regime consistent with the principles of the precautionary approach and in consideration of target species, NTADs, environmental factors and habitats of special concern.

The Scientific Committee

Article 11 of the Convention establishes a Scientific Committee, the functions of which are described in Article 12. They include reviewing the results of research, analysis and status assessments of target stocks or NTADs in the Convention Area and to assist development and assess information resulting from a regional observer programme[4].

[4] including work undertaken by scientific experts engaged by the Commission under Article 13, and for the observer programme, in conjunction with the Technical and Compliance Committee.

The Convention requires that the Scientific Committee recommend a research plan to the Commission[5]. The research priorities and Research Plan[6] described here has been prepared in response to this requirement.

This Research Plan is intended to serve an initial period of [5] years from 2007. As there will be an on-going need for an adaptive research plan to support the Scientific Committee's objective of providing the best available scientific advice, the Plan will be periodically reviewed to ensure it remains responsive to the Commission's needs.

RESEARCH PRIORITIES

The Commission has three overall research and data collection priorities:

- collection and validation of data from the fishery
- monitoring and assessment of stocks
- monitoring and assessment of the ecosystem

Collection, compilation and verification of data from the fishery

Data from the fishery are required to monitor catch and effort, and are an essential input to stock assessment. Increases in data quality and coverage will enable more accurate estimates of catches and are key to reducing uncertainty in stock assessments. Data are also required for tracking fleet dynamics and monitoring changes in the fisheries. A critical role of the Scientific Committee is to promote the collection and compilation of all necessary data and to assist in increasing data accuracy and coverage. Research activities include:

- monitoring the accuracy and coverage of operational-level catch and effort data, aggregated catch and effort data, and size composition data compiled by the Commission, and developing programmes to improve accuracy and coverage;
- developing programmes for the collection and compilation of related fisheries data, such as gear and vessel attributes, and other information, that can be used to standardise fishing effort and estimate fishing capacity and effective fishing effort;
- rescuing historical fisheries and related data;
- developing standards for the collection of operational catch and effort data, port sampling data, observer data and other types of data, as required, including minimum standards for data collection forms;
- developing sampling designs, including sampling protocols, for the collection of data through observer and port sampling programmes; and
- developing programmes to assist members and cooperating non-members in meeting data-related treaty obligations;

Monitoring and assessment of stocks

Stock assessment and modelling are the primary scientific tools used to estimate the condition of fish stocks and to evaluate the efficacy of conservation measures. Structural uncertainty in stock assessment derives, in part, from inaccurate or incomplete data from the fishery, mistaken assumptions about underlying biological processes, and lack of understanding of fishing vessels

[5] Article 12(2)(a)

[6] for the period 2006 to 2011

operations. Addressing uncertainties in stock assessment is a useful guide to assigning priorities to components of scientific the program.

Stock assessment and modelling

Research activities directly supporting stock assessments include:

- Routine application of existing methods
- Improvement of existing methods and development of new methods
- Refinement of biological reference points for use in stock status determination
- Use of simple simulation models to evaluate the sensitivity of stock assessment tools to violation of specific assumptions about biological processes, e. g. the dependency of natural mortality on age.
- Use of simulation models to project condition of stock under different fishery management regimes (management options evaluation)
- Development of quantitative socio-economic models for investigating impacts of management measures. Modelling should consider large scale (fleets) and small scale (agent-based) models to determine likely outcomes of regulatory and management measures.

Biological studies

Improved understanding of biological processes and the identification and definition of regional variability in these processes in an area as large the WCPO will reduce "structural" uncertainty in stock assessments. Required studies include:

- age and growth studies
- reproductive parameters and capacity
- length, weight and sex ratios in response to environmental and anthropomorphic factors
- trophic relationships (food webs, aggregation, maturity, spawning, ecological modelling, predator/prey relationships, etc.)

Tagging studies

Tagging is an important tool for biological and behavioural studies of fish and has special importance in the assessment highly migratory fish stocks (HMS). Stock assessments for other types of fish, e. g. small pelagic and demersal species, benefit greatly from "fishery independent" survey data. In many areas, periodic acoustic or scientific trawl surveys provide estimates of population size that are independent of data from the commercial fishery. Survey data provide independent estimates of biomass and reduce the uncertainties in the stock assessments. Unfortunately, the usual scientific survey methods are not applicable to HMS. Tagging studies on all scales are the closest approximation to fishery independent data currently available to support WCPFC management activities. Tagging studies provide information on rates and direction of movement, mortality, habitat utilization, aggregation and vulnerability, all of which are directly used in the stock assessments. Tagging activities include:

- mass tagging with conventional tags to determine large-scale population movement and mortality rates;
- specialized deployment of data storage tags, both conventional archival tags and pop-up satellite tags, to better define horizontal and vertical habitat preferences;
- deployment of other types of electronic tags to determines small-scale movements in relation to natural features and floating objects, such as fish aggregating devices;

Monitoring and assessment of the ecosystem

The ecosystem approach to fisheries is a place-based approach to management that requires managers to consider more than the impact of the fishery on single target stocks. Additional considerations include assessing the impact of environmental variability on target stocks and of the fishery on other species including prey, competitors and species caught in association with the target species (NTAD or non-target, associated and dependent species) and on habitat. Research activities include:

- collect data from the fishery on NTADs to permit catch estimation, risk assessment and stock assessment;
- identify key species that may indicate changes in trophic structure of the ecosystem;
- establish ecosystem indicators for monitoring natural variability and the effects of fishing;
- identify ecosystem constraints on population dynamics;
- identify habitats of special concern;
- identify maximum aggregate yield of all species that can be safely removed from the ecosystem without disrupting ecosystem structure and function;
- identify oceanographic features and processes that influence distribution and abundance of fish stocks and their vulnerability to fishing gear; and
- synthesis of data and ideas across disciplines into ecosystem-based models

CRITICAL ISSUES TO BE DECIDED BY THE SCIENTIFIC COMMITTEE

- ***Create transparent process for selecting candidate species for stock assessment and directed biological and behavioural research***

  The criteria by which species are selected for stock assessment are not clearly articulated. Currently, species which make the greatest economic contributions or which are close to MSY are those most frequently assessed. Other criteria, perhaps incorporating the ecosystem approach to fisheries and ecological risk assessment, could be envisaged.

- ***Geographic emphasis of field programs***

  The extreme size of the WCPFC Convention Area precludes synoptic fieldwork. Some means of selecting priority areas is required and may include:
  - Access to vessels and ports
  - Establish mechanisms for collaboration with scientists from other institutions to capitalize on expertise at minimal cost to the Commission, e.g. graduate students, post-doctoral students, professors on sabbatical leave, rotating assignments from members

- ***Clear identification of critical factors to over-exploitation of key species and communication of same to the Commission for management action***

- ***Clear identification of critical research necessary to provide the best (statistically sound) scientific information possible and communication of same to the Commission for funding consideration.***

RESEARCH PLANS

Immediate research tasks

- Improve data collection in the western region particularly Philippines, Indonesia and Vietnam.
- Design and implement a comprehensive 5-year tagging program in WCPO
- Begin planning of on-going basin-scale tagging program with cooperating RFMOs.
- Determine regional variability in size-at-age, size- and age-at-maturity and fecundity of bigeye tuna.
- Determine horizontal and vertical habitat utilization and role of aggregation by key species in relation to exploitation rates and gear configurations.
- Undertake research to develop better indices of abundance from both longline and purse seine catch and effort data

Medium term research plan

- NTAD data collection, catch estimation, risk assessment and stock assessment
- Apply alternative stock assessment models, e.g. SS-2
- Develop a framework for evaluating proposed fisheries management and conservation measures which includes simulation of multi-species population dynamics, the fisheries, data collection, stock assessment, management response and management implementation

On-going research needs

- Joint long-term basin-scale tagging program with cooperating RFMOs such as IATTC.
- NTAD biological research and data collection leading to stock assessment
- Continual refinement of stock assessment methodology to reflect international best practice, as appropriate for the stock assessment needs of the WCPFC.
- Ecosystem monitoring through the development and reporting of indicators
- Develop ecosystem models that incorporate available data; carry out empirical validation of their structural assumptions, parameter estimates and predictions.

IMPLEMENTATION AND REVIEW

[[Monitoring implementation of this Medium Term Research Plan will be the responsibility of the Chairman of the Scientific Committee in collaboration with the Executive Director.]]

Members of the Commission, including cooperating non-members, participating territories, observers, scientific experts and the secretariat will share responsibility for implementation of the Plan.

Opportunities to take responsibility for activities supporting implementation of components of the Plan will be considered at each meeting of the Scientific Committee.
At each regular session of the Scientific Committee each Specialist Working Group (Statistics, Fishing Technology, Methods, Biology, Stock Assessment and Ecosystems and By-catch) will review the elements of the Plan relevant to their respective Terms of Reference. Coordination of

the review will rest with the Chairman of the Scientific Committee in consultation with convenors of the SWGs, the manager of the science provider and the Executive Director.

A description obstacles to and progress in implantation of the research plan is in preparation. This report will be presented for consideration by the Scientific Committee for refinement and presentation to the Commission.

Full implantation of the Science Plan will probably be beyond the means of the Commission's core budget. Extra-budgetary funds from voluntary contributions of Members and other sources will be required. Nevertheless, adoption of the Science Plan by the Scientific Committee and subsequent strong support from the Commission is a prerequisite to securing the necessary extra-budgetary funds.

An independent external review of the Plan will take place every 5 years. The Scientific Committee will be responsible for preparing the Terms of Reference for the review. The Scientific Committee will present the report of the review to the next Regular Session of the Commission.

RELATIONS WITH OTHER ORGANISATIONS

Article 22 of the Convention provides that the Commission will consult, cooperate and collaborate with other relevant organizations, particularly those with related objectives and which can contribute to the attainment of the objective of the Convention. In relation to this Plan, relationships with the following institutions are of particularly significance.

Technical and Compliance Committee

The Executive Director, in consultation with the Chairman of the Scientific Committee, will ensure that the Technical and Compliance Committee is consulted on any element of the Plan directly relevant to the functions of the Technical and Compliance Committee.
The Executive Director will provide the Technical and Compliance Committee with copies of reports of the Scientific Committee relating to implementation and review of the Plan.

This commitment will be reflected in the Memorandum of Understanding developed between the Scientific Committee and the Technical and Compliance Committee.

International Committee for Scientific Research on Tuna and Tuna-like Species in the North Pacific

The Executive Director, in consultation with the Chairman of the Scientific Committee, will ensure that the International Committee for Scientific Research on Tuna and Tuna-like Species in the North Pacific (ISC) is informed of any element of the Plan directly relevant to the functions of the ISC.

This commitment, together with a commitment to collaboration, consultation and coordination, is reflected in the Memorandum of Understanding developed between the Commission and the ISC.

The ISC will be invited to participate in each regular session of the Scientific Committee.

Inter-American Tropical Tuna Commission

The Executive Director, in consultation with the Chairman of the Scientific Committee, will ensure that the Director of the Inter-American Tropical Tuna Commission (IATTC) is informed of any element of the Plan directly relevant to the functions of IATTC.

This commitment, together with a commitment to collaboration, consultation and coordination, is reflected in the Memorandum of Understanding between the Commission and the IATTC. The MoU provides for collaboration with respect to the collection and sharing of data and information, subject to data sharing protocols of each organisation, the development and implementation of joint research initiatives and the harmonisation of conservation and management measures.

The IATTC will be invited to participate in each regular session of the Scientific Committee.

Secretariat of the Pacific Community - Oceanic Fisheries Programme

As the provider of scientific services, provided for under Article 14 of the Convention, the Secretariat of the Pacific Community - Oceanic Fisheries Programme (SPC-OFP), will have a pivotal role in the Scientific Committee's monitoring, review and periodic refinement of the Plan. The SPC-OFP is a standing member of the Scientific Committee and, as scientific expert to the Commission has the capacity to report directly to the Commission n science matters.

The Executive Director, in consultation with the Chairman of the Scientific Committee, will ensure that the SPC-OFP is consulted a regular intervals between regular sessions of the Scientific Committee on progress with implementation of the Plan. A MoU between the Commission and the SPC-OFP reflects these arrangements.

Indian Ocean Tuna Commission

The IOTC Indian Ocean – Regional Tuna Tagging Project has initiated tag recovery mechanisms, with rewards, posters and primary contact personnel in Indonesia and in western and eastern Thailand. Both the IOTC and the developing WCPFC tagging projects expect significant tag recaptures from Indonesian and Thai canneries. In other words, tuna from both basins regularly mix at some of the 40+ canneries located in these countries. Fortunately, the personnel involved in both projects are in communication and full collaboration has developed. However, considering the transfer and movement of transhipped tuna between basins, some formal link and communication bridge between RFMOs and their research plans would be desirable.

Food and Agriculture Organisation

The Commission's Rules of Procedures provide for the participation of FAO in the meetings of the Commission and its subsidiary bodies. In relation to the Scientific Committee and this Research Plan potential areas for collaboration include the Coordinating Working Party on Fishery Statistics (CWP, www.cwpnet.org) and the Fishery Resources Monitoring System (FIRMS) which is part of the FAO Fisheries Global Information System (FIGIS, a network of integrated fisheries information). FIRMS draws together a unified partnership of international organizations, regional fishery bodies and, in the future, national scientific institutes, collaborating within formal agreement to report and share information on fisheries resources. For effective fisheries information management, FIRMS also participates in the development and promotion of agreed standards.