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Independent Review of the Commission's Transitional Science Structure and Function

WCPFC5-2008/11
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Report commissioned by the Secretariat

Introduction

1. The Inaugural Session of the Commission (WCPFC1) in December 2004 adopted the Final Report of Working Group II. Among other matters, the Report recommended:

- a provisional science structure for the Commission for a transitional period (expected to last some 3 to 5 years and representing the period between the Convention coming into force and a fully functioning Commission);
- that, during this period, the structure and functions of the science secretariat be flexible and adaptable; and
- an independent review of the transitional structure and function be carried out two years after entry into force of the Convention, or earlier if required, to determine the effectiveness of the science structure and to recommend changes as appropriate.

2. The First Regular Session of the Scientific Committee (SC1) at Noumea, New Caledonia, 8-19 August 2005 discussed procedural options for supporting the independent review, it's scope (with a focus on science data functions and science functions) and reporting options.

3. The SC1 advised the Second Regular Session of the Commission (WCPFC2) that the:

a) Scientific Committee recommends a new completion date for the review of June 2007;
b) Scientific Committee has forwarded a discussion paper to the Executive irector outlining elements for a draft TOR for the review;
c) Scientific Committee participants would provide advice to the Executive Director in writing by 1 April 2006 on the desirable skills and experience of those undertaking the Review;
d) reviewer(s) would need to attend the 2006 Scientific Committee meeting;
e) Scientific Committee, facilitated by the Secretariat, would finalize it's input to the TOR for the Independent Review inter-sessionally, based on input from the Secretariat and the contractor with a view to adopting the final TOR at next regular session of the Scientific Committee (SC2 in August 2006).

4. The Second Regular Session of the Commission, 12-16 December 2005 at Pohnpei, Federated States of Micronesia adopted the advice and recommendations of the Scientific Committee in respect of the proposed review.

5. The Secretariat, which received no advice from SC1 participants in relation to the desired skills and experience for the reviewer(s) as proposed at paragraph 3 (c) (above), drafted the provisional call for Expressions of Interest and draft Terms of Reference on the basis of the discussion paper referred to in paragraph 3(b) above.

6. The draft was considered at the Second Regular Session of the Scientific Committee (SC2), 7-18 August 2006 at Manila, Philippines. An informal small working group met in the margins of the Manila meeting to consider the possible process, terms of reference and schedule for the review.

7. The Plenary of SC2 subsequently formally considered the Terms of Reference, selection criteria and selection process for reviewers and possible schedule for the review. The recommendations to the Commission, adopted by SC2, were appended (as Attachment R) to the Summary Report of the Scientific Committee for forwarding to the Commission for consideration and endorsement.

8. At the Third Regular Session of the Commission (WCPFC3), 11-15 December 2006 Japan submitted a new proposal on the review process in relation to the composition of a steering committee, nomination of reviewers, costs, etc. In response, WCPFC3, noting the need for a review to be cost effective and independent, requested the SC to re-examine the terms of reference for the review of the Commission's science structure and function and to report on the results of the review to WCPFC4 in December 2007.

9. The Fourth Regular Session of the Scientific Committee (SC4) at Honolulu, USA, 13-24 August 2007 re-examined the work undertaken to that time in relation to the process and scope for the Review. SC4 recommended to WCPFC4 revised Terms of Reference, a process for the selection of reviewers and consultation process (Attachment P to the SC4 Summary Report). WCPFC4 at Guam USA, 3-7 December 2007, subsequently adopted the recommendation of the Scientific Committee.

10. In February 2008, the Secretariat advertised for Expressions of Interest (EoI) to undertake the Review as described in the ToR adopted at WCPFC4 (refer to Annex 1 to Attachment A). One response was received and a contract was subsequently negotiated with the Marine Resources Assessment Group (UK) for the assignment. The resulting report, at Attachment A, is the outcome of this work.

Recommendation

11. The Commission is invited to:

i. review the advice and recommendations contained in the Review report (Attachment A);
ii. consider appropriate responses to each recommendation presented in the Review report;
iii. consider a process for implementation of recommendations from the Review, refined as considered necessary, and adopted by the Commission; or
iv. consider alternative action.

Attachment A

WESTERN AND CENTRAL PACIFIC FISHERIES COMMISSION

Independent Review of the Commission's Transitional Science Structure and Functions

Final Draft for Consideration by the Commission

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Executive Summary

1. The basis for this Independent Review of the Commission's Transitional Science Structure and Functions is Articles 10 to 15 of the Convention covering: Functions of the Commission; Subsidiary bodies of the Commission; Functions of the Scientific Committee; Scientific Services; Functions of the Technical and Compliance Committee; and the Secretariat.

2. The review was conducted by a team of three persons from MRAG Ltd, principally through wide correspondence and interviews conducted during attendance at the 2008 meetings of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), the Scientific Committee (SC4) and the Northern Committee (NC4). The project team also collected information relating to other RFMOs and conducted independent analysis of all information collected in order to derive conclusions and recommendations for the post transitional period.

3. The project team took an inclusive approach to the review, meeting with and interviewing as many people as possible within the timeframe of the project. There was, however, no intention to use a questionnaire or structured sampling approach. The conclusions reached are those of the expert team, based on evidence collected and assessment of opinions and ideas expressed by respondents. Where the latter have been influential in reaching conclusions and recommendations, it is mentioned in the report. However, we have not made any specific attributions of these opinions and ideas to either individuals or delegations. This approach was used, and explained in advance to respondents, so as to encourage a review process that was as open and wide ranging as possible.

4. The institutional structure involved in the science an data functions of the WCPFC are complex; roles and responsibilities set out in the Convention and operating in practice were mapped out and used to inform subsequent analysis and recommendations.

5. In this Executive Summary we present the main recommendations arising from the review, using the same chapter structure as appears in the full report. Paragraphs are numbered for ease of reference.

Scientific data and information functions

Roles and Responsibilities

6. Data are central to the Commission's strategy to conserve and manage highly migratory fish stocks in the Convention Area and the Convention text places a number of obligations on the Commission itself with respect to data. Under Article 5, the Commission has the responsibility to collect and share, in a timely manner, complete and accurate data concerning fishing activities on, *inter alia*, vessel position, catch of target and non-target species and fishing effort, as well as information from national and international research programmes. In addition, under Article 6, the Commission is required to develop data collection and research programmes to assess the impact of fishing on non-target and associated or dependent species and their environment. One of the main functions of the Commission (Article 10) is to compile and disseminate accurate and complete statistical data to ensure that the best scientific information is available, while maintaining confidentiality, where appropriate.

7. The provision of accurate data to the Commission is a responsibility of CCMs, and this obligation is expressed in Article 23 of the Convention. Paragraph 2(a) states that CCMs shall provide annually to the Commission statistical, biological and other data and information in accordance with Annex I of the Agreement[7] and, in addition, such data and information as the Commission may require. To support CCMs in meeting this obligation, Annex III sets out terms and conditions for fishing that include recording and reporting of data (Article 5).

Data Submission

8. The Data Gaps Report[1] shows that the majority of the annual summary catch and effort data have been submitted, but most of the CCMs that collect operational level data have not reported them to the Commission. Australia, NZ, French Polynesia, New Caledonia and the US for the purse seine fleet have provided operational level data, although in most cases it is only since 2005 (i.e. not the historical data). 11 countries have submitted aggregate catch and effort data. Currently, no size and tagging data have been provided to the Commission.

9. Outreach activities coordinated by the Secretariat should be continued for CCMs experiencing difficulties with understanding and meeting their data reporting obligations. This is particularly important where both raised and unraised data are being reported. A set of practical guidelines should be developed.

10. The Commission should consider the development of targeted sanctions that would apply to CCMs that do not meet their data submission obligations. Examples are available in other RFMOs and regional organisations.

Data management and confidentiality.

11. In this section we discuss the performance of the Commission's data service provider (SPC). SPC has a dual role in terms of data custodianship; it both receives data from the CCMs under its service agreement with the Commission and receives data from the Members of SPC as their science provider[2]. This creates at least the perception of both a conflict of interest and risk with respect to data confidentiality. The issue of conflict of interest is taken up in a later section.

12. We conclude that the Commission's data service provider is providing high quality services and the Commission has benefitted from the considerable institutional knowledge and expertise existing within the organisation. SPC plays a significant and important role in assisting SPC members with their data submission obligations under the Convention.

13. SPC should review its available resources with respect to the expectation of increasing demands from WCPFC and its membership within its medium to long term planning process.

14. A data exchange agreement with SPC covering operational level data as well as aggregate data should be considered by the Commission.

Options for future data custodianship services

15. The Terms of Reference (Annex 1) set out a series of alterative options to be considered for the Commission's data services. The specific question from the Terms of Reference is as follows:

What would be the advantages and disadvantages of each of the following options for the provision of data custodianship services to the Commission?

(i) Provision from within the Secretariat;
(ii) Provision by a regional fisheries management organisation outside the Commission;
(iii) Provision by an agency within the Government of a member or participating territory;
(iv) Provision by a private agency.
(v) *Provision by SPC/OFP*

16. The significant balance of opinion, both from respondents, and the review team, is that the most viable option, from the perspective of effectiveness and efficiency, is for SPC to continue as the Commission's service provider for data custodianship services. The advantages gained by

[1] Final report on Causes of Data Gaps. Report to WCPFC. Prepared by FINNZ, October 2008.
[2] The OFP provides scientific services relating to oceanic (primarily tuna) fisheries management to its membership. These services include fishery monitoring and data management, ecosystem and biological research relevant to the fisheries, and stock assessment and evaluation of species- and ecosystem-based management options. These services are provided at both the national and regional levels.

utilising SPC's existing capacity significantly outweigh any disadvantages, although more needs to be done to engender confidence in data custodianship, such that barriers to data submission are removed.

17. The existing service provider arrangement should be formalised in a longer term service agreement (at least three years) that allows SPC to undertake longer term fiscal planning, thereby enabling more efficient allocation of resources. This agreement should include clear, enforceable requirements and responsibilities, such that there are no questions or uncertainties regarding the service to be provided, and the Commission's capability to monitor and ensure satisfactory performance.

18. At the same time, the Commission needs to take additional steps to improve the reporting of data in accordance with the existing rules and procedures, to support SPC in their efforts to compile the most comprehensive dataset possible to underpin stock assessments and other scientific analyses in support of decision making (see earlier recommendations).

19. The Commission derives significant benefits from having both its scientific data and science services handled by a single organisation with the requisite capacity to fulfil these requirements. If these services are to remain contracted out, a separation of the service provision would likely result in increased costs and a decrease in efficiency.

20. A central data facility for storage and handling of the data on which the ISC assessments (i.e. those required by WCPFC) are based should be developed. Options should be considered by the Commission and SC in conjunction with the ISC. Whichever solution is found, the database must be accessible to the WCPFC, and be made available to the Scientific Committee for the purposes of reviewing ISC stock assessments as needed.

Science functions

21. The report describes two main RFMO models for research, assessment and data analysis: the Working Group Structure and the Science Secretariat Structure. Articles 12 and 13 of the Convention enable the WCPFC to operate both of these models, thereby making most effective use of existing capacity in the region, while at the same time setting up the more traditional RFMO type structures of the Scientific Committee and its subsidiary groups.

Contracted Research

Contracting process

22. The Commission's main contractor for research is SPC-OFP. Several other contractors are also used. The Service Contract set up between SPC-OFP and WCPFC was transparent at the time of negotiation (2005). Its existence has been transparent since then, but it has not been let to tender because of the decision taken by the Commission that the most suitable organisation to undertake the work was SPC-OFP.

23. The other scientific research contracted out by the WCPFC would seem to be attracting interest from only a few capable institutions. Only one project (and only 2% of the total contracted out research budget) was let to a truly competitive tender. One project had to be advertised twice because there was no response to the first advert. Only one project received more than one expression of interest (it received 2).

24. The WCPFC should endorse the decision of SC4 (Report Attachment M) to formalize the method by which the work programme and budget of the Committee is agreed, including review of research proposals by a Research Sub-Committee (for example, Secretariat (coordinator), SWG Convenors, and Expert Advisors, as noted in Attachment M) or its equivalent made up of relevant SC officers. This should be augmented by formal feedback reporting to the Scientific Committee

25. To address the concern that very little interest has been generated by many of the EOIs, and much of the contract work has been taken by the WCPFC's institutional research organizations, wider advertisement of EOIs on the website (proposed by SC4) should be augmented by direct mailing to responsible officers in all CCMs, and elsewhere.

Science quality

26. The Commission should establish a programme of funded periodic external peer review of all contracted assessments; these should take place at suitable intervals, for instance once every 3 years. Expressions of interest should be sought from leading stock assessment scientists worldwide, and should include their participation in the stock assessment process as well as their review of the models and results. In order for such review to be undertaken within the current year of an assessment the actual assessment timetable for that year may need to be advanced by some months to allow the results to be available for discussion at the SC meeting

27. The Commission should consider widening participation at the stock assessment preparatory workshops (SAPWs) conducted by SPC-OFP (currently in February each year). This will require WCPFC to take ownership of the workshops and provide the funding required to run them. Further comments on this option are presented in later recommendations.

28. CCMs should be encouraged to request copies of software and data to undertake duplicate assessments. This activity should be undertaken in the context of generating better understanding of the assessments and testing their sensitivity to different model assumptions. The results of alternative model runs should inform the discussion and review of the assessments by the SC. This should not be allowed to confuse the existing process of generating science and management advice for the Commission. Should this activity result in the SC agreeing there is additional uncertainty in the assessment outputs, the advice from the SC should be more precautionary.

Conflicts of Interest

29. With such a small pool of contractors, many of whom are from Government departments, there is a potential for conflict of interest in two ways: (i) the national interest of contractors could act to bias the results of their work, and (ii) the recommendations and decisions of the Scientific Committee could be influenced by organisations seeking to obtain financial benefit from contracted work.

30. The main recommendation of relevance to conflicts of interest is to conduct periodic external peer review of the assessments conducted by the Commission's science provider (see above).

31. The Commission should also ensure that potential contractors are not part of the decision-making process of the SC. Although the Research Sub-Committee will need to call on the expertise of potential contractors in its deliberations, the Secretariat should continue to monitor potential "conflict of interest" issues and put in place processes to avoid them such as standard committee declarations of potential conflicts. Attachment M of the SC4 report may need to be reviewed and further refined, as needed, to ensure that the conflict of interest issue is adequately addressed.

Cost effectiveness

32. The total contracted research budget for WCPFC in 2008 was $650,000, $325,000 of which was the SPC-OFP Science Service agreement. $388,104 was contributed by SPC as a direct subsidy to the Science Service in 2008.

33. Overall, the Commission is getting good value for money. The science budget is currently rather low compared to the value of the fishery ($650,000 compared to some $4bn fishery value; less than 0.02%). Even accounting for the individual Member costs of scientific contribution to the ISC and SC, this appears to be a very small proportion of the fishery value. Additional funding (suggested following our concluding recommendations below) would be a responsible investment.

Non-contracted research

34. In addition to the work conducted under Commission contracts, non-contracted research that contributes to the Scientific Committee process is undertaken by CCMs and also by the ISC and its Members.

CCM research presented at the SC

35. There were about 50 working or information paper contributions to SC4 arising from non-contracted research, generated through a variety of mechanisms. Member authored papers comprised significant contributions from national research institutes in a number of CCMs, including Australia, Chinese Taipei, the EU, Japan, New Zealand, the People's Republic of China, the Republic of Korea and the United States. Additional contributions were made by NGOs (3 papers) and other organisations (ACAP, FFA, IATTC, 7 contributions).

36. Time is particularly short during the SC meeting, and one has to question the benefit derived from the time allocated to reviewing the papers presented to it through the BI-SWG and ME-SWG. A more appropriate time and place for these papers to be considered would be during the preparation for stock assessments.

37. If a decision is taken to formalise the Stock Assessment Preparatory Workshop (SAPW), the most appropriate place for papers on biology and methods to be considered is at that meeting. The hypotheses and data that they contribute can then be fully analysed and integrated into the stock assessment process. This would relieve pressure on the SC meeting, but could have the unintended consequence of making the PSAW meeting unwieldy and less effective. Therefore, while we recommend the BI-SWG and ME-SWG cease to convene routinely as part of the SC meeting, we suggest the following alternatives for such an approach which should be discussed by the SC (see also section on institutional analysis):
    (i) dissolve the BI-SWG and ME-SWG and encourage papers on biology and methods to be presented to the preparatory stock assessment workshop (SAPW), or other stock assessment workshops;
    (ii) as per (i), but have biology papers submitted to the SAPW and methods papers submitted to the SA-SWG; this would allow the SC to consider developments in stock assessment methods each year;
    (iii) agree on only biennial meetings of the BI-SWG and ME-SWG, these meetings taking place either adjacent to the SC or adjacent to the SAPW; require that the reports of these SWG meetings are forwarded to the stock assessment workshops rather than to the SC; and consider re-creating the SWGs as Ad-hoc Working Groups.

38. SPC should consider specific actions to train and mentor talented individuals from developing CCMs that would directly enhance their national participation in and contribution to the scientific process, including the preparation of scientific papers.

International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC)

39. As previously noted, the ISC works on a different model to the SC, in that all the assessments are conducted in international working groups by Members' scientists rather than through a contract with a single research organisation. Working groups are organised by species, maintain species-specific datasets and conduct direct assessments of these species. The data used to undertake assessments are not held by WCPFC or SPC-OFP.

40. The relationship between the WCPFC and the ISC is defined by the MOU. This allows for the provision advice to the NC, WCPFC and the SC based on the results of ISC assessments. However, only the NC can directly request information and advice from the ISC. We recommend that the MOU be updated to include an understanding that the SC can request the ISC to undertake additional work. This is discussed further in the section dealing with institutional issues

41. As with our enquiries regarding the SPC-OFP assessments, none of our interviews suggested that there were specific problems with the current ISC assessments in terms of science quality.

However, several (within both the NC and the SC) did emphasise that in order to be assured that the science was robust, additional review by the SC, external peer review, transparency and validation was required.

42. In accordance with Article 13 paragraph 4 of the Convention, the Commission should establish a programme of funded external peer review of all ISC assessments of relevance to the Commission's work. Peer reviews should take place at suitable intervals, for instance every 3 years. Expressions of interest to undertake the reviews should be sought from leading stock assessment scientists worldwide, and should include their participation in the data assimilation and stock assessment process as well as their review of the models and results. The Commission will have to make funding available for this purpose, and since these reviews will be in regard of northern stocks, then all costs might be defrayed by the NC members.

43. WCPFC should consider widening participation at the stock assessment workshops conducted by ISC through funded attendance of SPC-OFP scientists and independent SC representatives. Again this would be subject to the availability of relevant experts to attend and sufficient funding.

44. The SC and NC should request, or fund, validation work on ISC assessments, and request the ISC to test alternative hypotheses and model implementations of key ISC assessments.

45. In order for external validation to be possible, and to improve the understanding of ISC analyses, copies of the data sets used by the ISC should be systematically made available to the Commission, and preferably incorporated in the Commission's data holdings. Similar access to data and models should be provided for scientists wishing to undertake model validation work of ISC and SPC-OFP data.

Institutional analysis

Resourcing of the WCPFC Secretariat

46. The Secretariat needs to pro-actively support the new procedures developed under recommendations to improve data reporting and delivery of science to the SC and advice to the NC and Commission. While this has implications for staff activities, it is not anticipated that this will require additional human resources within the Secretariat at this time. Experience from other RFMOs, however, shows that the workload always increases over time as management procedures become more sophisticated and the demand for scientific advice increases commensurately. The situation should therefore be kept under close review by the Executive Director.

The Scientific Committee

Relationship between the SC and ISC

47. According to our interviews conducted during all three meetings, confidence in the assessments conducted by SPC-OFP and the ISC is impacted for the following reasons:
    - in the case of SPC-OFP assessments, confidence is undermined by a perception held by some delegates of conflicts of interest and the apparent closed nature of the analyses, with few scientists attending the SAPW or taking part in the assessments themselves;
    - in the case of ISC assessments confidence is undermined by the fact that most SC participants are not able to be present at ISC stock assessments, that working papers presented to the ISC WGs are not readily available[3] and the data used in assessments are not accessible for scientific review, and the lack of sufficient detail in reports and time to review the assessments at the SC meeting.

48. On the other hand there are features of both systems which are positive:

[3] To preserve intellectual property rights, the papers are not posted on ISC website but can be obtained through written request to the authors.

- there is considerable scientific and regional knowledge and expertise invested in both SPF-OFP and the ISC; it is logical for the Commission to use both of these existing institutional resources to obtain the best scientific evidence on which to base its management decisions;
- the working group structure of the ISC is open to participation by scientists from all eligible Members and the science benefits from the inclusion of Pacific-wide expertise (e.g. Mexico, IATTC[4]); and
- the efficient working structure of the SPC-OFP, which by limiting outside participation in assessments to individual specialists, allows a wide range of alternative hypotheses to be investigated.

49. The Commission needs to take action that reverses the apparent trend towards two completely separate, and non-cooperating streams of scientific advice. The SC should remain the primary source of scientific advice on all stocks, both for the Commission and the NC. The SC therefore needs the opportunity to effectively evaluate and validate the science arising from all sources, including SPC-OFP, ISC and others.

Organisation of the SC

Structural changes

50. The proposal to restructure the SC work plan to hold a SAPW each year, funded by WCPFC, hosted by SPC-OFP, at which all Members would be invited should create more time for discussion at the SC and also build confidence, transparency and openness within the stock assessment process. The first day or so of the workshop would be set aside for the consideration of papers presenting new information and methods that might be introduced into the assessments that will be conducted that year, which previously would have been presented to the BI-SWG and ME-SWG. We suggested previously that these two SWGs could cease to exist as separate entities. They could be retained to meet at the start of the SAPW, but in our view the former is the simplest and probably the most efficient option. The SAPW would agree data inputs and model runs to be undertaken by the SPC-OFP and an appropriate timetable for the work. The assessments themselves should still be conducted by SPC-OFP alone, with occasional expert assistance, as specifically required.

51. This recommendation carries a risk of creating a more unwieldy meeting of the SAPW, and will require more funding for meeting attendance by CCMs and preparation and management by the WCPFC Secretariat and SPC-OFP. Opening the meeting to wider attendance may also risk a tendency for political interference in setting the assessment agenda. We would strongly suggest that if this course is followed, the meeting remains a specialist stock assessment meeting and attendees be required to have scientific credentials concomitant with this objective. Wherever possible, the SAPW should be attended by the SC Chair and international peer reviewers, in years when a peer review is taking place.

52. A closer working relationship with IATTC and ISC should be developed. The two organisations should be routinely invited as observers to the SAPW, and specific ocean-wide stock assessment workshops should be organized between the SC, ISC and IATTC to study ocean-wide assessment issues. Where appropriate, approaches to the assessment of northern stocks should be included in the SAPW agenda.

53. WCPFC should consider providing assistance for external experts to attend its meetings, including those from other organizations and those undertaking auditing or peer review activities recommended in earlier sections.

54. Other workshops may be held on species not included in the main SPC-OFP work programme, soliciting their own input papers on biology and methods. If the Biology and Methods SWGs are retained, the logistics of the relationship between these groups and the other workshops would have to be explored further.

[4] IATTC has contributed to a number of the assessments done by the working groups of the ISC, such as those for northern bluefin tuna, northern albacore tuna, and some billfish assessments.

55. The SA-SWG should explicitly consider the report of the SAPW, the report of subsequent assessments performed by SPC-OFP, other assessments conducted independently by CCMs or other workshops, the assessments undertaken by ISC stock assessment working groups, their reports and that of the ISC, and provide advice to the SC on these assessments. The SA SWG will require significantly more time in its meeting to consider these issues in addition to the assessments provided by the SPC-OFP.

56. We propose the following restructuring of the SWGs:

57. Only the EB-SWG and the SA-SWG should meet regularly.

- The FT-SWG, ST-SWG and other *ad hoc* groups (such as the PTTP Steering Committee[5]) should meet only when they need to and for shorter periods of time than the SA- and EB-SWGs. Normally these groups should consider biennial meetings, but there will be times (such as when there are ongoing projects that need to be monitored, and at present for the ST-SWG as WCPFC data gaps are being analysed) that they need to meet annually. However, working groups that meet annually often have a tendency to continually justify their continuation on an annual basis, and the SC needs to be continually aware of this.

- The BI-SWG and ME-SWG should be either dissolved (with papers being considered either by the SAPW or the SA-SWG as appropriate) or retained as groups that meet occasionally as SWGs or *ad-hoc* Working Groups.

58. We also suggest that the SWGs are held in a less formal atmosphere than is currently the case (e.g. without national name plates). It is likely that this will only be possible if the attendance is significantly less than the SC plenary. Given the complex nature of the deliberations we recommend that CCMs send only those delegates with specialist scientific expertise, and those that are part of capacity building activities to this meeting. Any CCMs not sending delegates to the SWGs will retain the opportunity to contribute to the scientific debate through participation at the SC plenary meeting. This is similar to practice in other RFMOs and will help to reduce the overall time that many delegates need to spend at the SC.

59. Current levels of Secretariat support for the ISC, and the provision of a NC fund for ISC research on behalf of the NC, should be encouraged and improved.

Confidence-building

60. To assist with building confidence in the assessments presented to the SC, the recommendations in previous sections on exchanges between the SC, SPC-OFP and ISC and ISC WGs, should be implemented. Furthermore, the chairs or principal investigators of the ISC WGs should attend meetings of the SA SWG so as to fully explain in detail the data, models, parameter sets, results and assessment diagnostics for ISC assessments.

61. Implementation of this recommendation will depend largely on the availability of personnel and the willingness of their CCM to support the additional attendance and funding required.

62. The timetabling of intersessional work should be eased by providing a longer period between the meetings of the ISC and the SC (ideally 3-4 weeks), to allow for consolidation of the ISC report and preparation for the SC, particularly the SA-SWG, meeting.

63. The SC should consider the research requirements for all stocks under the purview of the Commission, developing its own Research Plan as at present and extending this to include explicit consideration of the workplan developed by the ISC and its working groups. This will promote the harmonization of the Commission's science provision, which will become increasingly important as requirements for the development of Ecosystem Based Management increase. However, it would be most beneficial if this harmonization was extended further through the MOU with ISC (see below).

[5] We note that funding commitments for activities such as the PTTP and the IPDCP may require an annual review mechanism, and it is logical for this to take place during the SC meeting.

Process

64. Where appropriate, the SC should explicitly endorse the assessments of the ISC, in the same way as it currently endorses the SPC-OFP advice. The SC needs to develop explicit advice to the Commission and the NC based on this advice. This can only be done if the SA-SWG and the SC have more time to understand and consider the ISC assessments and advice, and this in turn will require there to be more time between the meetings of the ISC and the SC.

65. The roles of the SC and the ISC in advising the NC need to be clarified. Our proposal is that the SC, as the statutory WCPFC body, should take the lead in endorsing the scientific work done by The Commission's science providers and SWGs, and providing advice to the NC and Commission, even if this advice is a simple endorsement of the advice of other bodies such as the ISC. In order for this to happen the SC chair should ideally attend the NC meetings and introduce the SC report, which should include statements of endorsement of the assessments and advice to the NC. However, to ensure a high level of technical explanation of the science, and to fulfil the mandate of the MOU, the ISC should also continue to attend the NC to present its report, although care will have to be taken that any points of contention between the ISC and the SC are discussed beforehand by the chairs of the SC and ISC, and reported to the NC in as clear and non-confrontational way as possible.

66. The MOU with the ISC should be amended to allow for ISC work to be requested by the SC as well as the NC. Should the SC not come to an agreement on stock assessment advice for northern stocks the NC could act on the advice of the ISC directly. However, this course of action should only be taken *in extremis* and with the overriding application of the precautionary approach. The ISC would of course also reserve the right to conduct its own business as it sees fit, including developing its own work programme. However, enabling the SC to request specific advice from the ISC would mean that the work programme of the ISC in respect of its work for the SC and NC became harmonized with the work programme of the SC itself.

67. SPC-OFP should be encouraged to continue its series of Tuna Stock Assessment Training Workshops, funded externally to the WCPFC, as a means of engaging PIC and Participating Territories including other developing States such as Philippines and Indonesia more fully in the assessment process. It is possible that once the training starts to deliver increased capacity, attendance at the SAPW will increase, and the need for the training workshops may be reduced to every two years rather than every year.

Workplan

68. Many of the changes suggested above will require considerable discussion prior to being endorsed by the Commission, the SC, the NC and the ISC. We propose a work plan to develop the proposals in detail which will allow their implementation in December 2009. We believe that early action to change the method of working of the SC and ISC as suggested in this review will be required to reverse the trend towards a two-track science system within the WCPFC.

69. We estimate the total additional annual cost of these recommendations to be approximately $100,000.

1. Introduction

1.1. Background to the Review[6]

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Convention) entered into force in June 2004 creating one of the first regional fisheries management organizations to be established since the 1995 adoption of the United Nations Fish Stocks Agreement (Agreement).

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 in accordance with the 1982 United Nations Convention on the Law of the Sea (UNCLOS) and the Agreement[7]. For this purpose, the Convention establishes a Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC). A small Commission Secretariat is based at Kolonia, Pohnpei State, Federated States of Micronesia.

The Convention applies to all species of highly migratory fish stocks (defined as all fish stocks of the species listed in Annex I of UNCLOS occurring in the Convention Area and such other species of fish as the Commission may determine) within the Convention Area, except sauries. Conservation and management measures under the Convention are to be applied throughout the range of the stocks, or to specific areas within the Convention Area, as determined by the Commission. The Commission currently has 25 Members and two Cooperating Non-Members. The three Pacific Overseas Territories of each of France and the US and Tokelau are Participating Territories within the Commission.

The Inaugural Session of the Commission in December 2004 adopted the Final Report of Working Group II, which was concerned with science structure and functions of the Commission. Among other matters, the Report recommended:

- a provisional science structure for the Commission for a transitional period (expected to last some 3 to 5 years and representing the period between the Convention coming into force and a fully functioning Commission);
- that, during this period, the structure and functions of the science secretariat be flexible and adaptable; and
- an independent review of the transitional structure and function be carried out two years after entry into force of the Convention, or earlier if required, to determine the effectiveness of the science structure and to recommend changes as appropriate.

In December 2007, the Commission endorsed a project to review the Commission's science structure and functions. This project was contracted out to MRAG Ltd, an independent consultancy based in the UK, and this report represents the output from that review. The terms of reference of the review are provided in Annex 1.

1.2. The Convention

The basis for the review is Articles 10 to 15 of the Convention. The content and purpose of these articles, of relevance to this review, are summarised in Table 1[8]. These Articles provide a basis for

[6] Additional background to the review is provided in paper WCPFC-SC3/GN WP-15, prepared by the Secretariat.

[7] The "Agreement" referred to here is the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. Annex I of the Agreement contains standard requirements for the collection and sharing of data. This document is available at http://daccessdds.un.org/doc/UNDOC/GEN/N95/274/67/PDF/N9527467.pdf?OpenElement.

[8] Note that this table is not intended to make any specific interpretation of these articles, nor modify their intended meaning in any way; the text in the summary column is intended for ease of reference only.

effective discharge of obligations contained in other parts of the Convention text. These include Article 5 that sets out the principles and measures for conservation and management, including the adoption of measures based on the best scientific evidence available, collection and sharing of data and protection of biodiversity; and Article 6 that covers *inter alia* the application of the precautionary approach, assessment of impacts on non-target and associated or dependent species, and the taking into account of uncertainties.

Table 1 Summary of the content and purpose of Articles 10 to 15 of the Convention of relevance to the current review

Article	Title	Summary (of relevance to this Review)
10	*Functions of the Commission*	• Determining total allowable catches and/or total levels of fishing effort within the Convention Area, and adoption of conservation and management measures to ensure the long term sustainability of highly migratory fish stocks (article 10(1)(a)); • Maintenance and/or restoration of stocks to above levels at which reproduction may be seriously threatened (Article 10(1) (c)); • Adopt standards for the collection, verification and timely exchange and reporting of data (Article 10(1) (d)); • Compile and disseminate accurate and complete statistical data to ensure that the best scientific information is available, while maintaining confidentiality, where appropriate (Article 10(1) (e)); • Obtain and evaluate scientific advice, review the status of stocks, promote the conduct of relevant scientific research and disseminate the results thereof; (Article 10(1) (f))
11	*Subsidiary bodies of the Commission*	• Establishes the Scientific Committee (SC) (Article 11(1)); • Establishes the principle of decisions by the SC being reached by consensus (Article 11(4); • The SC may consult other fisheries management, technical or scientific organizations with appropriate competence and may seek expert advice as required on an ad hoc basis (Article 11(5));
12	*Functions of the Scientific Committee*	• To provide the commission with the best scientific information available (Article 12(1)); • Recommend a research plan (Article 12(2)(a)); • Review assessments and other research prior to the consideration of recommendations by the Commission and provide information, comments and advice on those assessments, including conclusions on the status of target stocks and stocks of non-target, associated and dependent species (Articles 12(2)(b), (d) and (e)); • Encourage and promote cooperation in scientific research (Article 12(2)(c)); • Participation of representatives of the Oceanic Fisheries Programme of the Pacific Community and the Inter-American Tropical Tuna Commission, and other organizations and individuals with appropriate scientific expertise (Article 12(4)).
13	*Scientific Services*	• Establishes that the SC may engage the services of scientific experts to conduct assessments and scientific research and provide information and advice on the fishery resources covered by the Convention, in support of the work of the Commission (Article 13(1)); • To fulfil this function, the scientific experts may undertake the collection, compilation and dissemination of fisheries data according to agreed principles and procedures established by the Commission (Article 13(3)(a)); • The Commission may arrange for peer review of the work and output of the scientific experts (Article 13(4)); • The reports of the scientific experts are to be provided to the SC and the Commission(Article 13(5)).

Article	Title	Summary (of relevance to this Review)
14	*Functions of the Technical and Compliance Committee*	Establishes the functions of the Technical and Compliance Committee (TCC), including monitoring and review of compliance with conservation and management measures (Article 14(1)).
15	*The Secretariat*	Provides a mandate for the establishment of a Secretariat and specifies its structure functions, including (with particular relevance to this review): • that the Secretariat shall facilitate the compilation and dissemination of data necessary to accomplish the objective of this Convention (Article 15(4)(b)); and • (2) that the setting up and the functioning of the Secretariat shall, where appropriate, take into account the capacity of existing regional institutions to perform certain technical secretariat functions (Article 15(5)).

2. Technical Approach

The review was conducted principally through the following main activities:

- Attendance of the review team and meetings of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), the Scientific Committee and the Northern Committee during 2008 (see Table 2)
- Interviews and correspondence with individuals from CCMs and other interested parties (See Annex 2 for list of persons contacted)
- Collection of information relating to other RFMOs
- Independent analysis by the team of all information collected
- Preparation of the report, including conclusions and recommendations for the post transitional period

The project team took an inclusive approach to the review, meeting with and interviewing as many people as possible within the timeframe of the project. There was, however, no intention to use a questionnaire or structured sampling approach. The conclusions reached are those of the expert team, based on evidence collected and assessment of opinions and ideas expressed by respondents. Where the latter have been influential in reaching conclusions and recommendations, it is mentioned in the report. However, we have not made any specific attributions of these opinions and ideas to either individuals or delegations. This approach was used, and explained in advance to respondents, so as to encourage a review process that was as open and wide ranging as possible.

Table 2 Attendance of project team at relevant meetings during 2008

Task	**Timeframe**
Reviewer participates in ISC	20-24 July 2008
Reviewer participates in SC4	11-22 August 2008
Reviewer participates in NC4	9-11 September 2008
Reviewer participates in WCPFC5 for presentation of Draft Report	8-12 December 2008

3. Scientific data and information functions

In this section we discuss the extent to which the roles and responsibilities of the Commission's data submission and data management arrangements are defined and fulfilled effectively, both in the text of the Convention, and in practice. Specifically, we aim to identify any gaps, overlaps, or areas of ambiguity that exist. At the end of the section there is a discussion of a series of potential alternative options for the Commission's data service requirements. These options were specified in the Terms of Reference, and specifically discussed with respondents during the course of the review.

3.1. Roles and responsibilities set out in the Convention

Data are central to the Commission's strategy to conserve and manage highly migratory fish stocks in the Convention Area and the Convention text places a number of obligations on the Commission itself with respect to data. Under Article 5, the Commission has the responsibility to collect and share, in a timely manner, complete and accurate data concerning fishing activities on, *inter alia*, vessel position, catch of target and non-target species and fishing effort, as well as information from national and international research programmes. In addition, under Article 6, the Commission is required to develop data collection and research programmes to assess the impact of fishing on non-target and associated or dependent species and their environment. One of the main functions of the Commission (Article 10) is to compile and disseminate accurate and complete statistical data to ensure that the best scientific information is available, while maintaining confidentiality, where appropriate.

The provision of accurate data to the Commission is a responsibility of CCMs, and this obligation is expressed in Article 23 of the Convention. Paragraph 2(a) states that CCMs shall provide annually to the Commission statistical, biological and other data and information in accordance with Annex I of the Agreement[7] and, in addition, such data and information as the Commission may require. To support CCMs in meeting this obligation, Annex III sets out terms and conditions for fishing that include recording and reporting of data (Article 5).

A central function of the Scientific Committee is to identify data needs for research and coordinate activities to meet those needs. The activities referred to are both those of the CCMs themselves and, most importantly in the case of the WCPFC, those of the Commission's providers of scientific services. Article 13 sets out how the Commission, taking into account any recommendation of the Scientific Committee, may engage the services of scientific experts to provide information and advice on the fishery resources covered by the Convention and related matters. Included in the list of activities to be undertaken by scientific service providers are the collection, compilation and dissemination of fisheries data according to agreed principles and procedures established by the Commission, including procedures and policies relating to the confidentiality, disclosure and publication of data (Article 13, Paragraph 3(a)).

The Commission's Secretariat has an important role to play in facilitating the compilation and dissemination of data necessary to accomplish the objective of this Convention. Again, of particular relevance to the WCPFC, Paragraph 5 of Article 13 establishes that in order to minimize costs to the CCMs, the setting up and the functioning of the Secretariat shall, where appropriate, take into account the capacity of existing regional institutions to perform certain technical secretariat functions. In the current working model, this includes the receipt, recording, handling, analysis and dissemination of data, as carried out by the Commission's chief scientific services provider, the Oceanic Fisheries Programme of the Secretariat of the Pacific Community (see Section 4.2), and also the ISC.

While the Scientific Committee has a mandate to develop assessments and research on all stocks of relevance under the Convention and present the findings of that work to the Commission, in 2005, the Commission established the Northern Committee (WCPFC/Comm.2/12). In accordance with Article 11, paragraph 7, the purpose of the Northern Committee is to make recommendations on the implementation of such conservation and management measures as may be adopted by the Commission for the area north of the 20° parallel of north latitude and on the formulation of such measures in respect of stocks which occur mostly in this area.

The main roles and responsibilities with respect to data submission and management that currently operate in practice under the auspices of the Commission are illustrated in Figure 1. This diagram is intended to show the main linkages in terms of data capture, management and analysis leading to the delivery of management advice to the Commission. The main issues of note with respect to data capture, management and analysis described in the following sections; other aspects of this diagram, such as the provision of scientific advice and the related institutional structure are discussed in other sections of the report.

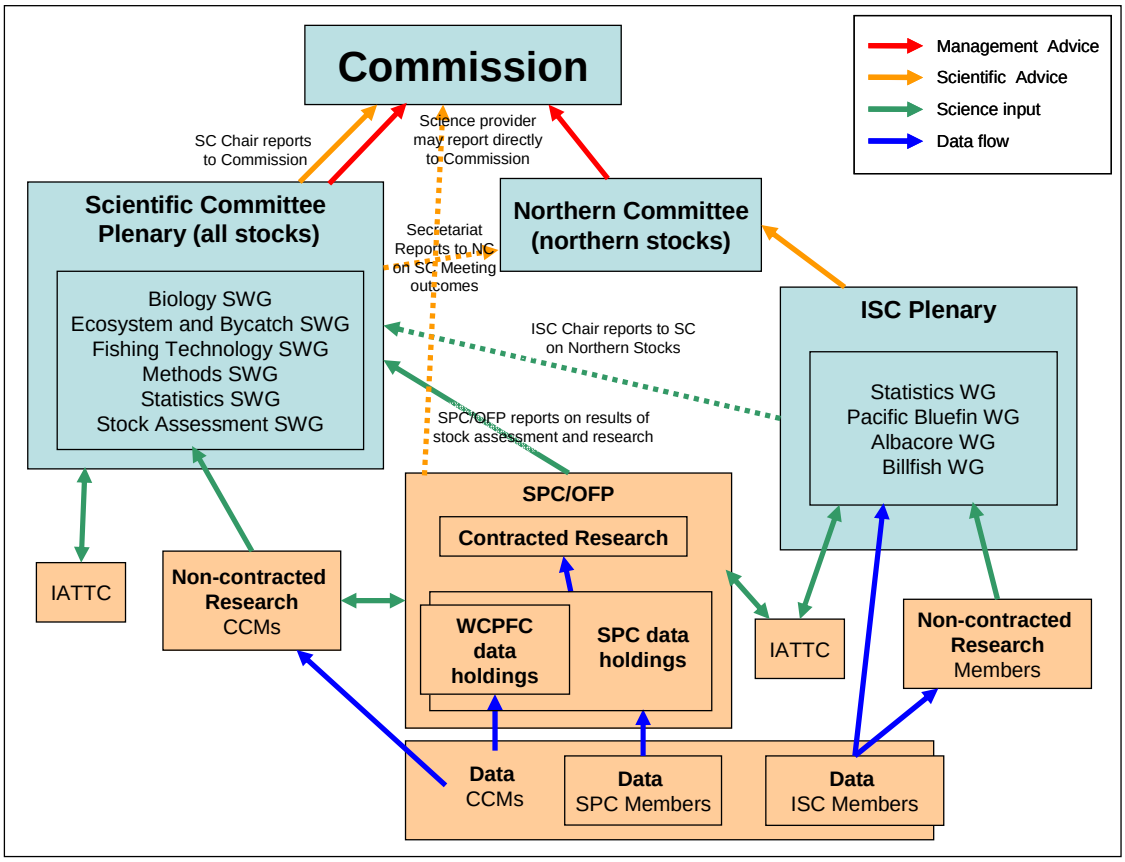

Figure 1 Illustration of current relationships in the provision and analysis of data, and the resultant delivery of scientific and management advice to the Commission. The dotted links between the ISC and the SC and between the SC and the NC are intended to be indicative of the relatively limited nature of the science input and scientific advice that is passing between these organisations. There is also a dotted link from the Science Provider (SPC-OFP) to the commission in accordance with Article 13 of the Convention. As is discussed later in this review, the SC has very little time allocated to the consideration of the assessments undertaken by the ISC and the transfer of scientific advice from the SC to the Northern Committee is served only by the attendance of the WCPFC Secretariat at the latter. There is also an option, not marked on the diagram, for the Chair of the ISC to report directly to the Commission (WCPFC-SC3/GN IP-2), however, to date this has not taken place. The double headed arrows between SPC/OFP and Non-contracted research, and between IATTC and various other bodies are intended to indicate collaborative research, or at least the sharing of views and ideas on stock assessments.

3.2. Data submission

In terms of data submission, the responsibility lies with the CCMs to submit the data that have been agreed by the Commission. The current requirements for data submission to the Commission are described in *Scientific Data to be Provided to the Commission,* adopted at the Fourth Regular Session of the Commission, Tumon, Guam, USA, 2-7 December 2007[9]. Those data are held by SPC, which is

[9] Available on the WCPFC web site: *Scientific Data to be Provided to the Commission (as revised by WCPFC4).pdf*

under contract to the Commission to provide data custodian services for all of the data required by the Commission[10].

When the Commission's data submission requirements were first established in 2005 (since revised in 2007), SPC was primed for a significant increase in the volume of data that they would be receiving, particularly with respect to fishing and fish stocks outside the area covered by their membership, but within the Area of the WCPFC. To date this has not happened, and significant data gaps still exist in the WCPFC data holdings, particularly with respect to the northern stocks and some essentially high seas fisheries.

A detailed audit of the data that have been submitted relative to these requirements and the gaps in data submission has recently been completed, including an analysis of the reasons why data have not been submitted and what can be done to improve the situation (referred to here as the Data Gaps Report)[11].

There are four main categories of data that should be submitted to the Commission:

- Annual Catch and effort data (total catch (1950 onwards) and number of vessels by gear type);
- Operational level Catch and Effort data (logsheet data with vessel identifiers e.g. individual sets by longliners and purse seiners, and individual days fished by pole-and-line vessels and trollers);
- Catch and Effort Data aggregated by time and area[12]; and
- Size Composition Data.

The Data Gaps Report shows that the majority of the annual summary catch and effort data have been submitted, but most of the CCMs that collect operational level data (26 out of 38[13]) have not reported them to the Commission. Australia, NZ, French Polynesia, New Caledonia and the US for the purse seine fleet have provided operational level data, although in most cases it is only since 2005 (i.e. not the historical data). 11 countries have submitted aggregate catch and effort data (Data Gaps Report). Currently, no size and tagging data have been provided to the Commission.

The Data Gaps Report provides information on the reasons given by the CCMs for not having submitted all of the data required. 4 respondents cited legal constraints (see footnote 12); 3 did not have the resource capacity to collate and provide the data; 3 did not understand how the data were meant to be submitted and 2 did not know the data were to be provided. In some cases (among the SPC membership), operational data have been submitted to SPC, but formal authority to release these data to the Commission has not been granted. Respondents interviewed during this study also indicated difficulty among some CCMs with respect to understanding what data should be submitted and to whom. In essence, the view was that while the data requirements are well defined, they are not necessarily well explained at a practical level.

This suggests that where there are impediments to data submission they arise essentially within the CCMs themselves. While there is uncertainty among some CCMs regarding roles and responsibilities for data submission, these should be relatively easily overcome through additional outreach from the Secretariat and capacity building initiatives, such as suggested in the Data Gaps Report, and possibly supported though the Special Requirements Fund and the Japan Special Fund. FFA Members have already reported during interviews for this study that the Commission data requirements and the

[10] Service provision to the WCPFC is governed by a general inter-organisational Memorandum of Understanding supported by annual service agreements identifying specific deliverables and deadlines.
[11] Final report on Causes of Data Gaps. Report to WCPFC. Prepared by FINNZ, October 2008.
[12] The requirement for aggregated data is a recognition that certain CCMs may be subject to domestic legal constraints, such that they may not be able to provide operational data to the Commission. Until such constraints are overcome, aggregated catch and effort data and size composition data, must be provided.
[13] The Data Gaps Report notes that the Commission has 24 members, one fishing entity and one regional economic integration organisation, plus 7 territories and 2 cooperating non-members. There are also 3 other states that have voluntarily submitted scientific data to the Commission. The Commission can therefore reasonably expect to receive data from up to 38 entities. The listing in Annex 2 varies somewhat from this assessment, but is taken from the Commission's web site, home page and the new statistics and data reconciliation section (under development).

interaction with SPC (e.g. though data workshops) has improved their national data collection, and this should continue in the future.

One area of ambiguity that was identified in the data gaps report and should be specifically addressed is the situation where operational data are not collected for 100% of fishing activity. In such cases, the Commission requires aggregate data to be provided, so that 100% of the catch is recorded. This implies the reporting of both the operational data that are available, plus aggregate data for the whole fleet. There are various items in the data provision requirements (e.g. raised and unraised data) with which some CCMs may need additional assistance.

With respect to following up on data gaps, this is the responsibility of the Secretariat[14], and issues of this type are normally handled through the TCC and also the SC (Statistics SWG), on the basis of data submission inventories prepared by SPC. SPC may also provide reminders to their membership on an *ad-hoc* basis, but this is not a central part of their role. Major recent developments in the filling of data gaps are listed in paragraph 249 of the SC4 report, but paragraph 250 notes that many gaps remain.

Discussion with various respondents during the course of this project has also indicated that some CCMs simply lack the political will to submit the data to the Commission. In some cases, this may be due to concerns over data confidentiality, however, there is no indication that these concerns are based on specific evidence of a breach of data security. Some respondents have suggested that sanctions should be imposed on CCMs who are delinquent in their data reporting obligations. This is clearly a complicated issue, particularly where these obligations are at odds with domestic legislation on data confidentiality. However, experience in other RFMOs suggest that incompatibilities in legal requirements are not insurmountable; it may take some time, but domestic legislation can normally be modified to enable countries to fulfil their international responsibilities. Hence the use of sanctions may have some useful application. The threat of sanctions for non-, or late submission of data is routinely used in other RFMOs. For example, in CCAMLR, when a vessel (or Contracting Party if the vessel is not authorised to report directly to the Secretariat) fails to submit a 5-day report for a period of one or two (depending on the fishery) subsequent 5-day periods, the fishery is automatically closed to that vessel, irrespective of any other domestic licensing arrangements that might be in place, and the Secretariat notifies all Contracting Parties to this effect.

SPC receives multiple submissions of data from coastal states in respect of licensed foreign fishing in EEZs and from flag states of those vessels. Flag states or entities are responsible for providing to the Commission scientific data covering vessels they have flagged, except where vessels operate under joint-venture or charter arrangements with another state, such that those vessels operate, for all intents and purposes, as local vessels of the other state. Scientific data compiled by coastal states should also be provided to the Commission. The data provided by coastal states in this case are operational level data, which have not yet been released to the Commission. The data provided by flag states are generally 5x5 or 1x1 degree-month aggregated data. One area where some confusion has occurred is where coastal states claim a charter arrangement and therefore provide the data, but the charter arrangement is not recognised by the flag state, which also provides the data, These instances of overlap have generally been reconciled through correspondence with the parties concerned.

The Data Gaps Report does not provide detail of data gaps at the level of (for example) species, gear and area. However, SPC publish a comprehensive annual audit of their data holdings in their Tuna Fishery Data catalogue[15]. This catalogue details data holdings in the categories listed above for the WCPFC, among others. For catch and effort data it lists the number of records by species, flag state, gear, data source (e.g. flag state or coastal state), level of spatial and temporal aggregation and units of catch and effort. In summary, this data audit shows that almost all of the operational level catch and effort data derive from coastal state data submissions and flag state submissions for distant water fishing are either in 1 degree squares (purse seine and trolling) or 5 degree squares (longline).

[14] There is a new facility on the Commission's web site (Data and Statistics), recently developed by the Secretariat, that enables CCMs to monitor the status of their data holdings with the Commission.
[15] At the time of writing, the most recent version available was that from September 2007.

SPC holds few of the data required to undertake independent assessments on the Northern Stocks that are under the purview of the ISC. These data are held and provided for analysis primarily by the flag states that send scientists to the ISC. The ISC has no central data repository for data used by the Working Groups in stock assessments[16], so the data are brought to the ISC Working Groups by the participating scientists each year. Access to these datasets for the purposes of independent scientific analyses, other than through the ISC, is therefore not a routine procedure.

CCMs also have a responsibility for the verification of data prior to submission. Under the agreement on *Scientific Data to be Provided to the Commission*, Catch reports should be verified with independent landings records, e.g. from the purchaser, catch position should be verified with VMS data and species composition should be verified with observer and/or port sampling.

With respect to dissemination of public domain data, SPC prepares the annual Western and Central Pacific Tuna Bulletin which is available to download from its web site. This is compiled from all the aggregated catch and effort data held at SPC and shows maps of all catches by gear for the WCPFC Convention Area. Separate sections on catch and effort by gear type and country are provided, showing total catch by major species (categories: albacore (for longline only), yellowfin, skipjack (for purse seine only), bigeye and other) and catch rates. The version prepared in July 2008 showed catches in the country sections up to the end of 2007. The summary maps were prepared for 2005 and 2006 (longline and pole and line) and 2006 and 2007 (purse seine).

SPC also publishes the Tuna Fishery Yearbook[17] on behalf of WCPFC, which is similar to the statistical bulletin prepared by ICCAT[18]. Both publications present annual catch estimates by year and flag from 1950 to the present. Since 2005, the ICCAT Statistical Bulletin has been published in a new format covering the whole time series of the nominal catch data available in the Secretariat database. This includes the complete data series for tuna and tuna-like species and for sharks, as well as other information (vessels and tagging data). The ICCAT bulletin therefore covers all species, whereas the WCPFC bulletin covers only the four target tunas and the four major billfish. The annual catch estimates currently available for non-target species in the WCPO are generally based on analyses of observer data and are currently too uncertain to be included in the WCPFC Yearbook

Recommendations on Data Submission

Outreach activities coordinated by the Secretariat should be continued for CCMs experiencing difficulties with understanding and meeting their data reporting obligations. This is particularly important where both raised and unraised data are being reported. A set of practical guidelines should be developed, if not already available.

The Commission should consider the development of targeted sanctions that would apply to CCMs that do not meet their data submission obligations. Examples are available in other RFMOs and regional organisations.

3.3. Data management and confidentiality

In this section we discuss the performance of the Commission's data service provider. SPC has a dual role in terms of data custodianship; it both receives data from the CCMs under its service agreement with the Commission and receives data from the Members of SPC as their science provider[19]. This creates at least the perception of both a conflict of interest and risk with respect to data confidentiality. The issue of conflict of interest is taken up in Section 4.2.3. While this is part of

[16] The ISC has proposed consolidation of data holdings at the Far Seas Fisheries Research Laboratory of the Japan Fisheries Agency, and sought a budget from Northern Committee members to fund this development.
[17] http://www.spc.int/oceanfish/docs/statistics/TYB.htm
[18] Downloadable from http://www.iccat.int/en/downloads.htm#stats
[19] The OFP provides scientific services relating to oceanic (primarily tuna) fisheries management to its membership. These services include fishery monitoring and data management, ecosystem and biological research relevant to the fisheries, and stock assessment and evaluation of species- and ecosystem-based management options. These services are provided at both the national and regional levels.

the section that deals with scientific research, we consider the issue with respect to data to be essentially the same, given that, if the conflict were to manifest itself (other than with respect to data confidentiality), it would be in terms of the research outputs. The confidentiality issue is discussed below.

With respect to the Commission's data, SPC is both granted access to the data and obliged to keep these confidential within the terms of the Commission's rules of data access[20]. In fact, SPC has access to the data potentially on two grounds. The first is as the Commission's service provider, both for data services and scientific research (paragraph 18 of the rules of access). In this role, SPC both receives data from CCMs and uses those data in scientific analyses and assessments to develop the reports required by the Scientific Committee. The second is as an RFMO. Paragraph 29 of the Commission's rules of data access states that if the Commission enters into agreements for the exchange of data with other RFMOs, such agreements must include requirements that the other RFMO provides equivalent data on a reciprocal basis and maintains the data provided to them in a manner consistent with the security standards established by the Commission. An agreement of this type is currently under development with IATTC[21]. SPC is also seeking a data exchange agreement with WCPFC, that would allow the OFP staff to use WCPFC data covered by the agreement for its scientific support to the FFA and to SPC members. The data that may be covered by such an agreement can potentially include operational level data, including catch and effort (including bycatch), observer, unloading, transhipment and port inspection data (Appendix 4 of the rules of access[20]). Paragraph 29 explicitly states that for the purposes of the rules and procedures, both SPC and ISC are to be treated as being equivalent to an RFMO. No agreements currently exist with respect to operational level data.

The Commission's rules of data access also set the level of data confidentiality. Different types of information are assigned a risk classification. For example, annual catch estimates are assigned the lowest risk classification and are regarded as public domain; operational level catch and effort data are assigned the highest risk level and are non-public domain. Access non-public domain data by CCMs and others is governed by the Commission's framework for access to non-public domain data. Under this framework, CCMs are required to make a written request to the Executive Director which is considered relative to the access rules. While SPC is authorised to access the Commission's data for the purposes of fulfilling its function as the Commission's science provider, it cannot legally allow any unauthorised access (e.g. by its members) to these data. To do so would be a serious breach of its terms of engagement. Equally, the data submitted to SPC by its members carry the same level of confidentiality. SPC can only disseminate these data if permission to do so is granted by the owners of the data. Some members, for example, have submitted operational level data to SPC, but have not granted permission for those data to be released to the Commission. However, SPC-OFP does use (but does not disseminate) these data for assessments and other work conducted for the WCPFC.

SPC has significant experience of handling fisheries data of a confidential nature. Given their similar characteristics and coverage, the fisheries data held by SPC are maintained in a central database, with data flags used to identify the access conditions for each data element. This effectively separates the data from different sources and while interviews with delegates at the Scientific Committee indicated that concerns about confidentiality clearly persist among several CCMs, there is no evidence that any breach has occurred in the past or is likely to occur in the future. SPC have in place both physical and electronic protection from unauthorised access. Certainly there is no reason to suspect that any kind of deliberate action might be taken by SPC staff in this regard. Several respondents commented specifically on the very high quality and hard work of the SPC-OFP staff working on the data service function.

The extent of the data held by SPC from different sources is variable, although they are generally all of relevance to the assessment of stocks under the purview of the Commission. The stock assessments undertaken by SPC use 3 basic types of data - catch & effort, size composition and tagging data. To undertake the assessments, SPC makes use of operational level catch and effort

[20] *Rules and Procedures for the Protection, Access to, and Dissemination of Data Compiled by the Commission*, As refined and adopted at the Fourth Regular Session of the Commission, Tumon, Guam, USA, 2-7 December 2007

[21] We note that there is already an agreement under which IATTC provides data to SPC, e.g. for the Pacific-wide assessment of bigeye.

data submitted to SPC through its Members[22]. These data are mainly collected under coastal state jurisdiction. SPC also has an extensive database of size data and sampling that have been provided through observer and research programmes in its members' EEZs. These data are used extensively by SPC to estimate purse seine catches by species, which is particularly critical for the assessment of bigeye tuna. Currently these data have not been provided directly to the Commission, but are available for its use. Observer data will be submitted directly to the Commission when the Regional Observer Programme is activated.

With respect to the resourcing of SPC to meet the Commission's service requirements, we received no indication of concerns during interviews that this was in any way inadequate. The data staff comprise six data entry technicians, two full time programmers a data manager and a fisheries statistician. This certainly seems to be an appropriate level of staffing. However, a comment was made by several individuals interviewed during the SC, who were on delegations of CCMs that are also members of SPC, that since the start of the arrangement between the Commission and SPC, the latter has had less time to respond to requests from its membership. In this regard it is important to note both that the Commission is placing increasing demands on SPC and is unlikely that this will decrease in the future, and that a significant part of the increased workload with respect to data services involves SPC in assisting SPC members meet their WCPFC obligations. This dual functioning at SPC will therefore likely require increased resources going forward.

Conclusions and Recommendations regarding data management and confidentiality

The Commission's data service provider, SPC, is providing high quality services and the Commission has benefitted from the considerable institutional knowledge and expertise existing within the organisation. SPC plays a significant and important role in assisting SPC members with their data submission obligations under the Convention.

SPC should review its available resources with respect to the expectation of increasing demands from WCPFC and its membership within its medium to long term planning process.

Data exchange agreements covering operational level data as well as aggregate data should be considered by the Commission.

3.4. Options for future provision of data custodianship services to the Commission

The Terms of Reference (Annex 1) set out a series of alterative options to be considered for the Commission's data services. The specific question from the Terms of Reference is as follows:

What would be the advantages and disadvantages of each of the following options for the provision of data custodianship services to the Commission?

- *(vi) Provision from within the Secretariat;*
- *(vii) Provision by a regional fisheries management organisation outside the Commission;*
- *(viii) Provision by an agency within the Government of a member or participating territory;*
- *(ix) Provision by a private agency.*
- (x) *Provision by SPC/OFP*

To answer this question, we have relied both on responses received during our consultations at the meetings of the ISC, the Scientific Committee and the Northern Committee and our team experience and consideration based on evidence received during the review and knowledge of the procedures of other RFMOs

[22] SPC has not yet been advised that such submissions can be released to the Commission, with the exception of data from US purse seine vessels, and data since 2005 from Australia, NZ, New Caledonia and French Polynesia.

According to most respondents, the only potentially viable options in the list were (i), (iii) and (v). Below we first discuss briefly why options (ii) and (iv) were not considered to be viable, and then discuss the remaining options in more detail.

With respect to option (ii), this would involve replacing the existing arrangement with SPC with an arrangement with another regional organisation. While there are RFMOs, such as IATTC, that have both the staff and capacity to undertake the task, many respondents did not think option (ii) was worth pursuing. It bears similarities to the current arrangement, in that the service could be provided by an existing third party organisation, potentially in the region, with significant experience of handling tuna fisheries data. However, given that, compared to SPC, there is far less overlap in membership between WCPFC and any other RFMO (including IATTC), from a political and logistical perspective this option was considered to be less desirable than the existing arrangement.

Option (iv) was simply not regarded as viable. We did not undertake a detailed investigation, however, the number of private organisations with the necessary capacity, expertise and experience to undertake the task that is currently performed by SPC is considered to be very small. In addition, given the economies of scale at SPC, this option was expected to be significantly more expensive for the Commission than the existing arrangement. There is also no reason to expect that such a change would address any of the concerns relating to the existing arrangement. Experience in other sectors, for example, shows that private data contractors do not have a particularly good record of maintaining data confidentiality.

Option (i); provision of data services from within the Secretariat, has been seen as a desirable long term goal for the WCPFC since the PrepCon meetings. Discussion of independent studies undertaken during the PrepCon process foresaw this as a primary function of the Secretariat. Many respondents expressed a preference for this approach, while at the same time recognising the pragmatism of the interim arrangement with SPC. It would certainly bring WCPFC into line with the other RFMOs around the world, all of which (depending on the definition of an RFMO) manage their own data requirements (the extent to which they also undertake the science function varies significantly more).

The Secretariat already has some internal data handling capacity through the development of the vessel register. However, many respondents recognised that there would need to be a significant increase in the Secretariat staff and IT infrastructure to enable it to take on the task of the Commission's data service, and that this would represent a significant short-term capital outlay. In this respect, a number of respondents noted the difficulty of recruiting experienced staff to take up technical positions at the Secretariat. This could pose a serious impediment to establishing the necessary in-house capacity to take over the data services task.

Several respondents noted that the volume of data now held on tuna fisheries in the WCPO would represent a significant challenge to developing a data hub in the Secretariat, and questioned the wisdom, and indeed the necessity, for moving the hub away from SPC (option v), particularly given that SPC itself has many of the characteristics of an RFMO with a membership that significantly overlaps with that of the WCPFC. In addition, given its international status, SPC has some immunity (as do other RFMOs) from organisations (national or otherwise) probing for data, e.g. under the legal terms of freedom of information. Provision of data services by a national agency (option iii), or by a private contractor (option iv) might not benefit from such protection.

Many respondents noted the advantage that WCPFC has already derived from engaging with SPC for data services. The amount of data already now available for undertaking assessments is significantly in advance of where it would be if the Commission was starting afresh, and the amount of data available for assessments is also much greater still than it would be if SPC were not able to contribute additional data resources (i.e. data outside of the WCPFC data holdings) for the analysis. There is also significant advantage in a single entity being available to provide both data and science services (and capable of doing so). SPC data services are able to respond rapidly to complex data queries from the scientists given that SPC scientists are able to work closely together with the SPC data managers.

With respect to option (iii), some respondents noted that this is a potential solution for the data services requirement of the ISC (see footnote 16). Currently the ISC has no central data facility that

contains the detailed data used in stock assessments. Data for stock assessments are brought to the ISC working groups each year by national scientists. This has an important impact in that it makes the analyses very difficult, if not impossible, to reproduce outside of the ISC working group meetings. Peer review and verification of results, for example by the WCPFC Scientific Committee is therefore not possible (see Section 4.3.2 for more discussion of the ISC). A central data facility for storage and handling of the data on which the ISC assessments (i.e. those required by the WCPFC) are based is therefore needed. Some respondents preferred the idea of an amalgamation of these data with those for the other stocks (i.e. those not assessed by the ISC) in the existing SPC database, and in our view this would be the most elegant and efficient solution. In this way the same data standards and formats can be applied to all of the data; this is particularly useful when running similar modelling procedures for different stocks. However, if this option is not acceptable, then any arrangement that allows the development of a robust fisheries database that endures from one year to the next would be preferable to the current situation. To the extent possible, this should use the same data formats and standards as those applied for the remainder of the WCPFC data. Whichever solution is found, the database must be accessible to the WCPFC, and be made available to the Scientific Committee for the purposes of reviewing ISC stock assessments as needed.

Conclusions and Recommendations on options for future data custodianship services

The significant balance of opinion, both from respondents, and the review team, is that the most viable option, from the perspective of effectiveness and efficiency, is for SPC to continue as the Commission's service provider for data custodianship services. The advantages gained by utilising SPC's existing capacity significantly outweigh any disadvantages, although more needs to be done to engender confidence in data custodianship, such that barriers to data submission are removed.

The existing service provider arrangement should be formalised in a longer term service agreement (at least three years) that allows SPC to undertake longer term fiscal planning, thereby enabling more efficient allocation of resources. This agreement should include clear, enforceable requirements and responsibilities, such that there are no questions or uncertainties regarding the service to be provided, and the Commission's capability to monitor and ensure satisfactory performance.

At the same time, the Commission needs to take additional steps to improve the reporting of data in accordance with the existing rules and procedures, to support SPC in their efforts to compile the most comprehensive dataset possible to underpin stock assessments and other scientific analyses in support of decision making (see earlier recommendations).

The Commission derives significant benefits from having both its scientific data and science services handled by a single organisation with the requisite capacity to fulfil these requirements. If these services are to remain contracted out, a separation of the service provision would likely result in increased costs and a decrease in efficiency.

A central data facility for storage and handling of the data on which the ISC assessments are based should be developed. Options should be considered by the Commission and SC in conjunction with the ISC.

4. Science functions

4.1. RFMO models for research, assessment and data analysis

There are two broad approaches taken by RFMOs to meet the science needs of the management process. The first, described as the "Working Group Model" involves national scientists on Members' delegations undertaking most of the research, assessment and data analysis both prior to and during a technical meeting held under the auspices of the RFMO. In the second, described as the "Science Secretariat Model", most, if not all, of the analytical work is undertaken by scientists employed within the RFMO's Secretariat. These models will be described in more detail below, along with examples drawn from both tuna and non-tuna RFMOs around the world. As we will see, due to the particular circumstances in the Western and Central Pacific, WCPFC currently falls somewhere between these basic models, which has both advantages and disadvantages for the organisation.

4.1.1. The Working Group Structure

In its earliest incarnation, the working group structure consisted of national scientists making their own assessments, possibly using their own data and presenting the results to scientific sessions of the RFMO (some form of Scientific Committee established under the terms of the RFMO's enacting Convention). This was the approach used, for example, by ICCAT, IOTC and CCSBT in the early years of their existence. As the science demands of management increased along with expansion of fisheries, growth in databases, and greater sophistication of assessment models, the RFMOs established subsidiary bodies of the Scientific Committee, usually called "working groups" or "working parties", at which scientists would both present their and work collaboratively on the assessments. This lead to a higher degree of cooperation on the science, and an opportunity to discuss new approaches. These working groups may be more or less specialised depending on the demands of the management process, and groups may come and go depending on the particular requirements at the time. Tuna RFMOs tend to have a large number of groups to deal with specific species, groups of species, or specific scientific topics. For example, ICCAT currently has four panels:

- Panel 1: Tropical tunas (yellowfin, bigeye and skipjack)
- Panel 2 : Northern temperate tunas (albacore and Atlantic bluefin)
- Panel 3 : Southern temperate tunas (albacore and southern bluefin)
- Panel 4: Other species (swordfish, billfishes, small tunas)

Plus a Permanent Working Group for the Improvement of ICCAT Statistics and Conservation Measures.

IOTC has a series of Working Parties (WPs) as follows:

- Working Party on Tropical Tunas
- Working Party on Billfish
- Working Party on Neritic Tunas
- Working Party on Temperate Tunas
- Working Party on Tagging
- Working Party on Methods
- Working Party on Ecosystems and Bycatch (previously the Working Party on Bycatch)
- Working Party on Tagging Data Analysis

IOTC also has a sub-committee of the Scientific Committee that focuses on data collection and statistics (formerly a Working Party).

The Terms of reference of these IOTC WPs are as follows:

- Review new information on the biology and stock structure of the relevant species, their fisheries and environmental data.
- Coordinate and promote collaborative research on the species and their fisheries.

- Develop and identify agreed models and procedures for the assessment of stock status of each species.
- Conduct stock assessments for each of each species or stock.
- Provide technical advice on management options, the implications of management measures and other issues.
- Identify research priorities, and specify data and information requirements that are necessary for the Working Party to meet its responsibilities.

The duration of the meetings of the WPs depends on the amount of work they have to do. By far the longest at IOTC is the Working Party on Tropical Tunas which met for 9 days in October 2008. Other WPs meet for less time (ranging from 1 to 4 days). The important feature, however, is that a significant amount of analytical work is undertaken at the meetings themselves, with scientists from different Members' delegations working together to reach agreed scientific outcomes. This is also the approach used by CCAMLR, which has a single working group dealing with all fish stocks (Working Group on Fish Stock Assessment) that meets for 12 days annually, plus a Working Group on Statistics, Assessments and Modelling that meets for a further 5 days. All of these working groups report directly to the Scientific Committee, which debates the outcomes and prepares management advice for the Commission.

An important element of the Working Group Structure is that assessments are undertaken using a common data pool compiled from official submissions made by Members of the organisation and held centrally in an organised database, for example, within the Secretariat of the Commission. This contributes to an essential feature of the assessments, which is that they must be reproducible (see Section 4.2.2.3). The implication of this requirement is that the assessments and the data on which they are based are sufficiently transparent, structured and robust to enable scientists other than those primarily involved in the assessment to re-produce essentially the same results. When this is not possible, for whatever reason, be it unavailability of the data, or the use of too many ad-hoc adjustments, it can lead to concerns over transparency and ultimately call into question the validity of the results, even when in fact there is no real problem. The results and documentation of what lead to them should also be kept in such a way that subsequent meetings can go back to what was done before and see clearly what was done and why.

When implemented effectively, the Working Group Structure provides an opportunity for scientists from Member States to (*inter alia*):

- reach agreement on the analytical model(s) to be used in assessments;
- critically review the data base (particularly on total catch, sample size being used and size data substitutions etc.);
- review and agree on input parameters such as growth, natural mortality, reproductive parameters etc.;
- select abundance index series that should be tested;
- agree on "base case" scenarios by selecting various parameters and scenarios; and
- decide what type of the sensitivity runs should be made.

It should lead to a process that is transparent and open, and hence less prone to criticism by those outside the meeting. Providing sufficient resources are allocated (particularly in terms of time), a working group environment helps the participants to reach agreement on the results and management recommendations, because everyone can participate the assessments. In essence, the RFMO benefits from the input of a large number of experts in a short period of time; the cost of which is spread across those countries that fund their scientists to participate.

However, there are some clear disadvantages that may be more or less significant in different situations. For example, the process can get bogged down in detail, and/or disagreements about data, such that agreement cannot be reached and the Scientific Committee is left with no clear advice on which to base its recommendations to the Commission. CCSBT has suffered from this problem in the recent past due to disagreements over catch and effort data, which are fundamental to its assessment process. A solution adopted in this case was to establish an independent Advisory Panel to provide external input to the stock assessment and scientific processes, and also to appoint

independent chairpersons for the Stock Assessment Group (CCSBT's working group) and the Scientific Committee.

The terms of reference of the Advisory Panel are to:

- participate in all meetings of the SAG, SC and other scientific meetings as requested by the Commission;
- help to consolidate parties' views to facilitate consensus; and
- incorporate their views in SAG/SC reports and provide to SC and CCSBT in the form of a report of their own views on stock assessment and other matters.

Another potential weakness in the Working Group Structure is that it relies significantly on the capabilities of the scientists that are able, by virtue of their respective countries, to participate. This may be as much an issue of time availability as of scientific background. It also tends to marginalise those countries that do not have sufficient scientific capacity and/or funds available to effectively contribute to the meetings. This can put those countries at a disadvantage in terms of their participation in the science and management debate, and can also impact the decision-making process if those countries are unwilling, or unable to agree to management measures when they are unclear about the scientific rationale for specific proposals.

Even with the extended length of some of the meetings mentioned above, time is still short for the assessment work to be completed, particularly as methods have become more sophisticated and databases and the number of fisheries, including by-catch issues, needing to be assessed have grown. Modern computing and modelling software packages have mitigated this problem to an extent, but it has become increasingly important for significant amounts of preparatory work to be undertaken in the intersessional period, particularly in the period leading up to the meetings when newly acquired data from the most recent fishing periods need to be checked and prepared for analysis. This has led some RFMOs that adhere primarily to the Working Group Structure to increase their in-house (i.e. secretariat) capacity to undertake not only data compilation tasks, but also preliminary data analysis and sensitivity testing, both of which can be significantly time consuming. Examples of RFMOs that have been increasing their in-house capacity in this way in recent years include CCAMLR and ICCAT. In some cases, the Working Group Structure is therefore developing in the direction of the Science Secretariat Structure, that is described in the following section.

4.1.2. The Science Secretariat Structure

The opposite end of the spectrum is the Science Secretariat Structure. The archetype of an RFMO that uses this structure is IATTC. When first established in 1950, IATTC comprised just two members: Costa Rica and the USA. Setting up a fully equipped science Secretariat was therefore an appropriate way of having the necessary science undertaken to support joint management decisions. Under the terms of the IATTC Convention, The Commission designates a Director of Investigations who is responsible to the Commission for the scientific programme, including the preparation of budgets the commissioning of research, co-operation with other organizations and the drafting of administrative, scientific and other reports for the Commission. Out of this grew the IATTC Secretariat at La Jolla, California that now boasts a Director, 30 scientific, policy and technical staff, including an Assistant Director and two Chief Scientists, 10 additional staff (technical support and administration), 2 visiting scientists and 19 additional staff spread across 7 field offices. The membership of IATTC has also grown to include 16 countries.

The work of the IATTC Secretariat is split into two main programmes as follows:

The principal responsibilities of the Tuna-Billfish Program are:

1. to study the biology of the tunas and related species of the eastern Pacific Ocean with a view to determining the effects that fishing and natural factors have on their abundance;
2. to recommend appropriate conservation measures so that the stocks of fish can be maintained at levels which afford maximum sustainable catches;
3. to collect information on compliance with Commission resolutions.

The principal responsibilities of the Tuna-Dolphin Program are:

1. to monitor the abundance of dolphins and their mortality incidental to purse-seine fishing in the eastern Pacific Ocean;
2. to study the causes of mortality of dolphins during fishing operations and promote the use of fishing techniques and equipment which minimize these mortalities;
3. to study the effects of different modes of fishing on the various fish and other animals of the pelagic ecosystem;
4. to provide a secretariat for the International Dolphin Conservation Program

Another example of an RFMO with a fully fledged Science Secretariat is IPHC. This organisation had a similar beginning to IATTC in that its original membership comprised only two countries; in this case the US and Canada. The current staffing of the secretariat is of a similar scale, comprising 24 scientific and technical staff plus 4 administrative staff and an Executive Director. Added to this are 12 port samplers, 8 scan samples (tagging programme) and of the order of 20 sea samplers.

In the examples shown here, the Secretariat is not only involved in holding and analysing the fisheries and survey data, but it is also responsible for a significant amount of the data collection itself.

Among the main advantages cited for this structure are the independence of the science, the opportunity for significant work to be undertaken throughout the year in a coordinated and well planned scientific programme, and hence greater continuity. However the very nature of this "closed" system that infers these advantages can also carry with it some disadvantages, in that there is less opportunity for peer review, particularly by scientists of member countries, and the science itself may be significantly driven by the agenda of one or two key individuals, rather than the specific needs of management and the organisation. If the organisation has few members, such as IPHC then this would seem to be less of a problem, but for organisations with more members, such as IATTC now has, the issues may be of greater concern. Indeed, IATTC now invites all scientists from member countries to participate in the review process during meetings in May, preceding annual meetings, to discuss the structure of assessment models and the assumptions and parameters that are used in the analysis. In addition, scientists from member countries have routinely spent significant periods of time at IATTC working with the staff scientists as well as attending workshops held by IATTC stock assessment scientists in member countries[23] (see Section 4.1.3 for discussion of the interaction between IATTC and WCPFC). Similarly the Scientific Committee can make requests for specific pieces of work, such as additional sensitivity runs etc.

This helps to make the science more transparent and open, however, the Secretariat may still not be bound by any specific agreements, nor accountable to the members for the decisions it subsequently makes in the analysis.

In terms of costs, the Science Secretariat Structure is often deemed to be more expensive than the Working Group Structure, because the costs are transparent in the budget of the Commission. However, this needs to be balanced against the costs to those member countries that fund the participation of their scientists at the working groups and their research programmes throughout the year that contribute to the work undertaken. Again, in the case of an organisation with a small membership where it is clear that the mandate for the science has been passed to the Secretariat and national programmes are curtailed as a result, it may be that the Science Secretariat Structure is more efficient. However, for organisations with a larger membership it seems likely that at least some national programmes would continue to function at more or less full capacity even in the presence of a Science Secretariat. Hence the overall costs in this case would likely be greater.

[23] IATTC's annual stock assessment review meeting is a publically open forum where the stock assessments are reviewed, discussed, and debated. In order to encourage the full involvement of the participants simultaneous translation to Spanish is provided. In addition to the annual assessment review meeting, IATTC has held a series of fall workshops to address particular aspects of the assessment methods and provide a mechanism to consider potential improvements to the methods.

4.1.3. The WCPFC Structure

Articles 12 and 13 of the Convention enable the WCPFC to operate both of the science structures described in the previous sections, making most effective use of existing capacity in the region, while at the same time setting up the more traditional RFMO type structures of the Scientific Committee and its subsidiary groups. This “hybrid” approach is illustrated in Figure 1.

Most of the tropical stocks under the purview of the Commission are assessed by SPC under contract to the Commission and the results of this work fed directly into the Scientific Committee and its Specialist Working Groups (SWGs). The SWGs of the Scientific Committee are primarily an additional layer of review within the Committee itself. While they are chaired independently of the Committee, their composition (i.e. attendance) is essentially the same, and they function largely as items on the Committee’s agenda rather than as the type of working groups described in Section 4.1.1. This part of the WCPFC structure is therefore most similar to the science secretariat structure described in Section 4.1.2, with SPC substituting for the in-house secretariat capacity of an organisation such as IATTC.

The stocks under the purview of the Northern Committee are assessed through a working group structure that makes use of the existing coordinating function of the ISC. In this case, national scientists attend species-based working groups, bringing data with them to undertake assessments in a workshop-type environment.

This flexible approach has been born out of the very reasonable and pragmatic desire to make best use of existing capacity within the region support the WCPFC in meeting its obligations, as set out in the Convention. Many respondents noted that the use of existing capacity had enabled the WCPFC to make rapid progress compared to other RFMOs with respect to the establishment of an information base on which to undertake the scientific assessment of stocks under its purview.

The hybrid approach, however, is not without its problems. A lack of interchange between the two “streams” through which the Commission receives scientific and management advice (see Figure 1 and discussion in Section 5.2.1) has engendered a low level of confidence exhibited by each side for the scientific output provided by the other (see Sections 4.3.2.1 and 5.2.1. On the one hand, ISC is viewed as being outside the WCPFC process, with no clear obligations to undertake scientific work specifically needed by the Scientific Committee. On the other hand, there are concerns about the independence of SPC given it is a regional organisation with membership that covers only a portion of the CCMs of WCPFC. In addition, there is concern among the SPC membership regarding the level of subsidy provided to the work undertaken in support of the WCPFC, which appears to be increasing as the database grows and the science becomes more complex.

This is unfortunate because there are clear advantages for both the WCPFC and the regional management of the tuna stocks generally in being able to draw on the substantial institutional experience and expertise that exists throughout both SPC-OFP and the ISC. The reasons for this situation and proposals for mitigating its consequences are discussed in the following sections.

4.2. Contracted Research

The main contractor for research is SPC-OFP through the Service Contract. Several other contractors are also used. The performance of the SPC-OFP Service Contract research and other contracted research is presented in this section.

4.2.1. Contracting process

The Service Contract set up between SPC-OFP and WCPFC was transparent at the time of negotiation (2005). Its existence has been transparent since then, but it has not been let to tender because of the decision taken by the Commission that the most suitable organisation to undertake the work was SPC-OFP. SPC-OFP maintains the Commission’s database, a comprehensive set of additional data necessary for stock assessment (see Section 3.3), and has the required technical expertise and staff complement to undertake this work.

Theoretically, the Scientific Services contract could be let to another organisation. However, any other organisation would have to develop the database and data analysis systems and acquire the technical expertise and staff equivalent to SPC-OFP in order to undertake the work. It is difficult to see how this could be done efficiently and effectively, while not increasing significantly the cost to WCPFC given that the current costs are significantly reduced by subsidy from the SPC membership (see Section 4.2.4)..

At SC3, a list of 59 science and research projects was identified for 2008. Many of these are allocated to the SPC-OFP Scientific Services core funding; many were not prioritised for 2008; and some were funded separately:

- 11 non-core funded projects were separately funded in 2008. 6 individual contractors were involved, including SPC, which was awarded a number of projects in addition to the core services project.
- 7 of the projects were progressed through direct source contracts:
    - Two of these were continuations of the IPDCP projects, including the rescue of historical commercial catch data (currently incorporated into the main IPDCP activity) and proceeded either through MOU or project contract, as have been done before, with relevant institutes in those countries (National Fisheries Research and Development Institute of the Philippines, the Bureau of Agricultural Statistics of the Philippines; and the Research Centre for Capture Fisheries, Ministry of Marine Affairs and Fisheries in Indonesia);
    - two were developed as matched funding arrangements with CSIRO to support projects already being undertaken or will be developed by CSIRO (swordfish assessment and albacore biology);
    - two were developed as arrangements with SPC as additions to the Science Services budget because SPC was the only sensible option for undertaking the work (tuna tagging project and ecological risk assessment); and
    - one was proposed by the FT-SWG convener, endorsed by the Commission and undertaken by him.
- 4 of the projects were progressed through open tender (calls for expressions of interest). Only one contract was awarded to an independent company rather than a national research institute, and only for this project (data gaps) was there any competition for the project (2 proposals). For the other projects only SPC and CSIRO expressed an interest; two were awarded to former and one to the latter.

The scientific research contracted out by the WCPFC would seem to be attracting interest from only a few capable institutions. Only one project (and only 2% of the total contracted out research budget) was let to a truly competitive tender. One project (Project 57. Development of Scoping Paper, and draft Work Plan, on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points and implementation of an MSE within the WCPO) had to be advertised twice because there was no response to the first advert. Only one project (study to identify causes of data gaps in the work of the WCPFC) received more than one expression of interest (it received 2).

Although the SC and the Secretariat have been following a logical course of action in assigning priorities to the SC's work programme, sourcing or advertising EOIs with potential contractors, the loop should be closed through formal reporting by the Secretariat to the SC of the work undertaken each year by contractors, making it clear which contractors have been used. Furthermore, to date although the SC has established the programme, implementation has been managed solely by the Secretariat. While this has been efficient, it has lacked the features of transparency, but we note that SC4 has already moved to address this (see recommendations below)

Recommendations on the Contracting of Research

The WCPFC should endorse the decision of SC4 (Report Attachment M) to formalize the method by which the work programme and budget of the Committee is agreed, including review of research proposals by a Research Sub-Committee (for example, Secretariat (coordinator), SWG Convenors, and Expert Advisors, as noted in Attachment M) or its equivalent made up of relevant SC officers. This should be augmented by formal feedback reporting to the Scientific Committee.

To address the concern that very little interest has been generated by many of the EOIs, and much of the contract work has been taken by the WCPFC's institutional research organizations, wider advertisement of EOIs on the website (proposed by SC4) should be augmented by direct mailing to responsible officers in all CCMs, and elsewhere.

4.2.2. Science quality

Our interviews with scientists at the SC, the NC and the ISC did not detect any major dissatisfaction with the quality of the science being carried out by SPC-OFP, but there was some disquiet expressed regarding the process of delivery of the outputs that could impact on quality control. Some respondents at managerial level expressed unease that the models were not subject to sufficient peer review and independent validation.

Standards for research in RFMOs are only briefly defined by the RFMO Panel report[24], in paragraph B.17, as

- Fishery data are assessed on a timely basis consistent with the life history of affected species and management strategy. The advice is publicly available.
- There is periodic independent advice and peer review of the assessments, reference points and management strategies. This advice and review is publicly available.

For the purposes of the review, in addition to the above, we ask the following questions of the contracted research:

- Has the contracted research taken into account sensitivities associated with data availability?
- Has contracted out research used the current best practice science?
- Does contracted out research examine new hypotheses and data in a continual quest for the best scientific analysis?
- Has contracted out research been clearly communicated, transparent
- Is contracted out research subject to peer review and does it respond to peer review comments?
- Does contracted out research satisfy requirements of reproducibility?

4.2.2.1. Best practice science and alternative hypotheses

Currently SPC uses stock assessment models that are both structurally and spatially complex, use a large number of separate data sources as inputs, and arrive at maximum likelihood fits for model parameters. The particular software they use for implementing the assessment model is MULTIFAN-CL, which is similar in some ways to other packages that have been developed to undertake assessments using multiple data sources, such as StockSynthesis, CASAL and A-SCALA. As with all complex models, it is usually very difficult to understand the influence of different data- and parameter- sets and model structure on the results. Best practice is therefore to investigate thoroughly the parameter space in which the model operates, and to compare model outputs with outputs obtained from different realisations of the same assessment formulated through different software programs and with different model structures. Both these types of validation have been done recently by SPC-OFP for the Bigeye assessment (WCPFC-SC4-2008/SA-WP-2, WCPFC-SC4-2008/SA-WP-3).

[24] Michael W Lodge, David Anderson, Terje Løbach, Gordon Munro, Keith Sainsbury, Anna Willock, August 2007. *Recommended Best Practices for Regional Fisheries Management Organizations*; http://www.chathamhouse.org.uk/publications/papers/view/-/id/523/

4.2.2.2. Transparency and peer review

There appears to be no formal process for peer review and independent validation of stock assessment models. To an extent, the workshops and SC meetings themselves represent a tacit peer review, but the Committee does have enough time to probe the assessments to sufficient depth to represent a robust process that builds sufficient confidence among all delegations. For example, discussion of the bigeye and skipjack assessment papers presented by SPC at SC4 was brief and did not probe in detail the assumptions in the analysis.

The stock assessment process followed over the last 3 years by SPC-OFP has been to conduct a preparatory workshop with limited invited participation early in the year. The most recent was in February 2008, attended by scientists from Australia, Chinese Taipei, Japan and FFA, as well as the Executive Director and the Science Officer of WCPFC. These workshops have focused on technical aspects of the methodology to be used in that year's assessments, the structure of the data to be used and the range of sensitivity analyses to be investigated. SPC invites individual scientists to these meetings, based on merit and their ability to contribute to the process.

Subsequently, SPC has developed the assessments according to the decisions taken at the workshops. Occasionally SPC has invited individual scientists to assist with the assessments (in particular, scientists from the US, Japan and IATTC[25]), contributing expertise in their individual capacity and not as national representatives. SPC has deliberately not focused on presenting preliminary results of assessments or soliciting comments from participants on such results.

There is a fine balance to be met between encouraging participation in stock assessments and undertaking the work exclusively:

- The advantages of increased participation include:
    - access to additional expertise in specific areas that the assessment team may have need of;
    - increased understanding among external scientists of the details of running the models, how to interpret the diagnostics and the development of a "feel" for the behaviour of the models;
    - the potential for external scientists to identify errors or misconceptions about data inputs; and
    - the assistance that added scientific expertise may bring to deal with the work-load.

- Disadvantages include:
    - the increased time it takes to educate new scientists about the complexities of model runs;
    - organizational and cost issues; and
    - the potential for national scientists to influence outcomes in the favour of national preferences and policies.

To date, SPC has been careful to retain control of the assessment process while making use of additional technical expertise, where necessary. This has been a cost-effective way of increasing participation in the stock assessment work, but it is perceived as not being sufficiently open to attendance by any Member. In the view of the review team, the assessment process is almost certainly better as it is currently being operating by SPC, compared to the likely result were it to be equally accessible to participation by all CCMs, because of the difficulty in running assessments with large numbers of participants. Nevertheless, there may be some merit in opening up the preparatory workshops to greater participation of qualified scientists. Any such development would need to focus on the development of better science, and not be confused with the capacity-building assessment training workshops that are held by SPC (see WCPFC-SC4-2008/GN WP-6)

[25] IATTC and SPC have collaborated on developing a Pacific-wide bigeye tuna assessment.

4.2.2.3. Reproducibility of assessments

A vital feature of assessments if they are to be subject to effective peer review is that they must be independently reproducible. Our understanding is that on only one occasion have scientists from a CCM attempted to reproduce an assessment conducted by SPC-OFP as part of its science services agreement with the Commission. In 2008, scientists from AFFRC (Japan) attempted to re-run the bigeye assessment. Assistance in set-up was given by SPC-OFP. AFFRC appears to have been largely successful in reproducing the assessment, but because some of the data required for the assessment are not owned by WCPFC (many of the data are held by SPC on behalf of their members and have not yet been provided to WCPFC), it is not possible for any external reviewer to reproduce the assessments precisely, based on WCPFC data alone. We are unaware of any other assessment validation carried out to date.

Recommendations on standards for contracted research

The Commission should establish a programme of funded periodic external peer review of all contracted assessments; these should take place at suitable intervals, for instance once every 3 years. Expressions of interest should be sought from leading stock assessment scientists worldwide, and should include their participation in the stock assessment process as well as their review of the models and results. In order for such review to be undertaken within the current year of an assessment the actual assessment timetable for that year may need to be advanced by some months to allow the results to be available for discussion at the SC meeting.

The Commission should consider widening participation at the stock assessment preparatory workshops (SAPWs) conducted by SPC-OFP (currently in February each year). This will require WCPFC to take ownership of the workshops and provide the funding required to run them. Further comments on this option are presented in later recommendations (see Section 5.2).

CCMs should be encouraged to request copies of software and data to undertake duplicate assessments. This activity should be undertaken in the context of generating better understanding of the assessments and testing their sensitivity to different model assumptions. The results of alternative model runs should inform the discussion and review of the assessments by the SC. This should not be allowed to confuse the existing process of generating science and management advice for the Commission. Should this activity result in the SC agreeing there is additional uncertainty in the assessment outputs, the advice from the SC should be more precautionary.

4.2.3. Conflicts of interest

With such a small pool of contractors, many of whom are from Government departments, there is a potential for conflict of interest in two ways:

(i) The national interest of contractors could act to bias the results of their work.
- The threat of this conflict is much less than would be experienced if a large proportion of the work was undertaken by national scientists, such as is the case with Member-produced science in RFMOs using the Working Group Structure (Section 4.1.1), such as CCAMLR. However, given that the main contractor, SPC, is not entirely free of regional interest, concern has been expressed by delegates from some CCMs that SPC allows, and even encourages the interests of its membership to influence its assessments. We have found no evidence for this being the case, for example in terms of selection of specific model formulations, or model runs. SPC provides briefings to SPC/FFA members on the assessment results and training in assessment methodology and interpretation. However, FFA exerts no influence over the assessments. Indeed, the assessment results have in the past conflicted with FFA interests, for example, the status of bigeye in relation to the purse seine fishery. We note, however, that the perception of conflicts can be as damaging to confidence in the scientific process as actual conflicts. An effective process of periodic peer review, along with other recommendations in Section 4.2.2 should help to reduce this perception.

- There is equally a potential conflict of interest for other major institutional contractors such as CSIRO, which was granted an amount of matched funding by WCPFC to undertake a swordfish assessment. In this particular case, however, the assessment, and another constructed by New Zealand scientists, were reviewed by the swordfish workshop hosted by SPC-OFP in April, attended by scientists from Australia, Cook Islands, Fiji, French Polynesia, New Caledonia, New Zealand, Tonga, FFA, WCPFC Secretariat and the SPC-OFP.

(ii) The recommendations and decisions of the Scientific Committee could be influenced by organisations seeking to obtain financial benefit from contracted work.
- This is an issue of possibly greater concern, considering the relatively small number of contractors having sufficient capacity and competency to bid for WCPFC science projects.
- The most sensible way of dealing with this issue would to be to ensure that such contractors, e.g. SPC-OFP, are not part of the decision-making process of the Scientific Committee when it is deciding project priorities and funding. One of the difficulties with this approach for the WCPFC will be that so much of the science knowledge is invested in one organisation that it may be difficult to adequately discuss science needs and priorities without consulting SPC-OFP. SPC-OFP has no formal voting powers, but is entitled, under the Convention, to participate in the SC discussions. Nevertheless, care should be taken to ensure that decisions on future funding initiatives are not taken directly by them.

Recommendations on Conflicts of Interest

The main recommendation of relevance to conflicts of interest is to conduct periodic external peer review of the assessments conducted by the Commission's science provider (Section 4.2.2).

The Commission should also ensure that potential contractors are not part of the decision-making process of the SC. Although the Research Sub-Committee will need to call on the expertise of potential contractors in its deliberations, the Secretariat should continue to monitor potential "conflict of interest" issues and put in place processes to avoid them such as standard committee declarations of potential conflicts. Attachment M of the SC4 report may need to be reviewed and further refined to ensure that the conflict of interest issue is adequately addressed.

4.2.4. Cost effectiveness

The total contracted research budget for WCPFC in 2008 was $650,000, $325,000 of which was the SPC-OFP Science Service agreement. $388,104 was contributed by SPC as a direct subsidy to the Science Service in 2008[26]. This is a considerable subsidy; 54% of the total SPC-OFP budget for the Science Service ($713,000). Additionally, two Extension Projects were added to the SPC-OFP budget, including Ecological Risk Analysis, which is a project running until 2010, and coordination of the Pacific-wide tagging project. The allocation of these additional projects to SPC-OFP appears sensible given the other work being undertaken by SPC-OFP.

SC3 agreed the following project categories for SPC-OFP in 2008.
- Collection, compilation and verification of data from the fishery 13 projects
- Assessment of stock status 4 projects
- Model development and refinement 2 projects
- Evaluation of management options as requested by the Commission 1 projects

As detailed above, 11 non-core funded projects were separately funded in 2008.

One way of assessing value for money is to examine the number of projects and outputs generated for each project. Contracted-out research generated a number of outputs which contributed directly to

[26] In essence, SPC calculate their budgetary requirement from WCPFC on the basis of the incremental cost. Exiting work of relevance to the WCPFC that was done prior to the agreement continues at no cost to the Commission. In the first year of the MOU, the WCPFC funding provided for two additional full time equivalents within the OFP (half data half assessment). Since then, additional positions have been funded, including the Ecological Risk Assessment work in 2007 and 2008.

the work of WCPFC in 2008. Some of these outputs are difficult to quantify – for instance data acquisition, model development, workshops etc. It is easier to quantify the outputs in terms of the production of SC4 papers, which include reports of workshops. A summary of these value calculations is given in Table 3.

Table 3 Breakdown of the 2008 scientific budget (USD) (from paper WCPFC-SC4-2008/GN-WP-3)

Item	Budget $	Number of projects	Number of WP/IP papers to SC4	Cost/ project $	Cost/ paper $
SPC-OFP Science Services	325,000	20	18	16,250	18,056
SPC-OFP Extension Projects - ERA, seabird interaction and tagging project	140,000	2	6	70,000	23,333
IPDCP, including rescue of historical catch data	115,000	2	4	57,500	28,750
SPC awarded responses to EOI	22,500	2	1	11,250	22,500
Other individual EOI awards	47,500	4	7	11,875	6,786
Total	**650,000**	**30**	**36**	**21,667**	**18,056**

The SPC-OFP cost per paper is quite consistent, being about $17000/paper for core Science Service projects and about $23000/paper for contract work. The true cost/paper of Science Service work taking into account the SPC subsidy, is somewhat higher ($37,000), but it must be borne in mind that this includes a substantial number of core functions and projects associated with data acquisition, collation, filtering/managing and database maintenance which are not easily captured with the metrics in Table 1. Comparisons of costs/paper are further complicated by the different types of paper being produced – for instance assessment papers will involve considerably more work than papers describing data holdings. For other contracts, the IPDCP fails to capture the level of work involved in collating data, and hence this appears to be a particularly expensive programme. However, this reflects a high initial investment because of the generally poor base to work from. Most other SPC activities are based on "established" processes, procedures and systems, but the IPDCP projects have to support an establishment cost in addition to an on-going administrative cost. Finally, the "other individual EOI awards" appear to be particularly efficient, in part (but not wholly) because many of them were matched funding arrangements.

In our experience, a cost/paper of $20,000 is not unreasonable for high-level scientific work such as is being undertaken by SPC-OFP and we therefore conclude that, in conjunction with the generally high quality of technical output, the contracted out research is cost-efficient. The SPC subsidy creates additional efficiencies for the core Science Services contract.

In addition to the output of projects, tasks and papers, SPC-OFP provides a number of added value services

- A repository of knowledge of WCPFC tuna and billfish population biology, fisheries, data, assessment and management;
- Assessment workshops and other training tools.
  - The stock assessment preparatory workshop in April 2008 was not explicitly funded by the Commission, but was created under the SPC-OFP Science Services contract.
  - Stock assessment education workshops have been held in the last two years as an education tool. These were not directly funded by the WCPFC; in June/July 2007 funding was primarily from the Global Environment Fund Oceanic Fisheries Management Project and in August 2008 from the Japanese Government funded "WCPFC Project on Capacity Building in Fisheries Statistics, Regulation and Enforcement for Small Island Developing States" (The WCPFC Project) as administered by the WCPFC. Both have been attended by scientists from many WCPFC PIC Members, increasing their understanding of the stock assessments being conducted by SPC-OFP for WCPFC.
  - An increasing information repository for broader ecosystem issues, particularly by-catch and incidental species science and research issues, in the WCPO.

- Ad hoc technical assistance, such as web site design and maintenance.

Conclusion on Cost Effectiveness of Contracted Research

WCPFC is currently getting good value for money from contracted out research. Currently the cost per paper of SPC research funded by WCPFC is about $17,000 for core Science Services papers (which are subsidised by SPC) and $23,000 for individual projects. In 2008 about 75% of Science Service papers addressed complex research and assessments, which are typically costly to undertake, and the project supports considerable data acquisition and processing that does not appear in papers. WCPFC benefits from a range of added value items with the Science Services contract. The cost of non-SPC projects is lower, some $7,000 per paper, but many of these are run as matched-funding projects undertaken by Member scientific institutions.

4.3. Non-contracted Research

In addition to the work conducted under Commission contracts, non-contracted research that contributes to the Scientific Committee process is undertaken by CCMs and also by the ISC and its Members.

4.3.1. CCM research presented at the Scientific Committee

There were about 50 working or information paper contributions to SC4 arising from non-contracted research, generated through a variety of mechanisms. Member authored papers comprised significant contributions from national research institutes in a number of CCMs, including Australia, Chinese Taipei, the EU, Japan, New Zealand, the People's Republic of China, the Republic of Korea and the United States. Additional contributions were made by NGOs (3 papers) and other organisations (ACAP, FFA, IATTC, 7 contributions). The majority of the CCM contributions to SC4 were to the BI-, FT-, and EB-SWGs, although there were also a few contributions to the ME-, ST- and SA-SWGs. Although these are useful background papers, and often provide useful guidance in respect of research needs and priorities, it is not clear how they contribute actively to the decision making process of the Commission.

Recommendations in 2008 of the BI-SWG and FT-SWG were primarily about future research work, and of the ME-SWG was most relevant to the future of stock assessment for WCPFC stocks. Papers to and recommendations of the SA-SWG contributed directly to SC Agenda Item 4, EB-SWG directly to SC agenda item 5 and ST-SWG directly to SC agenda item 6. Even here, however, the contribution of Member authored papers is probably less than the contribution of papers prepared under contract to answer specific projects identified by SC3. Some correspondents pointed out that it is very difficult to assess these papers at SC level because the data use for the analyses are often not held by WCPFC or SPC-OFP, and there is no time to subject them to detailed scrutiny at the SWG meeting. Consequently, they are subjected to less peer review than would initially be supposed.

Time is particularly short during the SC meeting, and one has to question the benefit derived from the time allocated to reviewing the papers presented to it through the BI-SWG and ME-SWG. A more appropriate time and place for these papers to be considered would be during the preparation for stock assessments. However, although this would generate more time at the SC, it would run the risk of increasing the attendance at stock assessment workshops to an unwieldy level, and diverting focus from the business of undertaking the detailed analyses required for efficient stock assessments. Alternative ideas for easing the pressure on the SC would be to hold meetings of the BI-SWG and ST-SWG only biennially.

An important point, raised by many respondents at SC4, is the need to build up the capacity of other CCMs to participate in the scientific process. Some went so far as to say that the use of SPC as the Commission's primary science provider might have the effect of stifling national capacity building, because SPC-OFP does the work for them. Maintaining an avenue for CCM authored papers is therefore clearly important. However, capacity building among small island developing states and other developing countries such as the Philippines and Indonesia is an on-going issue, and at present it is unrealistic to expect small island and other developing economies to support the development of

scientific capacity on the same scale of large developed countries. This is borne out by the overwhelming distribution of developed CCM authors of papers presented to the SC.

SPC undertakes outreach through briefings to SPC/FFA members on the assessment results and training in assessment methodology and interpretation. This is a key capacity building role that is consistent with the provisions of the Convention regarding the "special requirements of developing states". It may be, however, that SPC can do more in collaboration with specific CCMs to train and mentor talented individuals from developing countries that would directly enhance their national participation in the scientific process, including the preparation of scientific papers. This should have the benefit of increasing the number and diversity of CCMs that are contributing directly to the work and deliberations of the SC. This option should be given some consideration when planning future capacity building activities.

Recommendations regarding CCM research presented at the SC

If a decision is taken to formalise the Stock Assessment Preparatory Workshop (SAPW) (see also section 5.2.2), the most appropriate place for papers on biology and methods to be considered is at that meeting. The hypotheses and data that they contribute can then be fully analysed and integrated into the stock assessment process. This would relieve pressure on the SC meeting, but could have the unintended consequence of making the SAPW meeting unwieldy and less effective. Therefore, while we recommend the BI-SWG and ME-SWG cease to convene routinely as part of the SC meeting, we suggest the following alternatives for such an approach which should be discussed by the SC:

(i) dissolve the BI-SWG and ME-SWG and encourage papers on biology and methods to be presented to the SAPW, or other stock assessment workshops;
(ii) as per (i), but have biology papers submitted to the SAPW and methods papers submitted to the SA-SWG; this would allow the SC to consider developments in stock assessment methods each year;
(iii) agree on only biennial meetings of the BI-SWG and ME-SWG, these meetings taking place either adjacent to the SC or adjacent to the SAPW; require that the reports of these SWG meetings are forwarded to the stock assessment workshops rather than to the SC; and consider re-creating the SWGs as Ad-hoc Working Groups (see section 5.2.2.1).

SPC should consider specific actions to train and mentor talented individuals from developing CCMs that would directly enhance their national participation in and contribution to the scientific process, including the preparation of scientific papers.

4.3.2. International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC)

4.3.2.1. Status of cooperation between the SC and the ISC

As previously noted, the ISC works on a different model to the SC, in that all the assessments are conducted in international working groups by Members' scientists rather than through a contract with a single research organisation. Working groups are organised by species, maintain species-specific datasets and conduct direct assessments of these species. The data used to undertake assessments are not held by WCPFC or SPC-OFP.

The relationship between the WCPFC and the ISC is defined by the MOU. This allows for the provision advice to the NC, WCPFC and the SC based on the results of ISC assessments. However, only the NC can directly request information and advice from the ISC. We address this issue in more detail in Section 5. At a minimum, however, we recommend that the MOU be updated to include an understanding that the SC can request the ISC to undertake additional work[27]. In this section we primarily address the quality of ISC research and its validation.

[27] We note that the MoU was intended to be reviewed after its first 2 months of operation.

In a similar way to the SPC-OFP assessments, ISC assessments are peer reviewed by the working groups in which they are developed. There are, however, significant differences between them, as outlined below:

- SPC-OFP
  - Preparatory workshop + SPC-OFP assessment
  - Assessments not conducted each year for each species
  - Limited invited participation by Members in the preparatory workshop
  - Very limited invited participation by other Members in the assessment runs
  - Externally funded post-SC assessment education workshops with attendance from SPC countries and other non-SPC developing country CCMs (Indonesia, Philippines).
- ISC
  - Species workshops usually 2 meetings a year
  - Preparatory workshops and assessment workshops separated
  - Assessments not conducted each year
  - Participation by ISC members and selected observers, but although comprehensive participation is encouraged throughout the process, uptake is limited.

Our interviews detected concern amongst delegates from many CCMs over the lack of satisfactory review of ISC assessments by the SC and the perceived closed nature of the ISC assessment meetings.

The limited uptake of invitations to participate in scientific meetings is a common problem between the SPC-OFP and the ISC. For instance, the YFT/BET stock assessment workshop, April 2006, attracted only 2 participants from Japan when 12 from New Zealand, the EU, Japan and the USA had been invited. The ISC itself acknowledges regretfully that many of its Members do not participate in ISC meetings (Table 4).

Table 4 Meeting attendance for ISC Species Working Group and ISC meetings in 2008

	Albacore WG	Bluefin WG	Billfish WG	ISC meeting
Preparatory meeting(s)	Y (2)	Y	Y (2)	
Assessment meeting		Y		
Number of papers	13	47	24	
Canada	Y		Y	Y
Chinese Taipei	Y		Y	Y
Japan	Y	Y	Y	Y
Mexico		Y		Y
P.R China				
Republic of Korea				Y
USA	Y	Y	Y	Y
IATTC	Y	Y	Y	
SPC				
FAO				
PICES				

4.3.2.2. Science quality

As with our enquiries regarding the SPC-OFP assessments, none of our interviews suggested that there were specific problems with the current ISC assessments in terms of science quality. However, several (within both the NC and the SC) did emphasise that in order to be assured that the science was robust, additional review by the SC, external peer review, transparency and validation was required.

We have dealt with the issue of confidence-building for SPC-OFP assessments in previous sections. The Scientific Committee considered the issue of confidence-building in ISC assessments at its 2007 meeting (SC3 paragraphs 176-178) in which a number of models were presented (Information Paper SC3-GN-IP-2). A fourth option was suggested at the ISC meeting in which the SC would designate someone to attend the workshops of the ISC's working groups. That individual would be the SC representative and would keep the SC informed of the results of the work that was done or to call for

further review by the SC. That would give the SC a representative (or representatives) to follow the work of the ISC. Apart from the funding issue, the problem with this option is that, as shown in Table 4, there are a considerable number of meetings to attend, and assessments are only occasionally performed.

SPC is a Member of ISC (see ISC Operations Manual, July 2008) but due to time and financial constraints has not attended ISC meetings for a number of years. Although it would be useful for SPC to attend workshops, it would also be sensible if an additional independent SC scientist was also in attendance.

Like the SPC-OFP, the ISC acts as a service provider to the WCPFC in respect of the species under its purview: northern albacore, northern bluefin and northern billfish (north pacific swordfish and striped marlin, although striped marlin is not currently regarded as a "northern stock"). In terms of science quality, its assessments should be held to the same level of scrutiny as those of SPC-OFP. At present this is restricted to working group peer review, but we would recommend the same additional peer review and validation be undertaken as has been proposed for SPC-OFP assessments. For this to be possible, a central holding of data used for ISC stock assessments will need to be developed, as discussed in Section 3.2.

Stock assessments conducted by the ISC use the software SS2 (Stock Synthesis 2) for billfish and north pacific bluefin and Adapt for albacore (although this will also be assessed using SS2 at the next assessment in 2009). SPC-OFP assessments use MULTIFAN. In the same way that SPC-OFP assessments in MULTIFAN have been tested against implementations in SS2, so ISC assessments need to be tested against alternative implementations.

Recommendations on the ISC

In accordance with Article 13 paragraph 4 of the Convention, the Commission should establish a programme of funded external peer review of all ISC assessments of relevance to the Commission's work. Peer reviews should take place at suitable intervals, for instance every 3 years. Expressions of interest to undertake the reviews should be sought from leading stock assessment scientists worldwide, and should include their participation in the data assimilation and stock assessment process as well as their review of the models and results. The Commission will have to make funding available for this purpose, and since these reviews will be in regard of northern stocks, then all costs might be defrayed by the NC members.

WCPFC should consider widening participation at the stock assessment workshops conducted by ISC through funded attendance of SPC-OFP scientists and independent SC representatives. Again this would be subject to the availability of relevant experts to attend and sufficient funding.

The SC and NC should request, or fund, validation work on ISC assessments, and request the ISC to test alternative hypotheses and model implementations of key ISC assessments.

In order for external validation to be possible, and to improve the understanding of ISC analyses, copies of the data sets used by the ISC should be systematically made available to the Commission, and preferably incorporated in the Commission's data holdings. Similar access to data and models should be provided for scientists wishing to undertake model validation work of ISC and SPC-OFP data.

4.4. Summary of the functioning of the science provision

We have highlighted in previous sections several areas where the current structure and function of science provision for WCPFC could be improved.

The most challenging situation for WCPFC is that the structures for science provision on tropical stocks and northern stocks are quite different, following different models for generating assessments. Scientific advice on tropical stocks results from a series of tasks specifically formulated by the SC and

contracted out to a single agency (SPC-OFP) that reports back to the SC and SA-SWG. Scientific advice on northern stocks is derived from the work of a separate regional organisation (ISC) with a working group structure comprised of only a subset of the CCMs that reports to the SC under the terms of an MOU, but which is not otherwise bound to serve the WCPFC and its objectives. This is illustrated in Figure 1.

Is this affecting the quality of scientific advice received by the Commission and the Northern Committee? On balance, one would have to conclude that the scientific advice delivered to the Commission and Northern Committee is good, at least up to the industry standard; and for many of the assessments it is very good, at the level of best practice. What is currently not at the level of best practice is the peer review structure. Neither the ISC nor the SPC-OFP assessments are subject to sufficient peer review, either within the ISC or the SC. There is a need to engage peer review, validate assessments, and explore the sensitivity of results to alternative model formulations

One of our key recommendations is to formalise the SPC-OFP's SAPW as a WCPFC workshop and to disband or merge both the BI-SWG and ME-SWG with this workshop (this is discussed in detail in Section 5.2). We believe that this would simultaneously introduce efficiency savings, streamline the work and introduce greater transparency into the tropical stock assessments. In essence this represents a widening of the participation in the scientific process, with the intention of broadening the level of scientific ownership and building the confidence in the assessment results. Our recommendations with respect to the ISC are of a similar nature and intent, coupled with the development of a centralised and enduring data facility to enhance the reproducibility and review of the ISC analyses by non-ISC scientists (see also Section 5.2.1).

Overall, the Commission is getting good value for money. The science budget is currently rather low compared to the value of the fishery ($650,000 compared to some $4bn fishery value; less than 0.02%). Even accounting for the individual Member costs of scientific contribution to the ISC and SC, this appears to be a very small proportion of the fishery value. Additional funding (suggested following our concluding recommendations below) would be a responsible investment.

5. Institutional analysis

5.1. Resourcing of the WCPFC Secretariat

The difficulties associated with boosting institutional capacity within the Secretariat are discussed in Section 3.4 in the context of the option of bringing the data services function in-house. There are similar difficulties with respect to developing greater science capacity within the Secretariat.

An important part of the Secretariat's Science Manager's role is communication between the officers of the Scientific Committee, CCM research organizations and scientists, research contractors and the Scientific Committee. We would extend this to include communication between the ISC, and other non-contracted research and the Scientific Committee. In essence all of the science undertaken under the auspices of the WCPFC, be it by SPC, ISC, CCMs or other institutions, needs to be focused on the needs determined by the Scientific Committee. In this regard, there is some suggestion that greater clarity is needed from the Scientific Committee in identifying and prioritizing these needs, to make better use of the expertise in SPC and the ISC. The appropriate body to take this role would be the Research Sub-Committee (SC4 Report, Attachment M).

The process of communicating these needs, and commissioning the necessary work should be made a more formal part of the Science Manager's activities, with specific, routine protocols developed such that the science providers are all clearly aware of what the Scientific Committee is asking for, and delivery of outputs can be assessed.

Recommendations on resourcing of the Secretariat

The Secretariat needs to pro-actively support the new procedures developed under recommendations to improve data reporting and delivery of science to the SC and advice to the NC and Commission. While this has implications for staff activities, it is not anticipated that this will require additional human resources within the Secretariat at this time. Experience from other RFMOs, however, shows that the workload always increases over time as management procedures become more sophisticated and the demand for scientific advice increases commensurately. The situation should therefore be kept under close review by the Executive Director.

5.2. Scientific Committee

5.2.1. Relationship between the SC and ISC

According to our interviews conducted during all three meetings confidence in the assessments conducted by SPC-OFP and the ISC is impacted for the following reasons:

- in the case of SPC-OFP assessments, confidence is undermined by a perception held by some delegates of conflicts of interest (see Section 4.2.3) and the apparent closed nature of the analyses, with few scientists attending the SAPW or taking part in the assessments themselves;
- in the case of ISC assessments confidence is undermined by the fact that most SC participants are not able to be present at ISC stock assessments, that working papers presented to the ISC WGs are not readily available[28] and the data used in assessments are not accessible for scientific review, and the lack of sufficient detail in reports and time to review the assessments at the SC meeting.

On the other hand there are features of both systems which are very positive:

- there is considerable scientific and regional knowledge and expertise invested in both SPF-OFP and the ISC; it is logical for the Commission to use both of these existing institutional resources to obtain the best scientific evidence on which to base its management decisions;
- the working group structure of the ISC is open to participation by scientists from all eligible Members and the science benefits from the inclusion of Pacific-wide expertise (e.g. Mexico, IATTC[29]); and
- the efficient working structure of the SPC-OFP, which by limiting outside participation in assessments to individual specialists, allows a wide range of alternative hypotheses to be investigated.

While the current structure for the provision of advice appears to have resulted in reduced confidence among some parties, none of our respondents cast doubt on the technical and scientific competence of the scientists undertaking the assessments. However, confidence and trust are essential in generating the best scientific advice for the Commission.

In the MOU between WCPFC and the ISC, tasks can be requested of the ISC by the NC, although the ISC reports to the SC, the NC and the Commission. This creates an uncomfortable science structure:

- On the one hand, the ISC is a service provider, acquiring data and undertaking assessments that are submitted to the WCPFC SC; these assessments are at a level of detail similar to those reported by the SA-SWG; the ISC has its own specialist assessors in its Working Groups in the same way as the SA-SWG has specialist assessors in the form of the SPC-OFP and other contracted research;
- On the other hand, the ISC provides direct advice on management of the stocks to the NC, which can also receive advice from the SC, and is therefore at a near-equivalent status to the SC itself.

[28] To preserve intellectual property rights, the papers are not posted on ISC website but can be obtained through written request to the authors.

[29] IATTC has contributed to a number of the assessments done by the working groups of the ISC, such as those for northern bluefin tuna, northern albacore tuna, and some billfish assessments.

For the ISC to be acting as an equivalent body to the SC is not consistent with our understanding of the Convention, which sets up, in Article 11, its three subsidiary bodies, the Scientific Committee and the Technical and Compliance Committee and the Northern Committee; and in Article 13 a clear route for the provision of Scientific Advice to the Commission through the Scientific Committee. Since the ISC is not a WCPFC body it follows that it can only operate as an advisory body under Article 13, in a similar (but not contracted) role to SPC-OFP. We consider that it would be similarly inappropriate for the SPC-OFP to be providing advice directly to the Commission, even though the Convention allows for this in Article 13, paragraph 2. A number of correspondents expressed disquiet that the ISC is so important to the WCPFC in respect of northern stocks and yet has no legal status in the Convention, being subject only to its own rules and decisions notwithstanding the MOU with WCPFC. The WCPFC therefore could be vulnerable to a loss of science advice on its northern stocks should the ISC loose its funding or substantially change its structure, even though this may appear to be a remote possibility.

Parallels were drawn by a number of correspondents between the ISC and ICES. The latter undertakes independent research and stock assessments and provides scientific advice to NE Atlantic government authorities such as the EU and Norway. However, ICES does not provide advice direct to the Norwegian or EU management authorities; in the case of Norway ICES advice is scrutinized by Norwegian scientists (the Institute of Marine Fisheries) and in the case of the EU ICES advice is scrutinized by the Scientific, Technical and Economic Committee for Fisheries (STECF) which then makes management recommendations to the European Commission. Thus, the parallel between ISC and ICES is only consistent with the above interpretation that ISC should be providing advice to the Northern Committee through, and with the endorsement of, the Scientific Committee.

The SC is put in a difficult position in the current situation by being asked to approve the stock assessments conducted by the ISC and its advice resulting from these, but not being asked by the NC to provide management advice on them. It thus currently acts as a peer review group, but without the ability to fully review the stock assessments.

If this situation continues, there will almost certainly come a time when the SC does not believe that it has enough information to verify any advice being provided to the NC, but the NC acts on that advice in any case. At this point the Commission will truly have two separate paths for generating science and management advice, one of which is not a statutory body of the Commission. While this may provide adequate advice on stock assessments, it will not be able to fully integrate the other aspects of scientific advice required for good management, particularly Ecosystem-Based Management (EBM), because neither the fish stocks nor the bycatch species respect the artificial division of 20^{o}N.

If the Commission wishes to continue to have the best science advice, the work of the SC and ISC and the way in which scientific advice flows into the Commission must be harmonized. It is, in our view, essential that the SC has sufficient confidence in the assessments and advice coming from the ISC to be able to endorse that advice, in the same way as it endorses the assessments and advice presented to it by the SA-SWG. The SC must itself provide management advice to the NC based on its assessment of the ISC science and science arising from other parts of its agenda, notably agenda item 5. These recommendations will, in the future, increasingly integrate advice from its advisory groups on stock status, mitigation measures and EBM.

The SC must change for this to happen. Several correspondents from the ISC/NC community cited the politicization of the SC and the scientific process as a reason for keeping the ISC separate. Our recommendations on the structure of the SC and the ISC aim to address this politicization.

It is unreasonable to ask the ISC to undergo such changes to its operation without providing some additional support for it to do so. One of the major issues for the NC and ISC is the lack of substantial secretariat and data management support.

One issue raised by a number of correspondents was that the format of the advice provided to the Commission and the NC was different for different stocks. Streamlining the science advice through the SC should enable a single reporting format to be adopted by the SC for the advice to the NC and Commission.

Recommendations regarding the relationship between the SC and ISC

The Commission needs to take action that reverses the apparent trend towards two completely separate, and non-cooperating streams of scientific advice. The SC should remain the primary source of scientific advice on all stocks, both for the Commission and the NC. The SC therefore needs the opportunity to effectively evaluate and validate the science arising from all sources, including SPC-OFP, ISC and others. Further recommendations in this regard are elaborated in Section 5.2.2.

5.2.2. Organisation of the SC

5.2.2.1. Structure and process of SWG meetings

The SWGs of the SC currently meet during the week immediately prior to the SC Plenary. All members of the Commission are represented at these meetings. While this does allow for engagement of all CCMs in the science process, particularly developing States and participating territories, from the perspective of detailed review of the science, this makes them rather too formal and unwieldy to debate any issues in great depth. Although there is a different Chair for each SWG, they have virtually the same attendance as the SC plenary. They therefore function more as items on the agenda of the SC than separate working groups. The SC plenary subsequently debates the SWG reports, resulting in a significant duplication of effort at the SC. This has already been noted by a large number of delegations, and modifications to the way in which the SCs conducts its business that were implemented at the SC4 meeting have helped to reduce the problem to some extent, but this process could go further. In this regard, there are several interrelated and potentially conflicting issues that still need to be addressed:

- the format of the SWG meetings;
- the number of SWGs;
- the time needed to undertake a rigorous review of the science; and
- the overall length of the SC meeting (including the SWGs)

Many respondents agreed that two weeks for the SC meeting is too long. However, many also noted that there was not enough time to undertake a rigorous review of the assessments, particularly those provided by the ISC. These are apparently conflicting problems. The solution may be found in modifications to the format and number of the SWGs as we discuss below.

A large number of papers are produced for the SWG meetings (93 in 2007, 73 in 2008) and just the presentation of these papers takes most of the time available, leaving insufficient time for close scrutiny of the results, assessments and the development of management advice. Papers prepared for the Biology and Methods SWG are important, but are most relevant to the refinement of input parameters and methodological characteristics of assessments. It would therefore be more efficient if these papers were provided as background directly to the stock assessment workshops (e.g. SPC-OFP's SAPW) that can best use them. The BI-SWG and the ME-SWG may therefore not need to meet as separate entities. Papers could be submitted directly to stock assessment workshops rather than to the SWGs and the SC. There may still be a role, however, for the conveners of the current Biology and Methods SWGs to ensure that papers that are submitted to are pertinent to the issues to be considered at each meeting, and present findings that will actively contribute to deliberations.

The most important SWGs are Stock Assessment (SA) and Ecosystems/Bycatch (EB). These SWGs provide advice essential for the development of recommendations by the Scientific Committee and ultimately management measures by the Commission. It is most important that these groups meet every year. The FT- SWG and ST-SWG could potentially meet less frequently, convening when specific issues need to be addressed. In years when they are not meeting, relevant papers could be submitted directly to the EB-SWG, and the SA-SWG. In the case of the ST-SWG, it is to be expected that annual meetings early on in the life of the WCPFC would be necessary to establish harmonised and comprehensive statistical data collection, but eventually the group should not need to meet so frequently.

Providing more time for the SA-SWG and EB-SWG should allow more opportunity for debate and detailed investigation of the results of assessments performed before the meeting. Only much extended meetings of the SA-SWG would allow actual model runs to be undertaken, and our experience is that this would not be possible with such a large group of people. We would see that providing 3 days rather than 2 for the SA-SWG would allow considered and in-depth discussion of the current target species assessments developed by SPC-OFP (tropical stocks), ISC (northern stocks) and individual Members or special workshops such as the Southern WCPO Southwest Swordfish Assessment Workshop (2008). As the work of the SC matures, we can expect additional assessments, for instance of non-target species, to be included in the work of the SA-SWG, which would require it to meet for an additional 1 or 2 days. A similar length of time would be required by the EB-SWG. Remaining SWG meeting days should be allocated, in alternate years, to meetings of other SWGs as needed.

However, with the provision of more time for the SA-SWG and EB-SWG will come with a risk that more papers will be produced for these meetings. It should also be noted that there is currently considerable inter-sessional work by the Secretariat and individual scientists, which comes on top of the already-long 2-week SC meeting. We acknowledge that our proposal to expand the attendance at the SAPW will create an additional work-load, but note that our proposals for changing the way that biology and statistics papers are considered should help to relieve some of the current workload at the SC.

As will be the case for the SAPW, there will be an increasing need for the SWG conveners to ensure that papers are appropriate to the subject being considered. Currently all papers are presented at the SWGs, allowing less time for debate. One way filtering papers and providing more time for debate would be to require authors to specify the agenda item to which their paper is pertinent and a succinct summary that provides the main results of the paper *as they relate to the work of the SWG*, rather than as they relate to the paper. This also means that papers need only be introduced briefly.

5.2.2.2. Collaboration with other Pacific RFMOs and agencies

One of the strongest features of the ISC structure is that it deals with each of its species on a north Pacific-wide basis. With some exceptions (the southern albacore assessment and some bigeye assessments) the assessments considered by the SC are restricted to the area of the western and central Pacific, even though stock distribution may extend across the Pacific Ocean. IATTC is present as an observer at SC meetings, but has not usually been present at stock assessment meetings. They have been invited, but the main constraint to attendance may be time and availability at the critical times of year (February to April). We note also that SPC and WCPFC are always invited to the October stock assessment methodology workshop of IATTC, which usually focuses on issues of importance to stock assessment in general and tuna in particular. SPC sent 1 scientist in 2008, 2 in 2007, and 1 in 2006. The WCPFC science manager attended in 2006 and 2007 but not in 2008 owing to budget constraints.

Nevertheless, there are a number of issues on which closer cooperation with organizations covering other parts of the Pacific Ocean, particularly IATTC, and ISC would be beneficial:

- Ocean-wide assessments of southwest swordfish and bigeye;
- a single north-south albacore assessment (SC4 paragraph 167); and
- closer ocean-wide monitoring of shark and other bycatch.

Our recommendation, made previously and in more detail below, to expand the SAPW should be beneficial for the routine assessment of tropical stocks, but this workshop would not be capable of undertaking the large collaborative works necessary for a combined albacore assessment, for instance. There will, therefore, continue to be a place for WCPFC-sponsored special assessment workshops, such as that recently held for south west swordfish.

Recommendations for the organization of the SC

Structural changes

The proposal to restructure the SC work plan to hold a SAPW each year, funded by WCPFC, hosted by SPC-OFP, at which all Members would be invited should create more time for discussion at the SC and also build confidence, transparency and openness within the stock assessment process. The first day or so of the workshop would be set aside for the consideration of papers presenting new information and methods that might be introduced into the assessments that will be conducted that year, which previously would have been presented to the BI-SWG and ME-SWG. We suggested previously that these two SWGs could cease to exist as separate entities. They could be retained to meet at the start of the SAPW, but in our view the former is the simplest and probably the most efficient option. The SAPW would agree data inputs and model runs to be undertaken by the SPC-OFP and an appropriate timetable for the work. The assessments themselves should still be conducted by SPC-OFP alone, with occasional expert assistance, as specifically required.

This recommendation carries a risk of creating a more unwieldy meeting of the SAPW, and will require more funding for meeting attendance by CCMs and preparation and management by the WCPFC Secretariat and SPC-OFP. Opening the meeting to wider attendance may also risk a tendency for political interference in setting the assessment agenda. We would strongly suggest that if this course is followed, the meeting remains a specialist stock assessment meeting and attendees be required to have scientific credentials concomitant with this objective. Wherever possible, the SAPW should be attended by the SC Chair and international peer reviewers, in years when a peer review is taking place.

A closer working relationship with IATTC and ISC should be developed. The two organisations should be routinely invited as observers to the SAPW, and specific ocean-wide stock assessment workshops should be organized between the SC, ISC and IATTC to study ocean-wide assessment issues. Where appropriate, approaches to the assessment of northern stocks should be included in the SAPW agenda.

WCPFC should consider providing assistance for external experts to attend its meetings, including those from other organizations and those undertaking auditing or peer review activities recommended in earlier sections.

Other workshops may be held on species not included in the main SPC-OFP work programme, soliciting their own input papers on biology and methods. If the Biology and Methods SWGs are retained, the logistics of the relationship between these groups and the other workshops would have to be explored further.

The SA SWG should explicitly consider the report of the SAPW, the report of subsequent assessments performed by SPC-OFP, other assessments conducted independently by CCMs or other workshops, the assessments undertaken by ISC stock assessment working groups, their reports and that of the ISC, and provide advice to the SC on these assessments. The SA SWG will require significantly more time in its meeting to consider these issues in addition to the assessments provided by the SPC-OFP.

We propose the following restructuring of the SWGs:

- Only the EB-SWG and the SA-SWG should meet regularly.
- The FT-SWG, ST-SWG and other ad hoc groups (such as the PTTP Steering Committee[30]) should meet only when they need to and for shorter periods of time than the SA- and EB- SWGs. Normally these groups should consider biennial meetings, but there will be times (such as when there are ongoing projects that need to be monitored, and at present for the ST-SWG as WCPFC data gaps are being analysed) that they need to meet annually. However, working groups that meet annually often have a tendency to continually justify their continuation on an annual basis, and the SC needs to be continually aware of this.

[30] We note that funding commitments for activities such as the PTTP and the IPDCP may require an annual review mechanism, and it is logical for this to take place during the SC meeting.

- The BI-SWG and ME-SWG should be re-organised in accordance with the recommendations made in Section 4.2: either dissolution (with papers being considered either by the SAPW or the SA-SWG as appropriate) or retention as groups that meet occasionally as SWGs or Ad-hoc Working Groups.

We also suggest that the SWGs are held in a less formal atmosphere than is currently the case (e.g. without national name plates). It is likely that this will only be possible if the attendance is significantly less than the SC plenary. Given the complex nature of the deliberations we recommend that CCMs send only those delegates with specialist scientific expertise, and those that are part of capacity building activities to this meeting. Any CCMs not sending delegates to the SWGs will retain the opportunity to contribute to the scientific debate through participation at the SC plenary meeting. This is similar to practice in other RFMOs and will help to reduce the overall time that many delegates need to spend at the SC.

Current levels of Secretariat support for the ISC, and the provision of a NC fund for ISC research on behalf of the NC should be encouraged and improved.

Confidence-building

To assist with building confidence in the assessments presented to the SC, the recommendations in previous sections on exchanges between the SC, SPC-OFP and ISC and ISC WGs, should be implemented. Furthermore, the chairs or principal investigators of the ISC WGs should attend meetings of the SA SWG so as to fully explain in detail the data, models, parameter sets, results and assessment diagnostics for ISC assessments.

Implementation of this recommendation will depend largely on the availability of personnel and the willingness of their CCMs to support the additional attendance and funding required.

The timetabling of intersessional work should be eased by providing a longer period between the meetings of the ISC and the SC (ideally 3-4 weeks), to allow for consolidation of the ISC report and preparation for the SC, particularly the SA-SWG, meeting.

The SC should consider the research requirements for all stocks under the purview of the Commission, developing its own Research Plan as at present and extending this to include explicit consideration of the workplan developed by the ISC and its working groups. This will promote the harmonization of the Commission's science provision, which will become increasingly important as requirements for the development of Ecosystem Based Management increase. However, it would be most beneficial if this harmonization was extended further through the MOU with ISC (see below).

Process

Where appropriate, the SC should explicitly endorse the assessments of the ISC, in the same way as it currently endorses the SPC-OFP advice. The SC needs to develop explicit advice to the Commission and the NC based on this advice. This can only be done if the SA-SWG and the SC have more time to understand and consider the ISC assessments and advice, and this in turn will require there to be more time between the meetings of the ISC and the SC.

The roles of the SC and the ISC in advising the NC need to be clarified. Our proposal is that the SC, as the statutory WCPFC body, should take the lead in endorsing the scientific work done by The Commission's science providers and SWGs, and providing advice to the NC and Commission, even if this advice is a simple endorsement of the advice of other bodies such as the ISC. In order for this to happen the SC chair should ideally attend the NC meetings and introduce the SC report, which should include statements of endorsement of the assessments and advice to the NC. However, to ensure a high level of technical explanation of the science, and to fulfil the mandate of the MOU, the ISC should also continue to attend the NC to present its report, although care will have to be taken that any points of contention between the ISC and the SC are discussed beforehand by the chairs of the SC and ISC, and reported to the NC in as clear and non-confrontational way as possible.

The MOU with the ISC should be amended to allow for ISC work to be requested by the SC as well as the NC. Should the SC not come to an agreement on stock assessment advice for northern stocks, the NC could act on the advice of the ISC directly. However, this course of action should only be

taken *in extremis* and with the overriding application of the precautionary approach. The ISC would of course also reserve the right to conduct its own business as it sees fit, including developing its own work programme. However, enabling the SC to request specific advice from the ISC would mean that the work programme of the ISC in respect of its work for the SC and NC became harmonized with the work programme of the SC itself.

SPC-OFP should be encouraged to continue its series of Tuna Stock Assessment Training Workshops, funded externally to the WCPFC, as a means of engaging PIC and Participating Territories including other developing States such as Philippines and Indonesia more fully in the assessment process. It is possible that once the training starts to deliver increased capacity, attendance at the SAPW will increase, and the need for the training workshops may be reduced to every two years rather than every year.

5.3. Workplan and Budget

Many of the changes suggested above will require considerable discussion prior to being endorsed by the Commission, the SC, the NC and the ISC. We propose the following work plan to develop the proposals in detail which will allow their implementation in December 2009. We believe that early action to change the method of working of the SC and ISC as suggested in this review will be required to reverse the trend towards a two-track science system within the WCPFC (see Section 5.2.1).

We propose the following:

- Following discussion at the Commission meeting in December 2008, WCPFC should set up a **change management group** with constituents from the Commission, SC, NC and ISC in early 2009. This group would steer the detailed development of implementation plans for the recommendations in this report that are endorsed by the Commission in December 2009.
- A special working group meeting should be held associated with the SC in 2009 at which the recommendations in this report, and the detailed implementation issues discussed by the specialist change management group, would be presented. Prior to this meeting, the ISC should be requested to comment on the recommendations and the proposals of the change management group.
- The SC should take a decision at its 2009 meeting about the recommendations, which would be endorsed by the Commission in December 2009.

The recommendations in this paper have some budgetary implications. While the reduction in the number of SWGs may save some time during the SC meeting, it must be emphasized that this is primarily so that more time can be devoted to the stock assessments and ecosystem based management. Nevertheless, there is the potential to save 2 days from this meeting, at a cost of approximately $15,000, with other associated savings for CCMs if they elect to send delegates only to the SC plenary.

If the recommendation to create a more formal Stock Assessment Preparatory Workshop (SAPW) is accepted, which would subsume the meetings of the BI-SWG and ME-SWG, assistance to Members for attendance may have to be provided as well as additional funds for SPC-OFP, who would need to provide facilities. The costs of such a meeting may be approximately the same as the stock assessment education workshops, approximately $80,000 (SC4 GN WP-6).

Attendance of an SPC person and independent SC nominee at each ISC assessment workshop (but not the preparatory workshops), when these are expected to occur about once a year, and at the ISC meeting each year would be approximately $20,000.

The attendance of the SC chair at the Northern Committee meetings may also need to be funded, at approximately $3000

Peer review/validation (2 stocks every 3 years?) may cost $40,000 every 3 years

The total additional annual cost of these recommendations would therefore be approximately $100,000.

Annex 1: Terms of Reference of the Review

Objective

Using Articles 10 to 15 of the Convention as a basis, undertake, in consultation with interested Members, Cooperating Non-Members, and Participating Territories, a review of the science structure and science functions of the Commission

Scope and Tasks

The assignment will address, among other matters, the following questions in relation to scientific data functions and science functions of the Commission.

1) Scientific data functions

During the transitional period

- Have the respective roles and responsibilities of the Commission's data submission and data management arrangements been adequately defined and specifically, are there any gaps, overlaps, or areas of ambiguity?
- Are the Commission's rules and policies (or standards and specifications where they exist) regarding the security and confidentiality of data, including physical and electronic protection from unauthorised access, adequate?
- Has the Commission's data management performance been satisfactory in its provision of data custodianship services, and specifically have all of the Commission's rules and policies (or standards and specifications where they exist) for data compilation, processing, safekeeping and dissemination, been achieved?
- Are adequate resources available for both data stewardship and data custodianship services of the Commission?

Following the transitional period What would be the advantages and disadvantages of each of the following options for the provision of data custodianship services to the Commission?

(xi) Provision from within the Secretariat;
(xii) Provision by a regional fisheries management organisation outside the Commission;
(xiii) Provision by an agency within the Government of a member or participating territory;
(xiv) Provision by a private agency.
(xv) Provision by SPC/OFP

Outputs

1. Reviewer participates in 2008 ISC meeting.
2. Initial feedback and consultation during Fourth Regular Session of the Scientific Committee.
3. Initial feedback and consultation during Fourth Regular Session of the Northern Committee.
4. Draft Report for the Fifth Regular Session of the Commission, December 2008.
5. Final Report to subsidiary bodies throughout 2009 for their review and consideration in advance of:
6. Presentation of the Final Report to the Sixth Regular Session of the Commission in December 2009.

2) Science functions

Contracted Research

- Has contracted research been carried out to suitable standards?
- Have cost effective outcomes been obtained from the contract research?
- Is there adequate communication between research contractor, science manager and Scientific Committee?
- Are alternative cost effective research options available?
- Is the research contracting process transparent?
- Are the contactors free of conflicts of interests?

Secretariat and Scientific Committee

- Is the Secretariat adequately resourced to deal with the scientific matters (including data submission and data base contract management) of the Commission?
- Is the Scientific Committee functioning to meet the needs of the Commission? (e.g., is the best available information made available to the Commission, and its subsidiary bodies including the Northern Committee?)
- Following a review of the terms of reference of the specialist working groups, and the review the function of each SWG, determine whether all or any SWGs should continue to exist? If so, is there any other function (SWG) necessary to reply to the requests of the Commission (e.g. economics)?
- Are other cooperative arrangements required?
- Is engagement with Members including Pacific Island States and Participating Territories adequate and balanced?

Annex 2: List of Persons Contacted during the Review

ISC Meeting

Name
Christofer Boggs
Gary Sakagawa
Gerard Dinardo
Hideo Inomata
Hitoshi Honda
John Holmes
Koji Uosaki
Makoto (Peter) Miyake
Naozumi Miyabe
Ray Conser

SC4 Meeting

Name
Adam Langley
Aisake Batibasaga
Alain Fonteneau
Albert Wata
Antonio Mulipola
Berry Muller
Chiguk Ahn
Christofer Boggs
Dae-Yeon Moon
David Itano
David Kirby
Doo-hae An
Edwin Oreihaka
Eugene Pangelinan
Glen Joseph
Glenn Hurry
Hannah Parris
Haruo Tominaga
Hiroaki Okamoto
Hitoshi Honda
Ian Bertram
John Hampton
Jone Amoe
Julio Moron
Keith Bigelow
Kim Duckworth
Koji Uosaki
Kurt Shaefer
Lara Manarangi-Trott
Les Clark
Ludwig Komoru
Makoto (Peter) Miyake
Maruia Kamatie
Matthew Hooper
Moses Amos
Nick Davies
Noel C. Barut

SC4 Meeting

Name
Pablo Chavance
Pamela Maru
Peter Ward
Peter Williams
Raikaon Tumoa
Ray Clarke
Robert Campbell
Samasoni Sauni
Shelton Harley
Shui-Kai (Eric) Chang
Simon Nicol
Stephen Brouwer
Steven Retalmai
Susan Waugh
Tien-Hsiang (Ted) Tsai
Tim Lawson
Tony Taleo
Tu'ikolongahau (Hau) Halafihi
Tupalaga Poulasi
Ueta Faasili Jr
Wez Norris
Xiaojie Dai

NC Meeting

Name
Benjamin Tabios
Charles Karnella
Gary Sakagawa
John.Holmes
Joshua Mitchell
Kintoba Tearo
Lara Managangi-Trott
Liu Xiaobing
Naozumi Miyabe
Ray Conser
Sem Ponnambalam
Sylvie Lapointe
Takumi Fukuda
Tom Graham
Uale Taleni
Yukio Takeuchi

Annex 3: List of CCMs and Other Entities Providing Data to the Commission

	Commission Members and Participating Territories	Cooperating non-Commission Members	Other ENTITIES providing data, including those applying for CNM status
1	American Samoa	Belize	Ecuador
2	Australia	Indonesia	El Salvador
3	Canada		Mexico
4	Chinese Taipei		Panama
5	China		Senegal
6	Cook Islands		Vietnam
7	European Comminity		
8	Federated States of Micronesia		
9	Fiji		
10	France		
11	French Polynesia		
12	Guam		
13	Japan		
14	Kiribati		
15	Korea		
16	Republic of Marshall Islands		
17	Nauru		
18	New Caledonia		
19	New Zealand		
20	Niue		
21	Commonwealth of the Northern Mariana Islands		
22	Palau		
23	Papua New Guinea		
24	Philippines		
25	Samoa		
26	Solomon Islands		
27	Tokelau		
28	Tonga		
29	Tuvalu		
30	USA		
31	Vanuatu		
32	Wallis and Futuna		