出國報告(出國類別：其他)

參加「中西太平洋漁業委員會(WCPFC)第七屆科學次委員會(SC7)會議」報告

服務機關：行政院農業委員會漁業署
姓名職稱：技正　周世欽
　　秘書　王文英
派赴國家：密克羅尼西亞　波拿貝
出國期間：100 年 8 月 7 日至 8 月 19 日
報告日期：100 年 8 月 22 日

摘要

本次中西太平洋漁業委員會（WCPFC）第七屆科學次委員會（SC7）會議於本（2011）年 8 月 9 日至 17 日在密克羅尼西亞（Micronesia, FSM）波拿貝（Pohnpei）舉行，共有 26 個國家或領地參加，觀察員包括 IATTC、SPC、FFA 以及國際鳥盟等。有關本次會議結果摘要如次：

（一）主要魚種資源狀態及管理建議：

1.大目鮪：資源狀態：最大持續生產量（MSY）爲 76,760（範圍：68,360 - 83,720）公噸，資源處於過漁進行中（Overfishing）狀態，但尚未處於已過漁（Overfished）狀態。管理建議：考量赤道海域爲開發率及資源降低率最高之區域，佔 2001-2010 年漁獲量水準約 88%，親魚資源量在此區域降低約 17%左右，建議考量有效之空間管理措施。應降低所有體型大小魚體之漁獲死亡率，以確保漁獲死亡率低於最適水準並降低過漁之風險。

2.黃鰭鮪：資源狀態：MSY 爲 538,800（432,000 - 644,800）公噸，資源並未處於已過漁狀態且過漁並未正在進行中之狀態。管理建議：建議在西赤道海域之漁獲死亡率不應再增加。

3.正鰹：資源狀態：MSY 爲 1,503,600（1,274,000 - 1,818,000）公噸，資源並未處於已過漁狀態且過漁並未正在進行中之狀態。管理建議：因漁獲死亡率及資源量指標快速改變，漁獲努力量增加之情形應被監控，建議應考慮發展捕撈正鰹之限制。

4.南太平洋長鰭鮪：資源狀態：MSY 爲 85,200 公噸，資源並未處於已過漁狀態且過漁並未正在進行中之狀態。管理建議：因任何漁獲量或努力量增加將導致漁獲率的降低，特別是延繩釣漁業對於親魚資源的影響。建議漁船活動應以 CMM 2010-05「南太平洋長鰭鮪養護與管理措施」建議案有效管理。

（二）管理議題：有關限制性參考點（limit reference point）部份，建議以親魚及加入量（spawner and recruitment）關係比例之漁獲死亡率（$F_{X\%SPR}$）及親魚資源量初始

值之比例（$X\%SB_0$）爲方向加以考量，並對於以 MSY 爲基礎之參考點及目標參考點（target reference point）再進行討論，提出適當之參考點供管理決策使用。

（三）生態系及混獲忌避議題：SC 將發展「圍網漁業作業期間對於鯨鯊及海洋哺乳類動物之活體釋放綱要」。

（四）未來 SC 運作：資料及統計主題移至資源評估主題前召開；各項主題會議應控制時間以完成建議草案草擬及定案；有關生物、資源評估、方法及漁撈技術等重要研究報告移至資源評估準備工作會議討論，SC 僅確認未來前述各項之研究需求。

（五）原 SC 副主席庫克群島之 Dr. Pamela Maru 屆滿，SC 副主席留由 WCPFC 第 8 屆會議決定；生態系及混獲忌避主題之小組主席由斐濟 Jone Amoe 博士擔任，小組副主席之提名及確認則在明（2012）年度科學委員會（SC8）之前決定；資源評估小組主席由日本 Miki Ogura 博士擔任，小組副主席則將由美國選派科學家擔任。

我團代表心得與建議：（一）本年 SC7 會議結果將作爲本年底 TCC7 及 WCPFC8 年會後續討論之科學相關議題背景資料，擬積極研擬準備因應立場，採取務實可行及彈性方案，俾維護相關權益。（二）有關 SC7 所建議各項科學研究議題，將視可行性及重要性規劃納入明（2012）年遠洋相關科技計畫。

目次

壹、前言

「中西太平洋漁業委員會（WCPFC）」係依據 1995 年聯合國魚群協定（UNFSA）生效後，於 2004 年成立之區域性鮪類保育管理組織，其宗旨在於透過有效管理以確保中西太平洋海域高度洄游種群之長期保育與永續利用。WCPFC 設有科學（SC）、技術與執法（TCC）及北方（NC）等次委員會，每年均召開會議。

我國於 2004 年 11 月 2 日依公約規定完成加入 WCPFC 所需程序，成為 WCPFC 會員，又我國在太平洋區域無論是近海或遠洋鮪漁業均佔有重要之地位，為維護我國船隊作業權益，我國每年以會員身分參加 WCPFC 委員會及相關次委員會議。

WCPFC 第七屆科學次委員會訂於 8 月 9 至 17 日密克羅尼西亞（Micronesia, FSM）波拿貝（Pohnpei）舉行，本次會議共計 26 個會員國（包括我國）與會，及觀察員包括 IATTC、SPC、FFA 以及國際鳥盟等。主要針對資源評估結果與科學相關建議進行討論。我國由本署周世欽技正率團，團員包括本署王文英秘書、對外漁業合作發展協會於仁汾組長、劉弘一統計員等代表。

本次會議討論焦點包括討論大目鮪及正鰹等重要鮪魚資源評估與現況，提出重要養護管理措施之建議。

貳、會議過程及結果

我代表團於 8 月 8 日下午約 1 時 40 分抵達後，8 日下午 4 時進行團長會議，並於會議後與日本團進行雙邊諮商。茲將本次逐日會議情形概述如下：

8 月 8 日

一、 團長會議（8 月 8 日下午 4 時）：會議由日本水研所 Dr. Miyabe 及科學經理 Dr. Soh 主持，決定會議安排如下：

（一）討論本次會議議程，Dr. Soh 表示原議程 4.3 “Review of performance of FAD closures” 併入 3.3b “Review of CMM 2008-01”。

（二）本次會議將視會員國討論決定是否要對於生物、漁撈技術及方法論等主題場次選舉小組主席（convenor）。

（三）生態系及混獲之小組主席 Dr. Paul Dalzell 自 SCTB 時代擔任至今已逾 10 年，有意辭職，會中將重新選舉主席，澳洲代表提議可以由斐濟代表接任。

（四）SC 副主席 Dr. Pamela Maru 將於明年 WCPFC 8 任期屆滿，SC 將建議延任兩年，如果 Dr. Pamela 沒有意願，再另覓人選。

二、 台日雙邊會談（8 月 8 日下午 5 時 30 分，在日方下榻之旅館「China Star」餐廳進行）：我方由所有團員出席，日方代表包括：Dr. Ogura（團長）、Mr. Koya（水產廳代表）、Dr. Okamoto、Dr. Miyabe 及 Dr. Peter Miyake 等人。

（一）大目鮪、黃鰭鮪及正鰹資源評估結果與因應對策討論：

1. 黃鰭鮪：台日雙方對於黃鰭鮪本年（2011）度資源評估結果並無太多爭議點之討論，皆認爲黃鰭鮪資源處於健康狀態（未發生過漁且過漁並未處於進行中）表示樂觀，並認爲黃鰭鮪評估結果並不至於有太大之爭議。
2. 正鰹：日方表示該資源評估結果雖處於健康狀態（未發生過漁且過漁並未處於進行中），惟本年度資源評估所使用之資料已加入日本鰹竿釣漁獲統計資料及標示放流資料，與過去年度所使用之資料結構不同，在分析時仍存有不確定性。雖日方仍認爲該資源結構似乎出現問題，日本沿岸作業漁民反應近年正鰹捕獲量不佳及體型有小型化趨勢，可能因近年赤道區圍網努力量過大導致洄游至日本海域正鰹減少所致，故日方認爲有管理的必要，傾向在漁撈能力的控制方面提出看法。惟本年度因爲地震、核災及海嘯，導致作業型態改變，異於過去，故無從比較近兩年之差異，基此，日方將強調正鰹資源評估之不確定性。
3. 大目鮪：資源評估結果顯示狀態不佳，處於過漁正在進行中，但親魚資源則顯示雖尚未處於過漁狀態，但有趨向過漁狀態之傾向，屬悲觀狀態。日方認爲本次評估方法仍有問題，本次所使用的陡度（steepness），在參考案例部分，使用 0.8，其他設定從 0.65 至 0.95 皆有，評估結果顯示有相當大的範圍，亦即資源狀態從尚可之過漁尚未發生但過漁正在進行中（not overfished and overfishing）至過漁已發生且正在進行中（overfished and overfishing）皆有，故該報告雖有結果，但因範圍過大，故仍無結論，我方代表認爲 SPC 將以那些 CASE 做爲建議案，將

成爲會議重點，日方代表認同，目前日方將朝向該報告尚無明確結論以進行討論爲主。我方表示有關大目鮪資源評估結果，對於圍網及延繩釣漁業皆有影響，其中對於延繩釣漁業之影響較鉅，希望台日雙方在此議題合作，日方 Dr. Miyake 認爲，有關大目鮪資源主要受到圍網漁業影響，我方表示中西太平洋之延繩釣漁業近年來已呈穩定狀態，並無太大變動，最後經與日方就分區討論，認爲在第三區部分，圍網漁業之漁獲壓力最大。就此，雙方將就議題之層次合作發言。

（二）混獲議題：本次會議主要有「延繩釣支繩加重」及「藍染餌」以減緩海鳥混獲之相關報告發表，我方認爲此些措施應爲選項，且有區域性及對象鳥種之限制，台日雙方最後皆認爲倘會中對於此等忌避措施之管控進行討論時，應導向以確認熱點區域（hot spot area）及保育海鳥物種確認（例如瀕危等級）之相關研究獲議題爲優先。

（三）鯊魚議題：日方 Dr. Miyabe（SC 主席）表示，本年度鯊魚議題將爲重點，因爲 CITES 會議即將舉行，鯊魚議題將會被挑起。我方表示，因目前鯊魚漁獲統計資料普遍缺乏，資源評估作業將受限制，Dr. Miyabe 表示，資料缺乏乃是必然，但是委員會會受到壓力，勢必會進行主要鯊魚種類之資源評估作業，我方表示此部分 ISC 已開始進行，主要魚種爲 shortfin mako shark 及 blue shark，那 SC 將對何種鯊魚進行評估？Dr. Miyabe 進一步表示，目前鯊魚資料普遍缺乏，此留待討論。

（四）太平洋黑鮪漁獲統計資料問題：我方表示太平洋黑鮪目前已有管理上的壓力，但是資源評估尚未完成，因去年會議有類似討論，惟本次會議是否將會針對此議題進一步討論，乃爲我方考量之一。日方 Dr. Miyabe 表示因爲太平洋黑鮪資源評估主要係以數個國家之統計資料進行，並非全數 WCPFC 會員國參與即可解決，故此議題將不深入探討。我方則內部討論認爲 Dr. Miyabe 之意見，乃因太平洋黑鮪主要係爲北方委員會管轄魚種，故 SC 對此議題將留置 NC 討論。故推測本次會議對於太平洋黑鮪議題將不會有太多討論。

（五）另針對生態、漁業技術以及方法論小組主席選任，我方代表表示先前已經從 SC 架構下剔除此三小組，因此不支持該案，Dr. Miyabe 表示此項議題主要爲 SC5 會

議建議 3 年後檢視，如無會員國提議，則不會重新恢復此三小組。（雙邊會議於晚間 7 時 30 分結束）

8 月 9 日

一、 開幕（8 月 9 日上午 8 時 30 分）：

（一） 本次會議共有 26 個國家或領地參加，除我國外包括澳洲、中國、庫克群島、歐盟、密克羅尼西亞（FSM）、斐濟、美屬薩摩亞、日本、吉里巴斯、韓國、馬紹爾群島、諾魯、新喀里多尼亞、紐西蘭、帛琉、PNG、菲律賓、尼威、索羅門群島、東加、越南、美國及萬那杜等。觀察員包括 IATTC、SPC、FFA 以及國際鳥盟等。

（二） 會議由 SC 主席 Dr. Miyabe 開場後，隨即由執行長 Dr. Glenn Hurry 致歡迎辭，接續由波拿貝州長 Mr. John Esha 進行約 15 分鐘演說。會議自上午 9 時 20 分後正式進行。

（三） 由秘書處 Dr. Soh 對於委員會要求之各項議題進行說明（GN-WP-03），包括：大目鮪生物參數研究（Project 35）、FAD 混獲忌避措施研究（Project 55）、北太平洋紅肉旗魚、南太平洋長鰭鮪及劍旗魚未來評估作業、管理議題之權責規範、生物參考點、管理目標工作會議、鯊魚議題、與 ISC 資料交換、策略研究規劃、科學委員會結構、WCPFC SC 與 ISC 之 MOU、大目鮪資源評估同儕檢視、熱帶鮪類強化管理建議等，以上相關議題將於本次會議中討論。

二、 漁業狀況回顧（8 月 9 日上午 10 時 30 分，由 SC 主席 Dr. Miyabe 主持）

（一） 中西太平洋鮪漁業回顧：由 SPC/OFP 統計人員 Peter Williams 進行報告及 FFA 科學家 Dr. Peter Terawasi 報告。中西太平洋之總漁獲量創歷史第二高。

（二） 東太平洋資源狀況回顧：由 IATTC 科學家 Dr. Shaefer 進行報告。

三、 各國國家報告（8 月 9 日下午 1 時 30 分，由 SC 主席 Dr. Miyabe 主持）

（一） 我國國家報告由對外漁業合作發展協會劉弘一簡報，會中並無國家代表提問或表示意見。

（二） 今年有許多國家未繳交該國國家報告，包含馬紹爾、諾魯、帛琉、索羅門、萬那度等 FFA 會員國。

四、 資源評估主題(8 月 9 日下午 3 時 30 分,由日本 Dr. Miyabe 主持及美國 Dr. John Brodziak 共同主持)

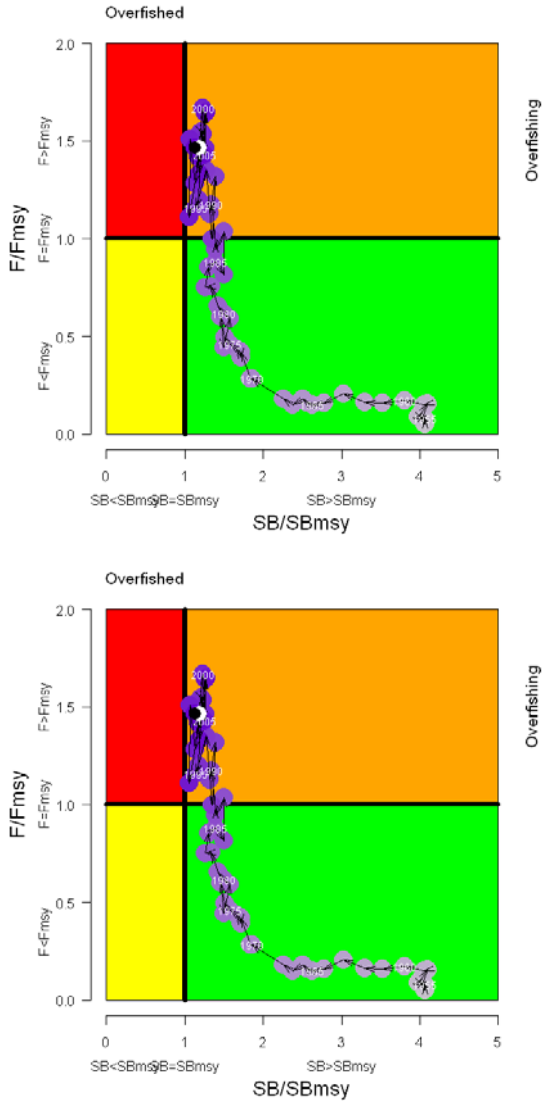
（一） 會議開始，日方代表 Dr. Okamoto 隨即要求發言表示，本次大目鮪資源評估其中「Run21」並未於本年四月之資源評估準備會議中討論，要求 SPC 於會中進行該會議主要成果說明，SPC Dr. John Hampton 回應，有關本年四月份會議結果列在資訊報告「SA-IP-02」，可以參閱，惟因非工作報告，無須進行簡報，有問題可以提問。日方代表接續表示，本次大目鮪資源評估，將去年之「base case」更名爲「reference case」,其意函爲何？「陡度(steepness)」設定爲 0.8 之「reference case」,是屬於特別個案還是一般性個案？要求說明，SPC 回應「reference case」就是參考個案之意。

（二） 隨後主席 Dr. Miyabe 打斷日本代表及 SPC 兩造間之爭議，表示進入議程 3.1 中西太平洋大目鮪之 3.1.1 回顧研究結果與資訊之第 a 項「Bigeye tuna age, growth and reproductive biology (Project 35)」(SA-WP-01）執行進度說明，由 SPC Dr. Simon Nico 報告。美方提問有關生殖成熟時程研究之樣本數量夠不夠？SPC 表示樣本應持續蒐集，目前分析仍有不足處。澳洲表示中西太平洋之大目鮪生物特性相關研究，應與東太平洋之研究結果進行比較，並表示支持本計畫研究。IATTC 表示有關成熟時程相關研究主要係應用在親魚資源量之推估，還有成長模式之應用，屬相當重要的研究計畫。SPC 回應將會進行。日本表示，可以體察此計畫之重要性，但是應小心計畫經費的增加。有關計畫內容及所需經費，秘書處 Dr. Soh 表示將在本週五進行本年度各項計畫內容及經費，希望各國代表出席參與討論。

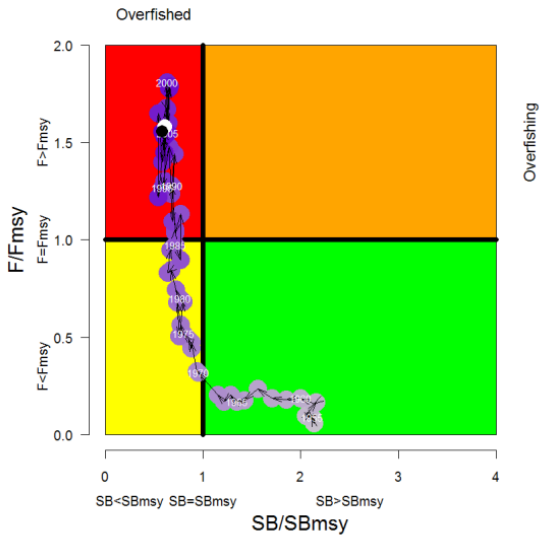
（三） 2010 年大目鮪資源評估結果討論（Stock assessment of bigeye tuna in the western and central Pacific Ocean，SA-WP-02)，由 SPC Dr. Simon Hoyle 報告。本次大目鮪資源評估所使用之資料包含彙整後資料（TASK II)、作業層級資料（日本)、標識放流等，陡度設定以 0.8 爲主，並搭配陡度 0.65 及 0.95 進行分析，共計進行 13 個 Run，主要結果簡述如下：

1. 「Run3j」(陡度爲 0.8)：MSY=76,760 公噸、$F_{current}/F_{MSY}$=1.46、$B_{current}/B_{MSY}$=1.25、

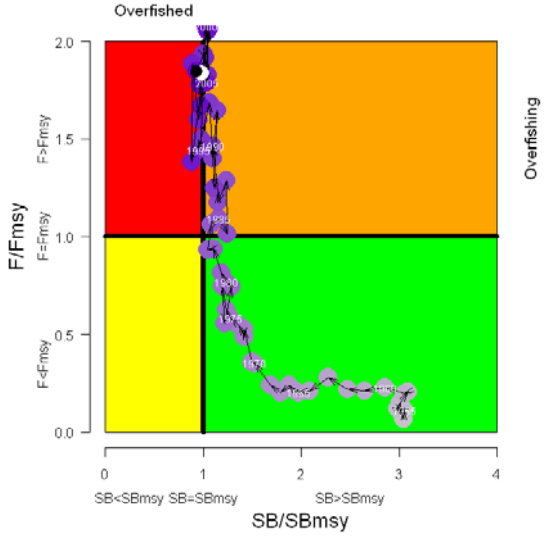
$SB_{current}/SB_{MSY}$=1.19，亦即資源處於 Overfishing 但尚未在 Overfished 狀態。Kobe plot 如下：



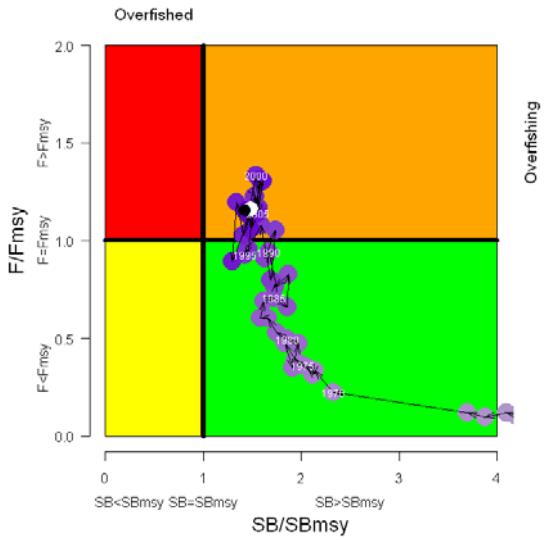
2. 「Run21」(陡度爲 0.8)：MSY=131,400 公噸、$F_{current}/F_{MSY}$=1.58、$B_{current}/B_{MSY}$=0.67、$SB_{current}/SB_{MSY}$=0.61，亦即資源已經過漁且過漁正在進行中（Overfished and Overfishing）。Kobe plot 如下：



3. 「Run13」(陡度爲 0.65)：MSY=70,080 公噸、$F_{current}/F_{MSY}$=1.84、$B_{current}/B_{MSY}$=1.07、$SB_{current}/SB_{MSY}$=0.98，亦即資源處於 Overfishing 但尚未在 Overfished 狀態，有趨近 Overfished 之傾向（特別是親魚資源量已處於 Overfished）。Kobe plot 如下：



4. 「Run14」(陡度爲 0.95)：MSY=83,720 公噸、$F_{current}/F_{MSY}$=1.16、$B_{current}/B_{MSY}$=1.48、$SB_{current}/SB_{MSY}$=1.49，亦即資源處於 Overfishing 但未在 Overfished 狀態。Kobe plot 如下：



日方表示，因目前各 Run 之分析使用資料不同，且搭配設定之陡度亦不同，以致分析結果產生差異，對於何種資料輸入之資源評估較爲合理（例如本次日本提供作業層級資料分析後之 CPUE 標準化資料、彙整後之漁獲努力量及標識放流資料等等）。美國表示目前計有 14 個「Run」的分析結果，何者爲候選的「Run」？以供進一步討論。SPC Dr. John Hampton 表示，由於各 Run 分析皆具有其合理及考量之優點，建議由會中討論選擇。由於會議時間已接近下午 5 時 30 分，主席 Dr. Miyabe 裁示明日（8 月 10 日）繼續進行討論，並請所有與會成員移往秘書處進行晚宴（本日會議結束）。

8 月 10 日

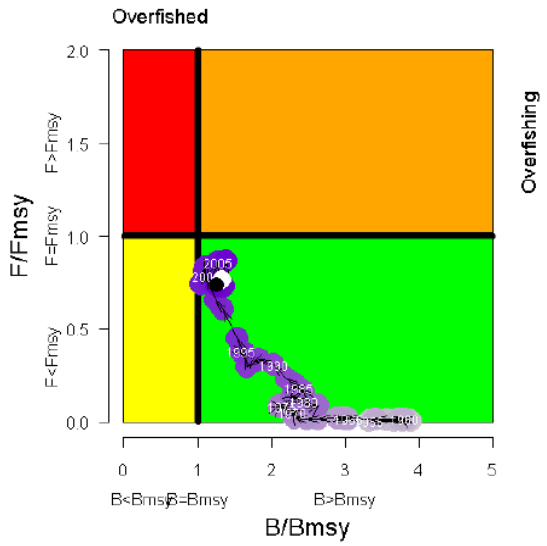
五、 資源評估主題(8 月 10 日上午 8 時 30 分由日本 Dr. Miyabe 主持及美國 Dr. John Brodziak 共同主持）

（一） 主席 Dr. Miyabe 表示先由越南及印尼完成國家報告。

（二） 接續進行資源評估主題（大目鮪）討論，主要討論如下：日方請 SPC 將 run Grid median 之信賴區間表現出來以了解其不確定性。SPC 表示已列於報告中之 Table 7，惟並未清楚說明。我方提問，有關圍網漁業在 1990 年中期快速增加，但在分析中並未探討圍網漁業對於大目鮪資源之壓力，此外圍網漁業的丟棄量亦未考慮，建議將此等納入分析。SPC 表示以後將此等因素納入分析考量。日方 Dr. Peter Miyake 表示，目前分析所使用的資料及陡度的設定，皆存有相當的不確定性，建

議應逐步就資料的不確定性及陡度的設定加以釐清，以健全大目鮪資源評估分析，我方對此發言表示支持。期間，FFA 會員國輪翻發言，肯定 SPC 所做研究，並肯定目前分析所使用之資料以較過去完整。惟會中認爲，本次大目鮪資源評估仍須有結果，對此主席裁示進入模式分析結果的選擇，考量各 Run 資料輸入不盡相同，故以作業層級資料及彙整後資料兩類之分析爲主，目前選定以 Run3j 爲主（包含相關之 MSY、$F_{current}/F_{MSY}$、$B_{current}/B_{MSY}$、Kobe plot 及相關的評估參數等），其他搭配陡度設定爲 0.65 及 0.95 等 6 個 Run 作爲範圍。已將模擬資源情況最差之 Run21 排除（即過漁已經發生且正在進行中，Overfished and Overfishing）。由 SPC Dr. Simon Shelton 整理資料。

（三）黃鰭鮪資源評估「Yellowfin tuna stock assessment - rev.1 - 03Aug2011（SC7-SA-WP-03）」，由 SPC 代表 John Hampton 博士進行報告，黃鰭鮪資源評估共分六區，其中 1-5 區資料使用日本延繩釣作業層級資料進行 CPUE 標準化，第 6 區南緯 10 度、東經 170 度至西經 150 度則使用台灣延繩釣資料進行 CPUE 標準化，本年度增加使用標示放標示放流資料、spill 採樣結果修正圍網漁獲資料以及印菲統計計畫蒐集之資料，另親魚與加入量生物關係參數陡度設爲 0.8，評估結果顯示該魚種並未 Overfishing 亦未 Overfished，Kobe plot 如下：



各模式評估生物參考點如下表：

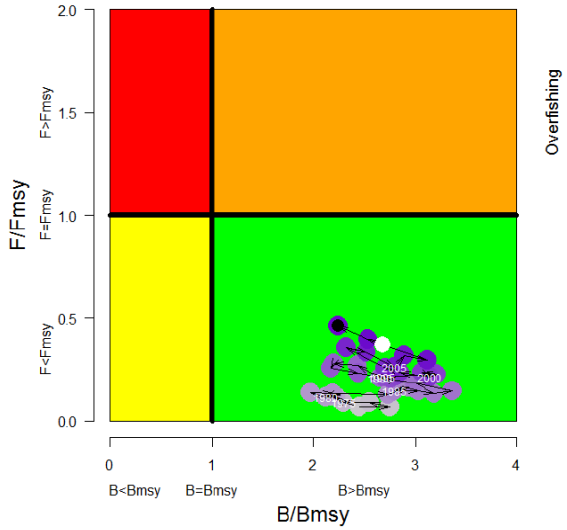
	LLcpueOP_TWcpueR6_PTTP	LLcpueOP_TWcpueR6_RTTP	LLcpueAG_PTTP
$C_{current}$	551,120	551,488	552,206
C_{latest}	507,100	508,329	509,019
$Y_{F_{MSY}}$ or MSY	538,800	493,600	490,400
$F_{current}$ /F_{MSY}	0.77	0.90	0.71
SB_{MSY}/SB_0	0.29	0.30	0.27
$SB_{current}$ /SB_0	0.42	0.40	0.49
SB_{latest} /SB_0	0.36	0.31	0.43
$SB_{current}$ /SB_{MSY}	1.47	1.34	1.83
SB_{latest} /SB_{MSY}	1.25	1.02	1.62
SB_{curr} /$SB_{curr\ F=0}$	0.44	0.40	0.45
SB_{latest} /$SB_{latest\ F=0}$	0.41	0.35	0.43

	LLcpueOP_TWcpueR6_PTTP	LLcpueOP_PTTP_TWcpueR6_dwtSize50	LLcpueOP_PTTP_TWcpueR6_h65	LLcpueOP_PTTP_TWcpueR6_h95	LLcpueOP_PTTP_TWcpueR6_hEST
$C_{current}$	551,120	551,416	551,300	551,283	551,330
C_{latest}	507,100	507,392	507,443	507,358	507,534
$Y_{F_{MSY}}$ or MSY	538,800	563,600	498,000	644,800	411,600
$F_{current}$ /F_{MSY}	0.77	0.76	0.91	0.54	1.23
SB_{MSY}/SB_0	0.29	0.27	0.34	0.24	0.38
$SB_{current}$ /SB_0	0.42	0.40	0.43	0.45	0.41
SB_{latest} /SB_0	0.36	0.33	0.37	0.38	0.35
$SB_{current}$ /SB_{MSY}	1.47	1.44	1.28	1.92	1.09
SB_{latest} /SB_{MSY}	1.25	1.19	1.08	1.63	0.92
SB_{curr} /$SB_{curr\ F=0}$	0.44	0.43	0.47	0.47	0.47
SB_{latest} /$SB_{latest\ F=0}$	0.41	0.39	0.44	0.44	0.45

澳洲代表提問第 6 區 1970 年以後台灣延繩釣 CPUE 變動趨勢與 1970 年以前日本延繩釣 CPUE 趨勢吻合，可以整併成標準化 CPUE，但近年來第 3 區日本延繩釣漁或資料回收率不高，可能會出現不確定性高之問題；印尼表示第 3 區可能有局部性資源問題，澳洲代表表示此議題可在管理主題中進行討論。因該魚種資源未過漁，會員國對評估結果無爭議，同意使用該資源評估報告之資源現況進行管理建議討論。

（四） 正鰹資源評估「SKJ Assessment-rev1（SC-7-SA-WP-04）」，由 SPC 研究人員 Simon Hoyle 博士進行報告，正鰹資源評估分爲三區，第 1 區爲北緯 20 度以北海域，主要爲日本沿近海鰹竿釣與小型圍網漁業，第 2 區爲北緯 20 度以南、東經 170 度以西海域，主要爲大型圍網、日本遠洋鰹竿釣、印尼及菲律賓小型漁業及其他漁業，第 3 區爲北緯 20 度以南、東經 170 度至西經 150 度間海域，主要爲大型圍網漁業，

資源 CPUE 以日本鰹竿釣漁業作業層集資料爲主，並在今年增加使用標示放流資料及圍網觀察員資料修正港口採樣體長資料，親魚與加入量生物關係參數陡度設爲 0.8，評估結果顯示該魚種並未 Overfishing 亦未 Overfished，Kobe plot 如下。



各模式評估生物參考點如下表：

	Reference case	Grid median	Grid 5%	Grid 95%
C_{curr}	1,540,000			
MSY	1,503,600	1,839,533	1,320,540	2,716,140
F_{curr}/F_{MSY}	0.37	0.30	0.09	0.52
SB_{MSY}/SB_0	0.27	0.23	0.12	0.32
SB_{curr}/SB_0	0.79	0.82	0.78	0.86
SB_{curr}/SB_{MSY}	2.94	3.89	2.48	7.06
Y_{Fcurr}/MSY	0.76	0.67	0.46	0.85

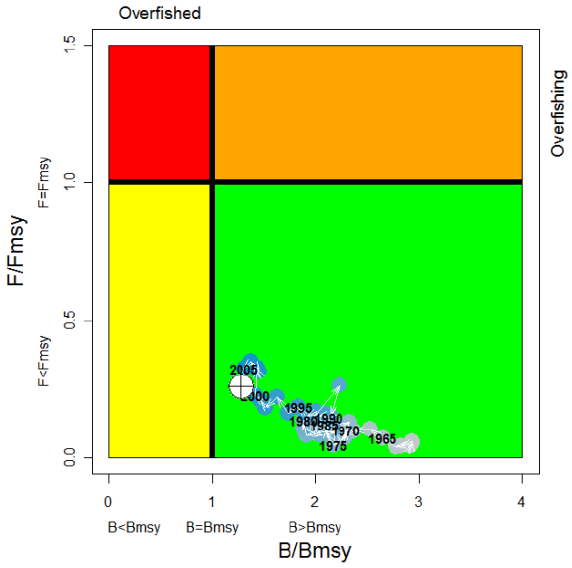
澳洲提問是否有使用 grab/spill 採樣進行正鰹漁獲量校正，SPC 代表 Tim Lawson 回覆此次評估並未使用該資料進行漁獲量修正；印尼代表提問資源評估使用印菲統計計畫資料使用情況，SPC 代表 Peter Williams 回覆因印尼目前作業報表回收不足，因此主要以菲律賓資料爲主，僅就印尼漁獲量總量進行魚種漁獲量切分；韓國代表提問目前日本鰹竿釣資料回收代表性低，以此資料做資源評估是否會有不確定過大之疑慮，SPC 代表 Simon Hoyle 回覆此資料不確定是否具有不確定性（uncertainty）存在，但不足以影響整體評估結果；日本代表表示，日本國內研究人員仍在進行相關資料蒐集以及 CPUE 研究，未來仍會與 SPC 合作提供資訊，並對第 2 區評估漁獲死亡率較先前評估結果高出 2 倍，式模式設定問題亦或是資料問題，SPC 代表 Simon Hoyle 表示主要受到今年使用標示放流資料結果所影響，日本代表另提問先前資源評估親魚與加入量生物關係參數陡度設爲 0.75，但今年

使用 0.8，應該與先前評估使用相同參數值才能比較，SPC 代表 Simon Hoyle 回覆有報告討論此數值，也有使用 0.75 進行評估，使用 0.8 主要爲與大目鮪及黃鰭鮪資源評估使用參數相同。因該魚種資源未過漁，會員國對評估結果無爭議，同意使用該資源評估報告之資源現況進行管理建議討論。

8 月 11 日

六、 資源評估主題（8 月 11 日上午 8 時 30 分，由美國 Dr. John Brodziak 及日本 Dr. Miyabe 共同主持）

（一） 長鰭鮪資源評估「Stock assessment of albacore tuna in the South Pacific Ocean（SC7-SA-WP-06）」，由 SPC 代表 Simon Hoyle 博士進行報告，該鮪種資源評估前次評估於 2009 年，此次資源評估將全南太平洋區分爲 6 區，其中第 5 及第 6 區在西經 110 度以東海域，主要使用日本、韓國以及台灣延繩釣漁業資料進行 CPUE 標準化，今年評估結果與 2009 年類似，結果顯示該鮪種未 overfishing 亦未 overfished，資源評估結果 Kobe Plot 如下所示：



評估生物參考點如下表：

Management quantity	Reference case		2009 Base case
$C_{2007\text{-}2009}$	54,520	$C_{2005\text{-}2007}$	66,869
$YF_{2007\text{-}2009}$	57,130	$YF_{2005\text{-}2007}$	64,490
MSY	85,200	MSY	97,610
$YF_{2007\text{-}2009} / MSY$	0.67	$YF_{2005\text{-}2007} / MSY$	0.66
$C_{2007\text{-}2009} / MSY$	0.64	$C_{2005\text{-}2007} / MSY$	0.69
F_{MSY}	0.14	F_{MSY}	0.14
$F_{2007\text{-}2009} / F_{MSY}$	0.26	$F_{2005\text{-}2007} / F_{MSY}$	0.25
B_0	1,141,000	B_0	1,309,000
B_{MSY}	605,900	B_{MSY}	692,100
B_{MSY} / B_0	0.53	B_{MSY} / B_0	0.53
$B_{2007\text{-}2009}$	762,240	$B_{2005\text{-}2007}$	965,860
$BF_{2007\text{-}2009}$	903,500	$BF_{2005\text{-}2007}$	1,041,000
$B_{2007\text{-}2009}F_0$	950,947	$B_{2005\text{-}2007}F_0$	1,159,433
SB_0	400,700	SB_0	460,400
SB_{MSY}	104,200	SB_{MSY}	120,000
SB_{MSY} / SB_0	0.26	SB_{MSY} / SB_0	0.26
SB_{2009}	234,537	SB_{2007}	273,557
SBF_{2009}	251,500	SBF_{2007}	292,500
$SB_{2009}F_0$	372,043	$SB_{2007}F_0$	402,873
$B_{2007\text{-}2009} / B_0$	0.67	$B_{2005\text{-}2007} / B_0$	0.74
$BF_{2007\text{-}2009} / B_0$	0.79	$BF_{2005\text{-}2007} / B_0$	0.80
$B_{2007\text{-}2009} / B_{MSY}$	1.26	$B_{2005\text{-}2007} / B_{MSY}$	1.40
$BF_{2007\text{-}2009} / B_{MSY}$	1.49	$BF_{2005\text{-}2007} / B_{MSY}$	1.50
$B_{2007\text{-}2009} / B_{2007\text{-}2009}F_0$	0.80	$B_{2005\text{-}2007} / B_{2005\text{-}2007}F_0$	0.83
SB_{2009} / SB_0	0.59	SB_{2007} / SB_0	0.59
SBF_{2009} / SB_0	0.63	SBF_{2007} / SB_0	0.64
SB_{2009} / SB_{MSY}	2.25	SB_{2007} / SB_{MSY}	2.28
SBF_{2009} / SB_{MSY}	2.41	SBF_{2007} / SB_{MSY}	2.44
$SB_{2009} / SB_{2009}F_0$	0.63	$SB_{2007} / SB_{2007}F_0$	0.68

紐西蘭及 FFA 會員國對近年來遠洋漁業國將印度洋作業船移入該區作業表示關心，另外會員國間租船認定不明導致漁獲資料重複提報；另美國代表提問從研究報告似乎暗示雌雄間成長以及死亡率似乎有不同，渠回覆目前尚未進行性別間差異分析，主要受到目前採樣資訊中沒有性別資訊，未來如要分析可能仰賴觀察員資料；中國大陸提問近年來其船隊捕獲率降低，是否有島國專屬經濟區內捕獲率資訊，渠回覆因資料已經整理成大區資訊，因此無法看出個別島國專屬經濟區之捕獲率資訊；澳洲提問是否有使用作業層級資料進行分析，美國代表 Keith Biglow 博士回覆作業層級資料已經在 2009 年評估使用，今年評估也有使用到作業層級資料分析結果；韓國代表提問該國延繩釣實際上會有季節性轉作情況，此情況會影響到船隊 CPUE 標準化結果，渠回覆漁獲資料事先已經進行統計分類，韓國延繩釣船很明顯在 2000 年之後有明顯轉移現象，在 2000 年後已經排除韓國延繩釣船

隊資料。該鮪種因未過漁，會員國對評估結果無異議。

科學次委員會第 39 號計畫報告「Regional study of south pacific albacore population biology: year 3 – biological sampling and analysis（SA-WP-05）」：由 SPC 代表 Simon Nicole 博士進行報告，該項計畫是由 SPC 與澳洲 CSIRO 聯合執行，並由 10 國（包含我國）協助相關資料蒐集、採樣之執行，其主要目的在於研究南太平洋長鰭鮪相關生物特性，包括成長、年齡判定、成熟年齡及季節以及產卵頻率等。報告中說明本 3 年期計畫所收集的西南方長鰭鮪生物採樣資料（耳石及性線），以及初步估計的生物學參數（年齡、成長及生殖），完整的參數評估以及在資源評估上的應用將於今（2011）年底完成。FFA 會員國表示該項計畫是長鰭鮪資源評估之基礎生物參數資訊蒐集，有其必要性，因此請會員國能支持該項計畫；日本代表表示該項計畫主要爲生物資訊，因此有必要在 SC 架構下之生物小組進行討論檢視成果。

（二） 南太平洋劍旗魚資源評估：此議題並無報告事項，由 SPC 代表 Shelton Harley 博士說明在統計小組文件中已經提供有關委員會要求下年度進行南劍旗魚資源評估所需資料調查報告，請會員國就該報告內容檢視提問。紐西蘭代表對於歐盟西班牙船隊未依照委員會規定提送漁或資料表達關切，請歐盟代表回應，因歐盟代表因個人急事未出席，因此由 IRD 研究人員代爲回覆，渠表示已經接獲歐盟總部通知將會近期內提供西班牙船隊作業層級資料，SPC 代表 John Hampton 博士表示在 Kobe 3 與歐盟進行會談，歐盟代表當場承諾將儘快提供相關資料並且也會將西班牙圍網船作業層級資料提送給委員會；美國代表提問澳洲先前與庫克群島聯合執行南劍旗魚標示放流，此資料是否會用在資源評估上，澳洲代表回覆負責該魚種資源評估之 CSIRO 將會使用該資料。

（三） 西南太平洋紅肉旗魚資源評估：此議題由紐西蘭代表進行口頭報告，因澳洲及紐西蘭爲該魚種主要漁業國，目前資料正在蒐集處理中，其中包含商業性捕撈漁業資料以及娛樂漁業資料，澳洲代表表示該國研究人員已經在 2009 年完成相關生物研究，資源評估希望日本及台灣能配合以完成該項工作。

（四） 北方紅肉旗魚及劍旗魚資源評估：由 ISC 旗魚小組主席 Jon Broadizk 博士進行報告，紅肉旗魚今年並無資源評估，北方劍旗魚資源評估結果顯示資源狀況良好無過漁跡象，另外該小組意將進行黑皮旗魚資源評估。澳洲代表表示資源評估結果應該提供 SC 完整評估報告，且紅肉及黑皮旗魚是否爲北方系群仍是未定論，渠回覆 ISC 資源評估報告都在網站上有公佈，可以自行下載閱讀，另外從基因分析上清楚證明北方紅肉旗魚是獨立系群有明確科學證據。

（五） 北方資源狀態（ISC 主席信函）：由 SC 主席 Dr. Miyabe 代爲宣讀，信函中說明北方系群資源評估現況以及 ISC 科學運作情況。FFA 會員國強烈表示因北方紅肉旗魚資源評估工作不理想，因此要求委員會將該種資源評估工作交給 SPC 執行。

（六） 北太平洋長鰭鮪資源評估「Stock Assessment of Albacore Tuna in the North Pacific Ocean in 2011（SA-WP-10）」，由美國 Dr. Steven 報告，主要係說明本年度 ISC 進行之北太平洋長鰭鮪資源評估結果，本次評估以 SS3 及 VPA 模式進行，資源狀態未處於過漁狀態且過漁並未發生中，屬健康狀態。會中主要對於所使用船隊之標準化 CPUE、生物參考點的選用、敏感性分析、標示放流資料之使用等方面進行探討，對於資源評估並無太多疑問。

（七） 隨後則進行本年度進行資源評估魚種之資源狀態及管理建議草案討論（由於會中多爲文字修正討論，過於繁瑣，僅將重要討論加以敘述）：

1. 正鰹：紐西蘭代表將「因爲赤道海域的高漁獲量導致資源分布的改變，以致降低在高緯度海域的正鰹漁獲量降低，例如澳洲、紐西蘭、夏威夷等」等文字列入，日本代表表示同意，並將日本也納入高緯度海域國家。
2. 黃鰭鮪：日方要求將大目鮪及黃鰭鮪所使用的 Run 及 Reference Run 統一表示方式。其餘因本魚種資源狀況上處於良好狀態，會中並無太多討論。
3. 大目鮪：FFA 國家輪番表示，將幼魚漁獲死亡率在 2010 年下降（意指圍網漁業之漁獲死亡率已獲控制），顯示目前管理措施有相當成效等文字列入。我方發言由於 2010 年資料乃是初步資料，且 2010 年漁獲統計資料蒐集並不完整，故此項結果有相當大的不確定性，建議刪除。美國 Dr. Keith Bigelow 表示支持我方

論點，亦建議刪除本段文字。由於 FFA 國家與我方及美國僵持不下，主席裁示三方討論後再決定。會中休息時間，我方與 FFA 國家進行說明，除前述說明外亦以大目鮪資源評估結果中之加入量於 2010 年極速下降，顯示幼魚加入量已發生問題，故並未顯示圍網漁業對於大目鮪幼魚影響已獲控制。美國代表在側陪同說明。最後 FFA 發言將此段文字刪除。

4. 南太平洋長鰭鮪：由於「資源顯處於健康狀態」文字過於模糊，會員國表示資源狀態文字應明確，建議將資源處於過漁狀態且過漁並未進行等文字列入，紐西蘭建議應將 CMM 2010-05 各項船隊管理措施落實等文字列入，澳洲呼應。FFA 國家亦表示認同。（會議於下午 6 時 30 分結束）

8 月 12 日

七、 資源評估主題（8 月 12 日上午 8 時 30 分，由美國 Dr. John Brodziak 及日本 Dr. Miyabe 共同主持）：本日先進行北太平洋長鰭鮪資源狀態管理建議草案進行討論。科學經理 Dr. Soh 表示，本段文字是由 ISC 提供，基本上是不做修正的。會中對於資源狀態及管理建議並無太多討論，隨即通過。最後，主席 Dr. John 說明所有魚種之資源狀態及管理建議文字將再做修整，下週一（8 月 15 日）上午再繼續做最後討論與確認。

八、 管理議題主題（8 月 12 日上午 9 時 30 分，由澳洲 Dr. Robert Campbell 主持）

（一）澳洲 Dr. Robert Campbell 簡報「Convener’s Draft Terms of Reference for Management Issues Theme（MI-IP-02）」，主要係說明「管理議題主題」之權責，包括：

1. Review and evaluate the potential of existing CMMs in achieving their stated management objectives and the trade-offs associated with reconciling multiple objectives;
2. Evaluate the utility of additional management measures on achieving the stated objectives of existing CMMs and the overall management objectives adopted by the Commission;
3. Review, evaluate and identify appropriate reference points and harvest strategies that

will assist the Commission achieve its management objectives;

4. Develop, and review, biological, economic and social performance indicators against which the achievement of management objectives can be assessed;
5. Develop, and review, appropriately structured multi-species, multi-fleet, bio-economic and/or ecosystem-based operational models that can be used to evaluate management measures;
6. Develop, and review, user-friendly software to assist fishery managers in understanding the implications of potential management measures and longer-term strategies;
7. Identify research and data required to support the evaluation of management measures;
8. Make recommendations to the Commission on the above.

會中僅就第 8 點產生疑慮，帛琉代表發言認爲應將「make recommendations」修改爲「provide advices」，隨後韓國代表發言表示該國並非以英語爲母語之國家，請主席說明「recommendation」與「advice」之差異，主席解釋後，並未有太多討論。

（二） 澳洲 Dr. Robert Campbell 簡報「Identification of candidate limit reference points for the key target species in the WCPFC（MI-WP-03）」，報告針對目前主要被各 RFMO 採用之限制性參考點「limit reference point」的三個內容進行檢視，其中包括：最大持續生產量（Maximum Sustainable Yield）、潛在產卵群生物量（spawning potential-per-recruit）及消耗量（depletion）。報告指出陡度（steepness）常被使用在評估漁業資源，但參考點（reference point）通常對陡度非常敏感，在陡度具不確定性時，可能做出不正確的評估結果及管理建議。並且提出三階段的階層方法（three-level hierarchical approach）去選擇並設定限制性參考點。

薩摩亞（Samoa）發言認爲應以 $F_{40\%SPR}$ 及 $20\%SB_0$ 作爲限制性參考點。日本隨即發言可以接受此類型之限制性參考點作爲管理依據，但是其百分比 40%及

20%如何估算或推定而得，仍存有相當大的疑點，不同的魚種有不同的設定，故應保持彈性，不應在現階段就訂定。美國代表亦表示百分比之設定會涉及到魚種的生殖成熟特性及時程，應在多加研究以確認，故應保持彈性。此外，日方接續表示，因爲此限制性參考點涉及到親魚資源量及加入量二者間之關係，所以陡度的設定亦增加其不確定性，此亦應考量。SPC 表示日方所陳述的意見是對的，應從魚種別考量陡度的設定，已確認親魚資源量及加入量二者間之關係。

紐西蘭代表認爲百分比的設定亦會產生風險，隨著百分比的高與低，風險亦伴隨發生，目前建議以低百分比爲主，即 20%SB_0。美國代表發言，如果對於陡度所影響的親魚資源量及加入量間之關係並無深入了解時，應可考慮從後端控制，或以相同之條件降低不確定性。此外，美國代表亦表示「Regime shift」對於資源量亦會產生相當之影響，而此不能只用限制性參考點加以考量，以 MSY 爲基礎之生物參考點亦須考慮，而對於資源的監控亦應了解其每年的變動及異常氣候事件發生的影響，有此現象之最明顯的魚種就是正鰹。另，倘使用限制性參考點，應以漁獲死亡率作爲考量，如此才能結合管理措施。FSM 代表則認爲爲強化管理及養護，應盡速通過此報告。PNA 代表表示除了限制性參考點外，目標參考點（target reference point）也是一種選擇，此外亦須結合經濟、社會等研究。SPC 表示目前報告中，無論是 F40%SPR 或是 20%SB_0，應只是的討論方向。最後，因爲各方皆無共識，主席 Dr. Robert Campbell 表示，此部分下週一（8 月 15 日）再進行討論。

（三） SPC Dr. Shelton Harley 簡報「Projections based on 2011 stock assessments（MI-WP-02）」，說明以延繩釣漁業、圍網、印尼/菲律賓之小型漁船漁業不同努力量（分別爲-30%、-15%、未增減、+15%、+30%）進行對大目鮪、黃鰭鮪及正鰹資源影響的投射分析，認爲目前的分析方式較去年適當且合理。會中並無太多討論。

（四） SPC Dr. John Hampton 簡報「Implementation and effectiveness of CMM 2008-01（WCPFC-2010-15）」，主要是針對去年的 WCPFC-2010-15 報告作更新及摘要，

相關報告內容爲「Analysis of purse seine set type behavior in 2009 and 2010（MI-WP-01）」，其指出圍網漁業近年漁獲努力量逐年增加， CMM 2008-01 並未達到有效限制圍網漁獲努力量；而針對 2010 及 2009 年圍網執行停用 FAD 期間漁業行爲進行分析，發現這段期間皆尚有漁船利用 FAD 作業，唯 2010 年以較 2009 年下降（由 13.5%降至 5.1%），大目鮪漁獲比例在此期間有大幅下降；關閉帶狀公海以歷史資料的角度而言，將降低約 14%圍網漁船努力量；延繩釣 2010 年大目鮪漁獲量基於 2001-2004 年平均水準約降低 30%。

日方表示 2010 年對於關閉區域以外的執法已經改善，所以在關閉區域內之大目鮪魚獲量已經下降，爲何目前大目鮪漁獲量仍然維持在高水準，SPC 表示過去並未考慮印尼及菲律賓之漁獲量資料。日方進一步表示如何可以知道大目諉之漁獲死亡率改變？SPC 表示目前因 2010 年之漁獲統計資料上不完全，故 2010 年之資料上無法可以完全採信，雖然目前大目鮪之幼魚漁獲死亡率已經下降，但仍要等到資料完整後才可以確認。此外，日方代表提問圍網漁業的努力量有下降嗎？SPC 回應在 2010 年之圍網漁業努量量是有移轉之情況。

（五） 法國 Dr. Patrick Lehodey 簡報「Prospects for effective conservation of bigeye tuna stocks in the Western Central Pacific Ocean（MI-WP-05）」，此研究是利用 SEAPODYM（Spatial Ecosystem And population Dynamics Model）分析針對圍網漁業關閉公海，對大目鮪資源保育的影響評估，結果顯示：必需注意若關閉公海時，圍網漁船轉移其努力量分佈，可能無法達到大目鮪保育的效果；在這些禁止作業的水域可減少漁獲努力量，達到對小大目鮪保育的效果；而限制圍網使用 FAD 作業亦對大目鮪保育有極大效果；若在大目鮪產卵區域同時限制延繩釣及圍網漁船作業，則可達最佳保育效果。

九、 生態系及混獲忌避主題（8 月 12 日下午 3 時 45 分，由美國 Mr. Paul Dalzell 主持）

（一） 法國 Dr. Patrick Lehodey 簡報「SEAPODYM working progress and applications to Pacific skipjack tuna population and fisheries（EB-WP 06 rev. 1）」，內容略以：正鰹成魚資源量經由預測分析顯示在 2008-2009 年處於較低水準，但是在 2009 至 2010

年發生 El Niño 事件後，2010 年之較高加入量即伴隨發生。2010-2011 年強大的 La Niña 事件，導致在 2011 年第一季之加入量較低。基於正鰹資源加入量與 ENSO 間之關係，未來可能可以對於未來資源狀況進行預測。此外，以時空間尺度更爲精細之「0.25 度方格x週」爲單位進行分析，可以用來對於正鰹資源變動及漁業行爲的改變進行調查。FFA 表示感謝 Dr. Patrick Lehodey 所作之研究，也認爲此方面的研究有助於環境及氣候因素對於漁業資源之影響的了解。會中並無太多討論。

（二） SPC Dr. Shelley Clarke 簡報「A Proposal for a Process for Designating WCPFC Key Shark Species for Data Provision and Assessment（EB-WP-05）」，內容略以：本篇報告係應 SC6 對於 SPC 要求發展關鍵鯊魚種類的名單產生及確認資源評估等程序而產生，該報告對於新的關鍵鯊種提供一評估架構，包括 1.漁業潛在影響，2.其他保育及管理系統的決定，3.生態考量的程度，4.可用資料的適切性及未來潛在可蒐集資料的可行性。由於會議時間已接近結束，主席裁示明日接續進行討論。（本日會議於下午 5 時 30 分結束）

8 月 13 日

十、 生態系及混獲忌避主題（8 月 13 日上午 8 時 30 分，由美國 Mr. Paul Dalzell 主持）

（一） 本（13）日上午美國代表 Dr. Keith Biglow 向我方表示，有關昨日下午 SPC 所報告之制定 WCPFC 關鍵鯊魚種類之過程，因涉及到由其他系統之養護及管理措施爲主要考量要素，立場傾向政治決定，將會刪除此項，希望我方支持。

（二） 有關 SPC Dr. Shelley Clarke 簡報「A Proposal for a Process for Designating WCPFC Key Shark Species for Data Provision and Assessment（EB-WP-05）」，主要討論爲：美國代表表示在目前程序草案中之三項「Designated for Conservation and Management under other Systems」，因爲係以其他系統之管理及養護措施爲主要考量，立場過於政治化，建議將此程序刪除。我方則表示鯊魚資源評估研究應以目前資料蒐集充分與否爲考量，並以科學需求爲基礎，亦建議將此項刪除。最後主席裁示，請 SPC 就此議題參考各方意見再行修正。

（三） SPC Dr. Shelley Clarke 簡報「An Indicator-based Analysis of Key Shark Species based

on Data Held by SPC-OFP（EB-WP-01）」，內容主要爲：鯊魚資源狀態指標可以在四個類別評估，包括 1.與漁業之交互作用指標；2.漁獲組成；3.漁獲率（單位努力漁獲量）；4.漁撈壓力之生物指標（例如體長分布之中位數、性比等）。

韓國代表提問資料篩選方法，渠回覆資料篩選非常複雜，所以不去多作說明，但資料篩選的目的是要剔除掉填報報表不確實的資料；澳洲代表提問有關 CPUE 標準化的方法，渠回覆目前資料沒有太多資訊可以做不同標準化方法選擇。

（四） SPC Dr. Shelley Clarke 簡報「Analyses of Catch Data for Oceanic Whitetip and Silky Sharks reported by Fishery Observers in the Hawaii-based Longline Fishery in 1995–2010（EB-WP-03）」，內容主要爲：以泛線性模式（GLM）對於以夏威夷爲基地之延繩釣漁業所捕獲之 Oceanic whitetip shark（Carcharhinus longimanus）及 Silky shark（C. falciformis）進行 CPUE 標準化之研究，會中並無太多討論。

（五） SPC Dr. Shelley Clarke 簡報「A Status Snapshot of Key Shark Species in the Western and Central Pacific and Potential Management Options（EB-WP-04）」，內容主要爲：說明目前 WCPFC 之 8 種關鍵鯊種(blue; shortfin and longfin mako; oceanic whitetip; silky; and bigeye, common and pelagic thresher sharks）的目前狀態及可能之降低鯊魚漁獲死亡率的措施。

日本代表表示海嘯過後，氣仙沼漁船三成以上損毀，碼頭設施也都損壞，因此近期會有很大漁業變化；澳洲代表表示希望能在 2012 年部分鯊種資源評估後，能提供委員會發展管理措施，提議委員會能討論有關禁止割鰭、放生等措施，以取代 5%鰭身比措施；韓國代表表示漁民捕獲鯊魚之後脫鉤放生可能會對漁民造成危險，因此韓國正在研究漁具以減少鯊魚混獲；日本表示鯊魚漁業具有歷史性，因此日本不可能同意禁止鯊魚漁獲留艙建議；紐西蘭代表重申鯊魚漁獲資料繳交的重要性，另外表示 FFA 去年提送委員會報告建議禁圈鯨鯊，並重申紐西蘭支持鯊魚漁獲禁止留艙規定，日本代表回覆鯨鯊問題是另一個議題，日本不同意禁止鯊魚漁獲留艙規定。

（六） 美國 Dr. Keith Bigelow 發表「Seabird Interaction Rates Estimated from Observer Data

(2004-2011) in the Hawaii-based Shallow and Deep-set Longline Fisheries（EB-WP-10）」，內容主要爲：以夏威夷爲基地之淺層及深層延繩釣漁業之觀察員資料對於該漁業與海鳥之互動進行研究。由於研究結果並未有明顯結論，會中並無過多討論。

（七）日本 Dr. Yukiko Inoue 簡報「Distribution of Seabird bycatch at WCPFC and the Neighboring Area of the Southern Hemisphere（EB-WP-07）」：澳洲代表提問該研究使用資料爲五度方格，應採用較細資料作分析，渠回覆有細部資料，這些資料只是初步整理，會作細尺度分析；美國代表提問是否有就不同觀察船使用之驅避措施作分類，不同的驅避措施會有不同的效果，渠回覆目前日本釣船使用避鳥繩爲主，因此並無驅避措施差異問題；紐西蘭代表提問就紐西蘭作業船資料發現在塔斯曼海附近潛水海鳥數量不多，但是從日本研究資料卻看到很多潛水海鳥，是否會有辨識錯誤問題，渠回覆這些觀察船都是南方黑鮪作業船，資料都是觀察員資料，但僅是初步資訊。

（八）日本 Dr. Daisuke Ochi 簡報「A Comparison of Two Blue-dyed Bait Types for Reducing Incidental Catch of Seabirds in the Experimental Operations of the Japanese Southern Bluefin Tuna Longline（EB-WP-09）」：紐西蘭代表提問是否有比較藍染餌料下鉤與起鉤釣獲海鳥的差異，因爲藍染餌料起鉤時會有褪色問題，渠回覆所採用資料爲實驗彙整資料，細部資料可以區分出下鉤釣獲或是起鉤釣獲，但結果並未在本報告中呈現；澳洲代表表示藍染餌料實驗應該要採用正常作業，不應該將延繩區分正常作業業間投鉤，藍染餌料日間投鉤，這樣無法評估正常作業情況下藍染餌料避獲海鳥的效果。

（九）日本 Dr. N. Sato 簡報「Preliminary Report of 2010 Weighted Branch-line Trials in the Tuna Joint Venture Fishery in the South African EEZ（EB-WP-08）」：紐西蘭代表表示因爲沒有對照組，因此此報告對於海鳥避獲效果的影響很難有明確科學證據，渠回覆在 20 年前美國延繩釣船都已經安裝投繩機，所以沒有辦法作對照研究，但分析結果仍顯示有明顯避獲海鳥效果。

（十） 本（13）日上午休息時間，日本與我國討論之後重要議題包括管理議題主題之限制性參考點設定及資源評估主題之大目鮪管理建議案。在限制性參考點部分，主要係原工作報告中之 $F_{40\%SPR}$ 及 $20\%SB_0$ 涉及到 steepness 設定之不確定性及魚種別生殖成熟時程差異，雙方將朝向 $F_{X\%SPR}$ 及 $X\%SB_0$ 發展。在大目鮪管理建議案部分，有關圍網及延繩釣漁業對於大目鮪資源影響及相關資源評估投射等結果應有公平對等之敘述，雙方將朝此調整文字。

十一、 WPEA 執行成果報告（8 月 13 日下午 3 時，在秘書處舉行，由美國 Dr. Tony Lewis 主持）：本次會議主要討論越南、菲律賓及印尼等國執行 WPEA 計畫成果，首先由科學經理 Dr. Soh 報告本計畫緣起、相關進展及本次越南、菲律賓及印尼等國計畫之執行目標。隨後依序由印尼、菲律賓及越南報告，贊助單位、主席與科學經理 Dr. Soh 提問答詢後，會議結束。（會議於下午 5 時 30 分結束）

8 月 14 日（星期日，休會）

8 月 15 日

十二、 生態系及混獲忌避主題（8 月 15 日上午 8 時 30 分，由美國 Mr. Paul Dalzell 主持）

（一） 會前，日本表示今（15）日上午討論議題將會涉及鯨鯊及其他相關的混獲物種釋放議題，並提及「Guidelines for safe and live release of encircled non-target animals during purse seine fishing operation」草案，希望我方支持。

（二） 美國科學家 David Itano 簡報「Status of the Purse Seine Bycatch Mitigation Project and research cruises funded by the International Seafood Sustainability Foundation with notes on the development of best practices for the live release of encircled animals（EB-WP-11）」，主要針對圍網混獲海洋動物時如何活體釋放的研究及進展進行簡介。日本於簡報後，表示該國已針對鯨鯊制訂漁船混獲後活體釋放的準則，並對於此議題提出「Guidelines for safe and live release of encircled non-target animals during purse seine fishing operation」草案，主要係說明釋放之程序，紐西蘭及澳洲皆表示支持，相關討論平順，本案隨即通過，於建議草案時再做處理。

（三） SPC Dr. Simon Nicol 報告「Report of the First Meeting of the Kobe Process Joint

Technical Working Group on Bycatch（EB-WP-14）」，針對該次會議議程以及重要的討論主題、內容進行報告，會中並無太多討論。

（四） 中國 Dr. Dai Xiaojie 報告「Review of Chinese Scientific Observer Programme in the Pacific Ocean in 2010（EB-WP-12）」，主要介紹 2010 年中國有 4 個觀察員航次，針對其分別航次的作業分佈、主要鮪類漁獲及鯊魚、海龜分類混獲數量，進行簡要報告。

日本提問中國觀察員能實際辨識報告中多種鯊魚分種（表列 16 種鯊魚），有無照相留存以確認魚種，渠表示觀察員確實有訓練辨識鯊種，而且觀察員都配有相機要求其必須同時照相紀錄。美國尋問觀察員觀測時間，渠表示至少有一半工作觀測，而且會同時記錄船長的作業報表。（會議於中午 12 時 30 分結束）

（五） 午間休息前，SC 主席 Dr. Miyabe 簡介目前管理建議版本後，請日方就所提內容簡述，隨後紐西蘭表示，目前版本以 FFA 及美國較爲相似，建議將三個版本內容經討論整合後再進行討論定案。最後，主席裁定午間休息，由起草國家及相關國家先行討論、整合版本後，於本（15）日下午資料及統計主題結束後或是晚間 6 點起，進行討論議定。

十三、 資料及統計主題（8 月 15 日下午 2 時，由庫克群島 Dr. Pamela Maru 主持）

（一） SPC Dr. Peter Williams 簡報「Data Gaps in the WCPFC Tuna Fisheries」，主要是針對會議文件「Scientific data available to the WCPFC（ST-WP-01）」進行報告，說明各國資料繳交及缺漏情況。會中相關發言主要係鼓勵各國提供歷史資料，及相關漁獲統計資料。

萬納度代表 FFA 會員國重申作業層級資料繳交之重要性以及建議提送 TCC 作討論；日本代表提出延繩釣漁船漁獲資料繳交會有近 2 年落差，所以日本會在資料繳交期限後再補資料，資源評估使用延繩釣漁獲資料取得上會有延遲；美國代表認爲中國小釣船 2009 年及 2010 年在吉里巴斯海域內之漁獲量有缺報之問題，資料提報歸屬問題要加以釐清，中國大陸代表表示 2009 年簽署入漁協定後部分作業船從印度洋移入太平洋海域作業，基於租船協定應該由吉里巴斯提報該漁

獲量，美國代表重申此案不在於誰提報的問題，而是漁獲短報導致大目鮪資源評估過程少 4,000 公噸列入總漁獲量，吉里巴斯表示沒有提送過科學資料因此不知道怎樣提送資料，中國大陸建議此案送 TCC 討論後決定提送資料國，美國表示無論如何資源評估過程還有管理投射都可以先作，紐西蘭表示資料短報或是未報牽涉到會員國義務問題，必須要提送 TCC 作討論；澳洲代表發言表示歷史性資料提送攸關資源評估結果品質，因此希望小組能有建議案要求會員國提送歷史性資料。

（二） SPC 科學家 Timothy Lawson 簡報「Report on Project 60: Collection and Evaluation of Purse-seine Species Composition Data（ST-WP-03）」，說明本計畫至 2008 年 3 月至 2010 年 8 月圍網各研究航次 grab 抽樣及 spill 抽樣的比較結果，包含漁獲組成比例、大目鮪體長頻度比較。另外，也回顧本計畫的目標達成情況及未來展望。

日本代表表示圍網船總量中細分魚種資訊可以在卸魚過程中取得作完整資訊；韓國代表表示已經在國內罐頭廠進行卸魚分類採樣，另外想知道 grab/spill 採樣對資源評估結果的影響，渠回覆因爲目前 grab/spill 採樣多爲 PNG 作業船，作業區域多在定置 FAD 附近，因此採到的小魚比較多，因此體長修正部分尚未使用在資源評估工作上。

（三） SPC 科學家 John Hampton 博士簡報「Misreporting of Purse Seine Catches of Skipjack and Yellowfin-bigeye on Logsheets（ST-WP-02）」，介紹圍網以 grab 抽樣及 spill 抽樣資料分析漁獲組成，結果顯示圍網作業報表填報正鰹漁獲比例過高；而觀察員以視覺觀測之漁獲比例，與實際抽樣資料一致。建議觀察員可以採用視覺觀測當作例行的觀測工作。

日本代表提問有關總漁獲量估算問題，總漁獲量是由觀察員估算以及觀察員估算的方法，渠回覆觀察員估算漁獲量的方法主要採用抄網次估算；日本強調應該將觀察員資料備分給觀察船，船旗國可以使用這些資料進行漁獲量修正；IATTC 代表提問是否有使用 ISSF 所提供資料進行查對，渠回覆西太平洋海域圍網會有單批漁獲多買主的問題，因此 ISSF 所提供之資料查對困難度極大。

（四） 結束各項工作報告簡報及討論之後，隨即進行本主題之管理建議草案討論議定，

由於本次大目鮪及黃鰭鮪等資源評估所指之 2009 及 2010 年資料不完全部分，其中包括中國與吉里巴斯間因租船協定所產生之漁獲量提報問題，粗估 2009 年中國低報（或未報告）約 4,000 公噸，爲中國代表表示依據兩造間之租船協定，漁獲量應由吉里巴斯提送委員會，然吉里巴斯宣稱中國並未報送資料給該國，故無法提送相關資料。美國建議中國於會後將資料提送給委員會以避免困擾，惟中國代表堅持本議題移由 TCC 處理，俟 TCC 確認此漁獲量歸屬於中國或吉里巴斯後，再由該國報送資料。由於 FFA 國家、中國、吉里巴斯、美國、澳洲、紐西蘭、日本等多國輪翻發言，以致會議時程延宕，最後主席對於此段文字，採逐句通過方式進行，有關此議題將移由 TCC 處理。（會議於晚間 5 時 50 分結束）

十四、 管轄魚種之管理建議草案討論（8 月 15 日晚間 6 時起，由 SC 主席 Dr. Miyabe 主持）

（一） 南太平洋劍旗魚、南太平洋紅肉旗魚、等其他魚種，因本年度並無進行資源評估，故引用去年建議文字，並無太大爭議，迅速討論通過。

（二） 本（2011）年度評估之南太平洋長鰭鮪、正鰹及黃鰭鮪，因資源狀況良好，亦無太多討論，亦快速通過。

（三） 在大目鮪管理建議部分，經過起草國家（日本、美國及 FFA）邀集相關國家討論後版本如下：

Management recommendations and implications

Bigeye tuna

1. The SC recommends a minimum of 32% reduction in fishing mortality from the average levels for 2006–2009 to return the fishing mortality rate to F_{MSY}. This recommended level of reduction is equivalent to a minimum 39% reduction of the 2004 level in fishing mortality, and a 28% reduction of the average 2001–2004 levels.
2. It is too early to quantitatively conclude weather CMM2008-01 has reduced fishing mortality for bigeye tuna to the levels specified in the CMM. Data for 2009 and 2010 have been incorporated into the stock assessments, but the 2010 data are incomplete and estimates of fishing mortality in the final year of the model (2010) are particularly uncertain.
3. The FAD closure introduced in 2009 contributed to the reduction of bigeye catches in 2009 and preliminarily in 2010 (cross reference). Total purse seine effort between 20N-20S has increased since 2004 by 14% or 21% in 2009 and 2010, respectively. Total purse seine effort between 20N-20S has increased by 6% from 2008 to 2010 corresponding to the implementation of CMM2008-01

and 2009 was a near record high for associated school effort in spite of the two month FAD closure. This occurred because of an increase in days fished and the provisions, exemptions and a range of other reasons from the regulations.

4. Longline catch in 2010 appeared to have been reduced by 34% from the 2001-2004 level. However this may be over estimated due to incomplete data for 2009 and 2010.
5. Reported catches since 2009 from the mix of surface fisheries in Indonesia and Philippines declined by 33% in 2010, however this needs to be confirmed when more detailed data for 2010, including purse seine effort data, are available.
6. Projections to 2021 indicate that fishing mortality would be reduced to close to the F_{MSY} level, and the stock would move to a slightly overfished state. However, these conclusions should be treated with caution because of data issues and uncertainty about whether fishing patterns in 2010, on which the projections are based, will be maintained, especially with regard to the low level of FAD sets in 2010.
7. Overfishing and the increase in catch of juvenile bigeye have resulted in a considerable reduction in the potential yield of the WCPO bigeye stock. The SC concludes that MSY levels would increase if the mortality of juvenile bigeye was reduced.
8. The SC noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation and depletion rates were highest in equatorial regions (regions 3 and 4 in the stock assessment model), which accounts for 88% of the total bigeye tuna catch (2001-2010), and that the spawning biomass in these regions is estimated to have declined to about 35% of the unexploited level. Measures may consider a spatial management approach.
9. Considering the incomplete submission of data, the SC highlighted the importance of improving the timely provision of all data necessary for stock assessment purposes and encourages all CCMs to provide data in accordance with the WCPFC data rules for scientific data to be provided to the Commission.
10. The SC recommends that the Commission should consider the results of updated projections at WCPFC8, and adopt additional measures to secure additional reductions in fishing mortality above those expected from the current CMM, to ensure that fishing mortality is reduced to at least the F_{MSY} level, and remove the risk of the stock being overfished. Measures that reduce fishing mortality across a range of fish sizes (e.g. fishing gears) are likely to produce the best results.

前述草案於討論中，主要在於第 3、4、6 等段落。紐西蘭認爲應以 CMM 2008-01 對於圍網及延繩釣漁業的設定爲主，並以該建議案之附件爲依據，所以延繩釣漁業之基準爲 2001-04 年水準，圍網漁業爲 2004 年之水準，日方表示對於管理措施執行之成效部分（亦即所降低之漁獲量及漁獲死亡率）應有公平之陳述，故在延繩釣及圍網漁業對於大目鮪漁獲量變動及漁獲死亡率改變趨勢之陳述，皆以 2001-04 年水準及 2004 年水準爲比較基準。最後各方妥協，以日方最後修正爲主。修改文字後版本，俟清稿後再附。（會議於晚間 8 時 30 分結束）

8 月 16 日

十五、 管理議題主題之管理建議草案討論（8 月 16 日上午 8 時 30 分，由澳洲 Dr. Robert Campell 主持）：

美國代表提問建議案使用之限制參考點應參考公約內容以符合委員會目標，紐西蘭代表發言指出公約僅有提式管理應採取參考點，但並未明確定義參考點，主席表示目前討論之參考點主要依據聯合國魚種協定（UNFSA），此為國際性文件，FFA 代表提示 SC 建議案應提是參考委員會公約附件二。針對主席提出考量到資源評估不確定性限制參考點不同水準，會員國間並無異議，然針對未來委員會管理措施之參考點，日本代表提出在會議中已表達應經過充分科學家討論後決定限制參考點水準，因此表達建議案中應保留數值空白（以 X%作代表，即 $F_{X\%SPR}$ 及 $X\%SB_0$），該建議經討論後採納。

針對 SPC/OFP 未來在資源評估後進行管理投射使用之參考點，小組主席建議必須有明確數值讓科學服務研究人員能依照指示進行模擬投射，美國代表提出產卵親魚量（SB）之參考點採 0.2-0.3（SB/SB_0），日本代表表示模擬數值應該更放寬，主席建議可採 0.2-0.5，另外針對下年度進行限制參考點模擬魚種小組會議建議以主要鮪種（大目鮪、黃鰭鮪、正鰹以及南太平洋長鰭鮪）先適用，同時作出建議希望未來 ISC 在資源評估結果中與 SPC/OFP 採用相同模擬數值，首先適用魚種為北太平洋長鰭鮪。

有關建議希望未來 ISC 在資源評估結果中與 SPC/OFP 採用相同模擬數值，首先適用魚種為北太平洋長鰭鮪部分，日本表示 SC 僅能對於委員會提出建議，並非向 ISC 直接提出要求，故建議修正文字。此時，科學經理 Dr. Soh 說明委員會、SC 及 ISC 間之關係。我國隨後表示，有關北方魚種資源之生物參考點設定，已於去年由北方委員會（NC）要求 ISC 提出建議並進行討論，SC 應無需再做建議，建議本段落刪除，最後紐西蘭將原文字修正為「建議委員會要求 ISC 對於生物參考點之設定，再多予討論」等類似文字。

十六、 資料及統計主題建議草案討論（8 月 16 日下午 2 時，由庫克群島 Dr. Pamela Maru 主持）：

本次建議草案主要討論係為圍網漁獲統計資料因具有漁獲量及魚種組成的不確定性，故紐西蘭與澳洲代表發言要求將此資訊送 TCC 之 CCMM 討論，我方發言表示圍網

漁業之漁獲量及魚種組成之不確定性，無法精準提報，乃爲本漁業之本質，而此問題屬於技術性問題，非管理及執法議題，移由 TCC 討論並無法解決問題。美國隨即發言支持，日本亦表示同意我方看法，並要求將相關文字刪除。此外，中國亦呼應我方看法。因爲紐西蘭與澳洲及相關 FFA 國家堅持，故將文字略做修正爲 SPC 所提之報告（Misreporting of purse seine catches of skipjack and yellowfin-bigeye on logsheets（ST-WP-02））移由 TCC 討論。

十七、 生態系及混獲忌避主題之管理建議草案討論（8 月 16 日下午 4 時，由美國 Dr. Paul Dalzell 主持）：

本主題建議草案之爭議，主要在於圍網漁業在作業期間應對於鯨鯊及海洋哺乳類動物之活體釋放（live and release）建議，因爲之前在本主題討論時，並未涉及海洋哺乳類動物之釋放問題，且日方已經提出草案「Guidelines for safe and live release of encircled non-target animals during purse seine fishing operation」中所未 non-target animals 並未設定物種，故於本節討論中，紐西蘭及澳洲堅持在鯨鯊之後再加上海洋哺乳類，引起日方反彈，並提出建議將海洋哺乳類刪除。此外，我方表示目前已獲同意之進一步討論之日方草案，並未設定物種，應可以涵蓋目前建議案之相關三個段落，建議將此三項段落整併爲一個段落。惟紐、澳兩方堅持加上 FFA 等國呼應，最後仍將海洋哺乳類動物列入。

十八、 未來工作計畫及經費、行政事務及其他事項等議程（8 月 16 日下午 5 時 30 分，由 SC 主席 Dr. Miyabe 主持）：

（一） 未來工作計畫及經費：主要討論之項目包括 2012、2013 及 2014 年之預定工作計畫（包含委由 SPC 及澳洲 CSIRO 之相關計畫），包括：大目鮪、正鰹、黃鰭鮪等魚種之生物相關研究（耳石、生殖腺），及標示放流試驗、生物參考點（包括目標參考點及限制性參考點等）研究等。

（二） 行政事務：主要議題係大目鮪資源評估之同儕檢視，由日本 Dr. Peter Miyake 進行報告，主要內容係檢視人員之選定、撿視項目及經費等程序。此外，有關明年度科學委員會會議之地點及主辦國議題，同時會中亦傳閱 WCPFC 文件，說明在 FSM Pohnpei 舉辦之經費節約情形，及承辦 SC 會議之條件，且會議地點及主辦國需經

由委員會同意。會中並無任何國家主動提出願意承辦。

（三） 其他事項：會中並無提出。

（四） 最後主席宣布散會，並於明（17）日進行本次會議之會議報告定稿。（會議於 16 日晚間 8 時 30 分結束）

8 月 17 日

十九、 未來工作項目及預算、未來 SC 運作及會議報告定稿等議程（8 月 17 日上午 10 時，由 SC 主席 Dr. Miyabe 主持）：

（一） SC 主席 Dr. Miyabe 表示先進行 SC 副主席、生態系及混獲忌避主題之小組主席及資源評估小組主席選舉。最後 SC 副主席留由 WCPFC8 決定；生態系及混獲忌避主題之小組主席由斐濟 Mr. Jone Amoe 擔任，副主席之提名及確認則在 SC8 之前決定；資源評估小組主席由日本 Dr. Miki Ogura 擔任，副主席則將由美國選派科學家擔任。

（二） 未來工作項目及預算討論（由美國 Dr. Keith Bigelow 主持）：澳洲提出有關「Harvest control rules」計畫 2012 及 2013 年之預算皆爲 15,000 美金，建議提高爲 30,000 美金。有關大目鮪資源評估研究同儕檢視計畫，2012 年規劃爲 56,000 美金，2013 年爲 83,000 美金，2014 年爲 91,000 美金。

有關正鰹耳石研究計畫 2014 年預算爲 125,000 美金，美國提出因正鰹亦受氣候影響成長及耳石判讀不易，建議將此計畫併同預算刪除，日本提出因正鰹耳石研究已發表於期刊可以參考，我方則表示同意美國及日本看法此計畫可以刪除並將經費移除。日方進一步表示 2014 年計畫目標爲何？有關正鰹研究應有明確的區域及研究方向已補足目前研究不足之處，可以朝向縮小計畫規模及經費考量。紐西蘭表示因爲正鰹資源評估研究需要，此計畫仍有必要存在。最後因無共識，正鰹耳石研究保留。

（三） 未來 SC 運作議題討論（由澳洲 Dr. Robert Campell 主持）：資料及統計主題移至資源評估主題前召開；各項主題會議應控制時間以完成建議草案草擬及定案；有關生物、資源評估、方法及漁撈技術等重要研究報告移至資源評估準備工作會議

（SPC Pre-Assessment Workshop）討論，SC 僅確認未來前述各項之研究需求。會中並無特別意見，迅速通過。

（四） 最後由 SC 副主席 Dr. Pamela Maru 進行會議報告清稿及定案，有關 WCPFC 管轄魚種管理建議（Management advice and implications）原文如下：

BIGEYE

- The SC recommends a minimum of 32% reduction in fishing mortality from the average levels for 2006–2009 to return the fishing mortality rate to F_{MSY}. This recommended level of reduction is equivalent to a minimum 39% reduction of the 2004 level in fishing mortality, and a 28% reduction of the average 2001–2004 levels.
- It is too early to quantitatively conclude whether CMM2008-01 has reduced fishing mortality for bigeye tuna to the levels specified in the CMM. Data for 2009 and 2010 have been incorporated into the stock assessments, but the data for these years are incomplete and estimates of fishing mortality in the final year of the model (2010) are particularly uncertain.
- The FAD closure introduced in 2009 contributed to the reduction of bigeye catches in 2009 and preliminarily in 2010 (Agenda item 4.3a). Total purse seine effort between 20N-20S is 14% and 21% higher in 2009 and 2010, respectively, relative to 2004, and is 27% and 35% higher in 2009 and 2010, respectively, relative to the average of 2001-2004 (for flag specific references, refer to attachment B, CMM 2008-01).
- Total purse seine effort between 20N-20S has increased by 6% from 2008 to 2010 corresponding to the implementation of CMM2008-01 and 2009 was a near record high for associated school effort in spite of the two month FAD closure. This occurred because of an increase in days fished and the provisions and exemptions within the CMM2008-01 and a range of other reasons.
- Longline catch in 2010 appeared to have been reduced by 34% from the 2001-2004 level and by 48% from 2004 (for flag specific references, refer to attachment F, CMM 2008-01). However this may be over estimated due to incomplete data for 2009 and 2010.
- Reported catches since 2009 from the mix of surface fisheries in Indonesia and Philippines declined by 33% in 2010, however confirmation is required when more detailed data for 2010 are available including purse seine effort data.
- Projections to 2021 indicate that fishing mortality would be reduced to close to the F_{MSY} level, and the stock would move to a slightly overfished state. However, these conclusions should be treated with caution because projections are based on incomplete data and the assumption that catch and effort levels in 2010 will be maintained.
- Overfishing and the increase in catch of juvenile bigeye have resulted in a considerable reduction in the potential yield of the WCPO bigeye stock. The SC concludes that MSY levels would increase if the mortality of juvenile bigeye was reduced.
- The SC noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation and depletion rates were highest in

equatorial regions (regions 3 and 4 in the stock assessment model), which accounts for 88% of the total bigeye tuna catch (2001-2010), and that the spawning biomass in these regions is estimated to have declined to about 17% of the level that is estimated to occur in the absence of fishing ($SB_{2010,F=0}$). The Commission may consider measures that utilise a spatial management approach.

- Considering the incomplete submission of data, the SC highlighted the importance of improving the timely provision of all data necessary for stock assessment purposes and encourages all CCMs to provide data in accordance with the WCPFC data rules for scientific data to be provided to the Commission.
- The SC recommends that the Commission should consider the results of updated projections at WCPFC8, and adopt additional measures to secure additional reductions in fishing mortality above those expected from the current CMM, to ensure that fishing mortality is reduced to at least the F_{MSY} level, and remove the risk of the stock being overfished. Measures that reduce fishing mortality across a range of fish sizes (e.g. fishing gears) are likely to produce the best results.

YELLOWFIN

- The SC determined that the WCPO yellowfin appears to be capable of producing MSY. The stock is not experiencing overfishing and is not in an overfished state. Projections to 2021 indicate that fishing mortality is projected to remain below F_{MSY} and the spawning biomass will remain above SB_{MSY}.
- However, the SC noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation rates were highest in the western equatorial region (region 3 in the stock assessment model), which accounts for ~81% of the total yellowfin tuna catch, and that the spawning biomass in this region is estimated to have declined to about 31% of the unexploited level ($SB_{2010,F=0}$).
- The SC recommended that there be no increase in fishing mortality in the western equatorial region.
- The increase in catch of juvenile yellowfin has resulted in a moderate (~40%) reduction in the potential yield of the WCPO yellowfin stock. The SC concludes that MSY levels would increase if the mortality of juvenile yellowfin was reduced.

WCPO SKIPJACK TUNA

- Catches in 2010 were roughly 1.556 million mt, the second highest recorded and below the record high catch of 1.608 million mt in 2009. Equilibrium yield at the current F is about 1.14 million mt. This is about 76% of the MSY level. The assessment continues to show that the stock is currently only moderately exploited ($F_{CUR}/F_{MSY} = 0.37$) and fishing mortality levels are sustainable. However, there is concern that high catches in the equatorial region could result in range contractions of the stock, thus reducing skipjack availability to higher latitude (e.g. Japan, Australia, New Zealand, Hawaii) fisheries.
- If recent fishing patterns continue, catch rate levels are likely to decline and catch should decrease as stock levels are fished down to MSY levels. Due to the rapid change of the fishing mortality and biomass indicators relative to MSY in recent years, increases of fishing effort should be monitored. The Commission should consider developing limits on fishing for skipjack to limit the declines in catch rate associated with further declines in biomass.

- Fishing is having a significant impact on stock size, especially in the western equatorial region and can be expected to affect catch rates. The stock distribution is also influenced by changes in oceanographic conditions associated with El Nino and La Nina events, which impact upon catch rates and stock size. Additional purse-seine effort will yield only modest gains in longterm skipjack catches and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas. The management of total effort in the WCPO should recognize this.
- Noting the uncertainty in purse-seine species composition, SC7 urged the Commission to continue improving estimates of purse-seine composition data. SC7 requested CCMs, port states, flag states and vessel operators to support efforts for paired spill and grab sampling together with the effort to collect landings and cannery data.

SOUTH PACIFIC ALBACORE

- The South Pacific albacore stock is currently not overfished nor is overfishing occurring, and current biomass levels are sufficient to support current levels of catch. Any increases in catch or effort are likely to result in catch rate declines, especially relating to longline catches of adult albacore, with associated impacts upon vessel profitability. SC7 further notes that vessel activity must be managed, as per the requirements of CMM 2010-05.
- The SC7 noted that the impact of oceanographic and climate variability is a key area of uncertainty and supported continued integration in future stock assessments. SC7 recognised the economic difficulties faced by the domestic albacore fisheries of Pacific Island countries and territories.

SOUTH PACIFIC SWORDFISH

- The advice from SC5 should be maintained, pending a new assessment or other new information. SC7 recommended that Statistics Paper IP-04 be forwarded to the TCC for consideration.

SOUTHWEST PACIFIC STRIPED MARLIN

- The stock status description and management advice from SC2 should be maintained, pending a new assessment or other new information..

NORTH PACIFIC STRIPED MARLIN

- SC7 recommends an immediate reduction in fishing mortality for this stock. SC7 noted that CMM 2010-01 was agreed by WCPFC7 to achieve this goal, but that the catch limits in that CMM need to be reviewed to ensure that they are sufficient.
- SC7 recommended that SPC should work with ISC on the data related work required for the next assessment. If the ISC fails to provide stock assessment results by SC8, future stock assessments for this stock be undertaken by the science service provider as part of the work programme of the SC.

二十、 有關下次會議（SC8）初步規劃爲 2012 年 8 月 7 至 15 日，地點將在確定後公佈。

二十一、會議報告定稿後，SC 主席 Dr. Miyabe 於 17 日晚間 7 時 30 分宣布會議結束。

參、心得與建議

一、 本次會議重要結果如次：

（一）主要魚種資源狀態及管理建議：

1.大目鮪：資源狀態：最大持續生產量（MSY）爲 76,760（範圍：68,360 - 83,720）公噸，資源處於過漁進行中（Overfishing）狀態，但尚未處於已過漁（Overfished）狀態。管理建議：考量赤道海域爲開發率及資源降低率最高之區域，佔 2001-2010 年漁獲量水準約 88%，親魚資源量在此區域降低約 17%左右，建議考量有效之空間管理措施。應降低對於所有體型大小魚體之漁獲死亡率，以確保漁獲死亡率低於最適水準並降低過漁之風險。

2.黃鰭鮪：資源狀態：MSY 爲 538,800（432,000 - 644,800）公噸，資源並未處於已過漁狀態且過漁並未正在進行中之狀態。管理建議：建議在西赤道海域之漁獲死亡率不應再增加。

3.正鰹：資源狀態：MSY 爲 1,503,600（1,274,000 - 1,818,000）公噸，資源並未處於已過漁狀態且過漁並未正在進行中之狀態。管理建議：因漁獲死亡率及資源量指標快速改變，漁獲努力量增加之情形應被監控，建議應考慮發展捕撈正鰹之限制。

4.南太平洋長鰭鮪：資源狀態：MSY 爲 85,200 公噸，資源並未處於已過漁狀態且過漁並未正在進行中之狀態。管理建議：因因任何漁獲量或努力量增加將導致漁獲率的降低，特別是延繩釣漁業對於親魚資源的影響。建議漁船活動應以 CMM 2010-05「南太平洋長鰭鮪養護與管理措施」建議案有效管理。

（二）管理議題：有關限制性參考點（limit reference point）部份，建議以親魚及加入量（spawner and recruitment）關係比例之漁獲死亡率（$F_{X\%SPR}$）及親魚資源量初始值之比例（$X\%SB_0$）爲方向加以考量，並對於以 MSY 爲基礎之參考點及目標參考點（target reference point）再進行討論，提出適當之參考點供作管理決策使用。

（三）生態系及混獲忌避議題：SC 將發展「圍網漁業作業期間對於鯨鯊及海洋哺乳類動物之活體釋放綱要」。

二、 本年 SC7 會議結果將作爲本年底 TCC7 及 WCPFC8 年會後續討論之科學相關議題背景資料，擬積極研擬準備因應立場，採取務實可行及彈性方案，俾維護相關權益。

三、 有關 SC7 所建議各項科學研究議題，將視可行性及重要性規劃納入明（2011）年遠洋相關科技計畫。

肆、附件

附件一、我國代表團成員、議程及相關準備資料

我國代表團成員

單位	職稱	姓名
漁業署	技正	周世欽
	秘書	王文英
中華民國對外漁業合作發展協會	組長	於仁汾
	組員	劉弘一

議程及相關準備資料

AGENDA ITEM 1-OPENING OF THE MEETING
- 1.1 Welcome address
- 1.2 Meeting arrangements
- 1.3 Issues arising from the Commission
- 1.4 Adoption of agenda
- 1.5 Reporting arrangements
- 1.6 Intersessional activities of the Scientific Committee

AGENDA ITEM 2-REVIEW OF FISHERIES
- 2.1 Overview of Western and Central Pacific Ocean (WCPO) fisheries*
- 2.2 Overview of Eastern Pacific Ocean (EPO) fisheries
- 2.3 Annual Report (Part 1) from Members, Participating Territories and Cooperating Non-Members (CCMs)
- 2.4 Reports from regional fisheries bodies and other organizations

SC6

Chinese Taipei

132. Three types of Taiwanese tuna fishing vessels operated in the Convention Area in 2009: 75 large tuna longline fishing vessels, 1,220 small tuna longline fishing vessels and 33 distant-water purse-seine fishing vessels. The total 2009 catch by the large tuna longline fishery was 22,318 mt, 38,704 mt for the small tuna longline fishery, and 192,075 mt for the distant-water purse-seine fishery. In 2009, the number of scientific observers was 21, with 31 observation trips conducted. Logbook data collection for the large tuna longline fishery in 2009 was modified, and now includes more shark species (i.e. thresher shark, tiger shark, white shark, porbeagle, crocodile shark, hammerhead shark and oceanic white-tip shark).

AGENDA ITEM 3-STOCK STATUS THEME

3.1 WCPO bigeye tuna
- 3.1.1 Review of research and information
  - a. Review of Project 35
  - b. Review of 2011 stock assessment

SC6

Project 35 – Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology

6. To assist SC in determining the priority of Phase 21, SC6 requested that the report to the 2011 meeting include outcomes from three runs of the 2010 bigeye stock assessment model; specifically i) the use of the growth curve estimated from the pilot study; ii) the use of the maturity ogive estimated from the pilot study; and iii) a combination of i) and ii).

7. SC6 encouraged all flag states to achieve the 5% observer coverage of such vessels as required by the observer CMM to facilitate the collection of biological samples.
8. SC6 also recommended that:

- Maturity schedules for stock assessments should be estimated using histological methods. Gonad index (GI) values can be used for evaluating spawning distributions but should not be used for estimating maturity schedules.
- Presentation of Project 35 (the bigeye age and reproductively pilot study) be deferred to SC7. Included in the report to SC7 will be three sensitivity analyses (revised growth curve, new maturity ogive and both combined) using the 2010 bigeye assessment.

3.1.2 Provision of scientific information

a. Status and trends*

b. Management advice and implications*

SC6

257. SC6 selected run 3d, which had a steepness estimated at 0.98 (hereafter referred to as the base model) to represent the stock status of bigeye tuna and considered run 4b to illustrate status assuming a lower value to steepness (0.75) (Table BET1).

258. SC6 agreed that the value of steepness is difficult to estimate in assessment models and the estimated value of 0.98 should be considered uncertain. Most estimated values of steepness in sensitivity runs were >0.95; however, the actual value of steepness for the WCPO bigeye stock currently remains unknown. As a comparison to the base model, SC6 chose to also represent stock status with a value of 0.75, which was the mid-point of five steepness values (representing the range 0.55–0.95 of plausible steepness values) considered in sensitivity runs in the 2010 assessment.

259. For the base model, $F_{current}/F_{MSY}$ is estimated at 1.41, indicating that overfishing is occurring for the WCPO bigeye tuna stock and that in order to reduce fishing mortality to F_{MSY}, a 29% reduction in fishing mortality is required from the 2005–2008 level (Fig. BET5). Considering historical levels of fishing mortality, a 31% reduction in fishing mortality from 2004 levels is required (consistent with the aim of CMM 2008-01), and a 20% reduction from average 2001–2004 levels.

260. Current stock status in the base model indicates that the current total and spawning biomass are higher than associated MSY levels ($B_{current}/B_{MSY}$=1.39 and $SB_{current}/SB_{MSY}$=1.34). This indicates that that the WCPO bigeye stock is not in an overfished state (Table BET1, Fig. BET5 top) if the spawning biomass reference period is 2005-2008. However, if the spawning biomass period is considered to be 2009, then the spawning biomass is further reduced (SB_{latest}/SB_{MSY}=1.17).

261. Stock status results with regard to MSY RPs are far worse when a lower (0.75) value of steepness is assumed, run 4b requires a 49% reduction in fishing mortality is required from the 2005–2008 level to reduce fishing mortality to F_{MSY}. The stock is in a slightly overfished state (SB_{latest}/SB_{MSY}=0.97) when the lower value of steepness (0.75) is assumed.

262. The bigeye assessment in 2010 is comparable to the 2008 and 2009 assessment (Table BET2) although there are differences in catch and effort data, size frequency and a few different structural assumptions. The primary differences are revised catch estimates for all fleets from Indonesia and the Philippines; exclusion of some size data from the Philippines; and increased purse-seine catches based on experimental spill samples.

263. In comparing the 2009 and 2010 assessment using the same MSY time window (2001–2004), the 2010 base model is more optimistic, with an $F_{current}/F_{MSY}$ estimate of 1.25 compared with 1.53 in run 14 of the 2009 assessment (Table BET3).

264. An analysis of current levels of fishing mortality and historical patterns in the mix of fishing gear types indicates that MSY has been reduced to less than one-half of its levels prior to 1970 through the harvesting of juveniles (Fig. BET6).

Table BET2. Comparison of WCPO bigeye tuna reference points from the 2010 base model

(steepness estimated as 0.98); shown in parentheses is the alternative 2010 run (steepness assumed as 0.75), ranges of six sensitivity analyses in the 2009 assessment and base model and sensitivity analyses in the 2008 assessment.

Management quantity	2010 assessment Run3d (Run4b)	2009 Assessment	2008 Assessment
Most recent catch	126,769 mt (2009)	134,315 mt (2008)	143,059 mt (2007)
MSY and MSY (recent R)	73,840 (65,640) mt 132,403 (131,495) mt	52,120-67,800 mt 110,000~146,114 mt	Base case: 64,600 mt 56,800-65,520 mt
$F_{current}/F_{MSY}$	1.41 (1.97)	1.51-2.55	Base case: 1.44 1.33-2.09
$B_{current}/B_{MSY}$	1.39 (1.09)	1.11-1.55	Base case: 1.37 1.02-1.37
$SB_{current}/SB_{MSY}$	1.34 (0.97)	0.85-1.42	Base case: 1.19 0.76-1.20
$YF_{current}/MSY$	0.94 (0.56)	0.12-0.92	Base case: 0.94 0.50-0.97
$B_{current}/B_{current, F=0}$	0.23 (0.24)	0.18-0.29	Base case: 0.26 0.20-0.28
$SB_{current}/SB_{current, F=0}$	0.17 (0.18)	0.11-0.19	Not available

265. SC6 recommended a minimum 29% reduction in fishing mortality from the average levels for 2005–2008, with the goal of returning the fishing mortality rate to F_{MSY}. Recommended reductions in fishing mortality change between stock assessments and between the time windows in which MSY levels are calculated. The current recommendation is equivalent to a minimum 31% reduction in fishing mortality from 2004 levels, and a minimum 20% reduction from average 2001–2004 levels. Current stock status indicates that the current total and spawning biomass are higher than associated MSY levels ($B_{current}/B_{MSY}$=1.39 and $SB_{current}/SB_{MSY}$=1.34).

266. The base model estimate of the $F_{current}/F_{MSY}$ ratio in the 2010 assessment was 1.25 and lower than the estimate (1.53) in the run 14 of the 2009 assessment when estimated over the same MSY window (2001–2004), thus stock status is more optimistic in the 2010 assessment.

267. Interpretation of stock status with regard to MSY RPs and associated fishing mortality reductions are highly dependent on the steepness in the stock recruitment relationship. Steepness is difficult to estimate and, therefore, generally uncertain. SC6 noted that the current stock status may be overly optimistic as estimated steepness (0.98) is essentially one (1), whereby recruitment is completely independent of spawning biomass. If steepness is substantially less than 1, then the interpretation of stock status is more pessimistic and greater reductions in fishing mortality will be required to obtain F_{MSY}, suggesting that the stock may be in an overfished state.

268. Overfishing and the increase in catch of juvenile bigeye have resulted in a considerable reduction in the potential yield of the WCPO bigeye stock. SC6 concluded that MSY levels would increase if the mortality of juvenile bigeye was reduced.

269. Considering the late submission of bigeye data, SC6 highlighted the importance of improving the timely provision of all data necessary for stock assessment purposes and encouraged all CCMs to provide data in accordance with the WCPFC data rules for scientific data to be provided to the Commission.

270. SC6 reiterated the advice from SC5 on the efficacy of CMM-2008-01 in reducing fishing mortality:

i. CMM-2008-01 is likely to achieve one of its objectives: not exceeding levels of fishing mortality on the WCPO yellowfin tuna stock beyond the level experienced either in 2004 or the annual average of the period 2001–2004.
ii. However, even if fully implemented and complied with, CMM-2008-01 is extremely unlikely to achieve its most important objective: reducing fishing mortality on the WCPO bigeye tuna stock to at least 30% below the level experienced either in 2004 or the annual average of the period 2001–2004. Furthermore, if the high seas pockets closure results in effort being

transferred to high seas areas to the east, where bigeye tuna generally form a greater proportion of the purse-seine catch, the objectives of CMM-2008-01 will be even less likely to be achieved.

3.2 WCPO yellowfin tuna

3.2.1 Review of research and information

3.2.2 Provision of scientific information

a. Status and trends*

b. Management advice and implications*

3.3 Requests from CMM 2008-01

a. Fishing effort for bigeye and yellowfin tuna from other commercial tuna fisheries*

b. Review of CMM 2008-01*

Review of the implementation and effectiveness of CMM 2008-01 (WCPFC7-2010/15.rev 1 29 November 2010) circulated in WCPFC 7th commission meeting

Executive Summary

The paper provides a review of the implementation and effectiveness of CMM 2008-01 using the most current data and stock assessments available.

Implementation of CMM 2008-01

The implementation of the CMM was reviewed for its key components – purse seine effort, the FAD closure, the high seas pockets (HSP) closure, longline catches and catches by other fisheries. The main conclusions from the paper regarding implementation are as follows:

Purse seine effort

CMM 2008-01 has not been effective in constraining growth of purse seine effort, with effort (excluding domestic purse seiners based in Indonesia and Philippines) in 2010 estimated to have increased by approximately 22-27% compared to effort in 2004, and by 36-42% compared to the 2001-2004 average effort.

FAD closure

The FAD closure in 2009 seems to have been largely respected, with about 10% of observed fishing days (based on currently available observer data) during the closure period having activities that might be interpreted as, or supporting, FAD fishing. The proportion of bigeye tuna caught in unassociated sets during the closure was slightly higher than in previous years. Reasonable levels of catch and effort were maintained during the closure and 2009 was a record year for the purse seine fishery overall. The proportion of associated sets in the ten months of 2009 that were not closed to FAD fishing was high, with the total number of associated sets in 2009 being the highest since 2004 and the second highest ever.

High seas pockets closure

Available data from all sources indicate that the HSP closure since 1 January 2010 has largely been respected. However, the closure has clearly not resulted in a removal of effort from the fishery, as 2010 purse seine effort looks like being around 10% higher than the previous record level in 2008-2009. The additional effort that has occurred in 2010 appears to have occurred mainly in PNA waters, with the eastern high seas not subject to an unusual increase in effort in 2010.

Longline catches

The longline catch of bigeye tuna in 2009 was 65,596 tonnes, the lowest since 1996. The catch represents a 21% reduction from the average bigeye catch in 2001-2004. The longline catch of yellowfin tuna in 2009 was approximately 9% less than the average catch in 2001-2004.

Other fisheries

For fisheries other than purse seine and longline, total catches for 2009 are slightly less than their respective average levels for 2001-2004 for both bigeye and yellowfin tuna.

Effectiveness of CMM 2008-01

The paper also reviewed the effectiveness of the CMM, in particular in reducing the fishing mortality of bigeye tuna as recommended by the Sixth Regular Session of the Scientific Committee

(SC6).

A grid of generic stock projections was compiled according to a detailed request by SC6. The projections incorporated changes in longline catch, purse seine associated effort and Indonesian and Philippines domestically-based effort. The changes in catch or effort for these three fishery groups ranged from a 50% reduction to a 30% increase, as per the SC6 request. The detailed results of the projections for the three species (bigeye, skipjack and yellowfin tuna) are posted on the WCPFC 7 web page as Microsoft Excel files.

Within the many combinations investigated, there is a relatively small subset, summarized in Table 4, that achieves the objective of the CMM in reducing bigeye tuna fishing mortality to a level consistent with MSY. Typically, significant reductions in at least two of the three fishery components are required to achieve MSY conditions. However, for the subset of projections in which F_{MSY} for bigeye tuna was achieved, the reductions in total catches that result are relatively minor, a maximum of 5.6%. This is because (i) there is some degree of increase in the three stocks under all scenarios in the subset; (ii) we assume that effort reductions for purse seine associated sets are compensated by transfer of that effort to purse seine unassociated sets; and (iii) in scenarios that reduce effort targeted at smaller fish (purse seine associated sets and Indonesia and Philippines domestic fisheries), some of the catch forgone is taken by fisheries targeting these fish at larger size (longline and purse seine unassociated sets).

The SC6 request called for information on three additional scenarios: (i) the implementation of the CMM as written, taking into account available information to date from the fisheries; (ii) the implementation of the CMM without exemptions; and (iii) the implementation of an additional high seas closure in the region 10ºN-20ºS, 170ºE-150ºW, referred to as "the eastern high seas".

(i) For the implementation of the CMM as written, we estimate that a 14% reduction in bigeye tuna overfishing (F/F_{MSY} reducing from 1.49 to 1.42) can be expected.

(ii) In the absence of the various exemptions and exclusions built into the measure, our best estimate of the amount of bigeye tuna overfishing expected to be removed is 50% (F/F_{MSY} reducing from 1.49 to 1.26).

(iii) The eastern high seas have on average accounted for approximately 4% of purse seine effort in the WCPFC Convention Area, although utilization can be higher during El Niño periods. The proposed closure of the eastern high seas, under the assumption that the historical effort in this area would not be redistributed, is estimated to remove 8% of bigeye tuna overfishing (F/F_{MSY} reducing from 1.49 to 1.45). While this percentage reduction is small, it is large relative to the percentage of purse seine associated set effort removed (3.2%), due to the relatively high vulnerability of bigeye tuna to purse seine associated sets in this region.

3.4 WCPO skipjack tuna

3.4.1 Review of research and information

3.4.2 Provision of scientific information

a. Status and trends*

b. Management advice and implications*

SC6

310. SC6 selected run 41 as the base model to represent the stock status and Committee's advice on skipjack tuna. A value of 0.75 was chosen as the mid-point of the range of steepness values considered in the 2010 assessment. Similar to bigeye tuna, the actual value of steepness for WCPO skipjack currently remains unknown.

311. Fishing mortality rates tended to be higher during the last decade than for the preceding period, and fishing mortality and biomass indicators relative to MSY started to move to 1.0, although they remained substantially below the F_{MSY} level ($F_{current}/F_{MSY}$=0.34) (Table SKJ1). The stock is not in an overfished state because biomass is above the B_{MSY} ($B_{current}/B_{MSY}$=2.42). Table SKJ2 compares RPs between the 2010 and 2008 assessments, and the key conclusions based on MSY quantities between assessments are similar.

Table SKJ2. Estimates of reference points from the 2010 and 2008 skipjack tuna stock

assessments. The spatial domain of the 2008 assessment was limited to the equatorial region of the WCPO.

Management quantity	2010 Assessment	2008 Assessment
Most recent catch	1,575,287 mt (catch based on spill sampling)[a]	1,546,436 mt (2007[b]) 1,726,702 mt (2007[c]) 1,410,389 mt (WCPO catch based on spill sampling)
MSY	1,375,600 mt	1,280,000 mt
$YF_{current}/MSY$	0.80	0.70
$B_{current}/B_{current, F=0}$	0.63	0.66
$F_{current}/F_{MSY}$	0.34	0.26
$B_{current}/B_{MSY}$	2.24	2.99
$SB_{current}/SB_{MSY}$	2.67	3.82

[a] Total catch in 2009 of 1,789,979 mt based on grab sampling.
[b] Equatorial region, based on grab sampling. [c] WCPFC region mt, based on grab sampling.

312. Catches in 2009 increased to a historical high of ~1.8 million mt. This is significantly above the estimated MSY of ~1.35 million mt. The assessment continues to show that the stock is currently only moderately exploited and fishing mortality levels are sustainable. Catch rate levels are likely to decline and catch should decrease as stock levels are fished down to MSY levels. Due to the rapid change of the fishing mortality and biomass indicators relative to MSY in recent years, increases of fishing effort should be monitored.

313. Fishing is having a significant impact on stock size, especially in the western equatorial region and can be expected to affect catch rates. Additional purse-seine effort will yield only modest gains in skipjack catches and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas. The management of total effort in the WCPO should recognize this.

314. There is concern, yet to be substantiated, that high catches in the equatorial region could result in range contractions of the stock, thus reducing skipjack availability to higher latitude (e.g. Japan, Australia, New Zealand) fisheries.

315. Noting the uncertainty in purse-seine species composition, SC6 urged the Commission to continue improving estimates of purse-seine composition data. SC6 requested CCMs, port states, flag states and vessel operators to support efforts for paired spill and grab sampling together with the effort to collect cannery data.

3.5 South Pacific albacore

3.5.1 Review of research and information

a. Review of Project 39

b. Review of 2011 stock assessment

SC6

Project 39 – Regional study of the stock structure and life history characteristics of South Pacific Albacore

9. SC6 encouraged the science services provider to take any new biological parameters into account when next updating the South Pacific albacore assessment.

3.5.2 Provision of scientific information

a. Status and trends*

b. Management advice and implications*

SC6

316. SC6 noted that it may be necessary to obtain progress on some of the biological studies that were discussed in the Biology theme before useful results can be obtained from a new assessment, but noted that there have been substantial differences between different assessments over time and between model configurations, and it is important to reduce the uncertainty in the assessment to

support work on more comprehensive management arrangements than those included in CMM 2005-02.

317. SC6 noted that the albacore assessment should be kept up to date because of increasing effort on this stock. CCMs also encouraged that any future work on South Pacific albacore tuna should include effects of oceanographic change, and address possible local depletion.

318. No new information on the stock status of this species was presented to SC6; therefore, management recommendations from SC5 are maintained.

3.6 South Pacific swordfish

3.6.1 Review of research and information

3.6.2 Provision of scientific information

a. Status and trends*

b. Management advice and implications*

SC6

319. WCPFC8 is anticipated to review CMM 2009-03 in 2011. Several CCMs noted that a new assessment for South Pacific swordfish should be planned for next year, and that additional discussions should consider any information available on this assessment, including how it may be possible to extend the spatial scope of previous assessments to include the south-central Pacific.

320. The advice from SC5 should be maintained, pending a new assessment or other new information.

3.7 Southwest Pacific striped marlin

3.7.1 Review of research and information

3.7.2 Provision of scientific information

a. Status and trends*

b. Management advice and implications*

SC6

321. SC6 noted that following Australia's request to SC5 to add southwest Pacific striped marlin to its work plan as a high priority, Australia, New Zealand and SPC collaborated in the development of two funding proposals in 2010. However, despite the high priority ranking for such an assessment, both from WCPFC's SC and AFMA, proposals did not receive funding in 2010. SC6 noted that Australia has sought domestic funding for a revised southwest Pacific striped marlin stock assessment several times since the last assessment but without success. It was noted that given the last stock assessment was carried out in 2006, an updated assessment is urgently needed. It was proposed that SPC be tasked with carrying out a revised stock assessment for presentation at SC7.

322. SC6 noted that no stock assessment was conducted for southwest Pacific striped marlin in 2009; therefore, the stock status description and management recommendations from SC2 are still current.

3.8 North Pacific striped marlin

a. Status and trends*

b. Management advice and implications*

SC6

323. A 2010 published study refined the ISC 2007 assessment by conducting two assessment scenarios to account for different hypotheses about the steepness (0.7 and 1.0) of the stock-recruitment dynamics. The probable status of North Pacific striped marlin indicated that F/F_{MSY} (2001–2003) was 3.67 under scenario 1, and was 1.90 under scenario 2. Corresponding estimates of striped marlin biomass were below S_{MSY} and ranged from 29% of S_{MSY} under scenario 1 to 44% of S_{MSY} under scenario 2. In relation to MSY-based RPs, striped marlin was experiencing overfishing and the stock was considered depleted under each steepness scenario. The ISC reported that a two-stock scenario (WCPO and EPO) stock assessment for striped marlin

will be completed in 2011.
324. SC6 recommended that WCPFC7 further develop a measure for the conservation of North Pacific striped marlin given the high fishing mortality of this species.
325. SC6 noted that considerable effort towards a CMM was made by an informal working group at WCPFC6. However, after four rounds of revisions, the proposed CMM was unsuccessful. As a consequence, this species was identified at that meeting as a priority for CCMs' consideration this year towards the development of a CMM. A new stock assessment is scheduled for 2011 under a different stock scenario. SC6 recommended as a precautionary measure that the Commission consider adopting an interim measure for 2011, which would be revised pending a new striped marlin assessment.
326. If the WCPFC decides to control the fishing mortality rate of North Pacific striped marlin as advised by ISC, it could do so through limits either on fishing effort or on catch, or through other controls. If it decides to limit catches, it would be helpful to know the levels of catch that correspond to a range of reference fishing mortality rates. Therefore, pending a new striped marlin assessment to be conducted by ISC, SC6 recommended that WCPFC7 request ISC to provide estimated catch levels corresponding to average fishing mortality during 2001–2003, and fishing mortality RPs, including F_{MSY} and F at various spawning potential ratios.
327. SC6 requested a clear direction on how the WCPFC's science services provider will work with ISC scientists on the assessment planned for 2011. The stock assessment report on this species must be discussed in full at SC7 like any other new stock assessments.

NC 6

2.5 Striped Marlin Working Group
43. G. DiNardo presented a status report on the activities of NC's Striped Marlin Working Group (SMWG), and a proposal for future activities. While SMWG's work plan identifies five research tasks, most of the working group's activities were focused on longline gear modifications. In particular, expected reductions in striped marlin catch relative to the fishing target (bigeye or yellowfin tuna) associated with the removal of the two shallowest hooks. These gear modifications result in significant reductions in striped marlin catches with no significant reductions to bigeye tuna catches and slight reductions in yellowfin tuna catches. These findings are consistent with similar research in other areas. It was reported that the USA will fund gear development aimed at reducing striped marlin catches, but this research is being conducted outside the purview of SMWG. While progress has been made, it continues to be hindered due to the need for broader scientific and technical support to complete the tasks than is currently available within NC, as well as the lack of financial support. It was also noted that the current SMWG chair will be resigning effective immediately, which hampers future progress. Given these concerns, it was proposed that SMWG be abolished and that the research tasks be assigned to the Commission.
44. NC6 agreed to abolish the SMWG but also agreed that it should continue to work on striped marlin. NC7 may prepare a draft CMMs based on the outputs of stock assessment in 2011. The USA reminded meeting participants that striped marlin is on TCC6's agenda, at which time there will be another opportunity to discuss appropriate actions.

3.9 Northern stocks

3.9.1 North Pacific albacore (CMM 2005-03)

a. Status and trends*

b. Management advice and implications*

SC6

329. The most recent ISC stock assessment for North Pacific albacore was completed in 2006 and a full stock assessment will be conducted by ISC in 2011 and reviewed at ISC11. No formal update of stock status has been conducted since the 2006 assessment. However, at its 12–13 July 2010 meeting, the albacore working group (ALBWG) undertook a qualitative update using available fisheries data from 2006 to 2009 and an index of spawning stock biomass (SSB) (Japanese longline CPUE age 6–9+). Based on this update, the ALBWG concluded that:

i. A new stock assessment will be necessary to fully understand the implications of the new data available since the last stock assessment;
ii. The 2006 stock assessment estimated that albacore spawning biomass reached an historical high in 2005 and then projected a decline thereafter. The age 6–9+ index shows that SSB has declined from previous high levels and appears to be relatively stable since the last stock assessment;
iii. The ALBWG did not focus on recruitment in its latest qualitative review and is unable to provide insight into recruitment in recent years beyond observations in previous plenary reports; and
iv. Nominal effort in most fisheries (as measured by the number of vessels) appears to have declined slightly or been stable since 2005. Although catches exhibit more interannual variability than effort, with the largest variation occurring in the Japan pole-and-line fisheries, most fisheries catches have declined or remained relatively stable over the same period. This could mean that F_{2009} is less than the $F_{2002–2004}$ (0.75 yr^{-1}) used in the 2006 stock assessment projections. Alternatively, F_{2009} may be as high as the value used in the stock assessment projections because the level of recruitment after 2005 is not known.

330. Based on analyses conducted by the ALBWG since ISC9, the following points are highlighted.

i. Both the ISC9 and ISC10 plenaries note that there is increasing uncertainty concerning the status of North Pacific albacore in the absence of a new stock assessment.
ii. The ISC10 plenary notes that there are no strong positive or negative signals in the age 6–9+ SSB index since the last stock assessment.
iii. The next stock assessment is expected to be completed in early 2011 and the results will be presented at ISC11.
iv. The ISC9 plenary reported that the estimated value of $F_{SSB\text{-}ATHL}$ (F that maintains SSB above the average level of its 10 historically lowest points) is 0.75yr^{-1} for a 25-year projection period using fishery data through 2008. This value is similar to $F_{2002–2004}$=0.75 yr^{-1}, estimated in the last stock assessment.

332. ISC10 had no new information to alter its conservation advice from that provided at ISC9 in July 2009. SC6 recommended that the WCPFC adopt ISC's conservation advice provided on North Pacific albacore.

3.9.2 Pacific bluefin tuna (CMM 2010-04)

a. Status and trends*
b. Management advice and implications*

SC6

333. In 2010, ISC's Pacific bluefin working group (PBFWG) conducted an update of the 2009 analysis along with a complete set of sensitivity analyses and stock projections using data through 2007. Data used in the 2010 update were analyzed using the same methods and parameters in the stock assessment model as in 2009.

334. The updated "current" fishing mortality rate was calculated as a three-year average (2004–2006) with the terminal year of the model results (2007) excluded due to unreliable estimates. The PBFWG reviewed the results of the update with the objectives of characterizing the recent relative change in fishing mortality rate and spawning biomass. It should be noted that even the most recent estimates of fishing mortality would not yet reflect any actions with regard to the fishery management decision for Pacific bluefin taken by WCPFC6 (CMM 2009-07, Dec. 2009).

335. A summary of the 2010 update is as follows.

i. A number of sensitivity runs were conducted in 2010 to investigate uncertainties in biological assumptions and fishery data. Results indicate that the assumption of adult M is particularly influential to the estimate of absolute spawning biomass and fishing mortality. Although absolute estimates from the stock assessment model were sensitive to different assumptions of

M, relative measures were less sensitive.

ii. The estimate of spawning biomass in 2008 (at the end of the 2007 fishing year) declined from 2006 and is estimated to be in the range of the 40–60 percentile of the historically observed spawning biomasses.

iii. Average fishing mortality for 2004–2006 ($F_{2004–2006}$) had increased from $F_{2002–2004}$ by 6% for age-0, approximately 30% for ages 1–4, and 6% for ages 5+.

iv. 30-year projections predict that at $F_{2004–2006}$ median spawning biomass is likely to decline to levels around the 25th percentile of historical spawning biomass with approximately 5% of the projections declining to or below the lowest previously observed spawning biomass. At $F_{2002–2004}$ median spawning biomass is likely to decline in subsequent years but recover to levels near the median of the historically observed levels. In contrast to $F_{2004–2006}$, $F_{2002–2004}$ had no projections (0%) declining to the lowest observed spawning biomass. In both projections long-term average yield is expected to be lower than recent levels.

334. ISC's plenary reached consensus on the management advice for Pacific bluefin tuna as follows: given the conclusions of the July 2010 PBFWG workshop, the current (2004–2006) level of F relative to potential biological RPs, and the increasing trend of F, it is important that the level of F is decreased below 2002–2004 levels, particularly on juvenile age classes.

335. SC6 recommended that WCPFC adopt ISC's conservation advice provided on Pacific bluefin tuna.

3.9.3 North Pacific swordfish

a. Status and trends*

b. Management advice and implications*

SC6

336. In 2010, the EPO stock assessment was updated to include missing swordfish catch from the IATTC area. Results of the updated EPO stock assessment were consistent with the previous 2009 EPO stock assessment.

337. Based on 2009 stock assessment results, the exploitable biomass of the WCPO swordfish stock was estimated to be about 75,000 mt in 2006 (B_{2006}), roughly 30% above B_{MSY}. The exploitation rate on the WCPO stock in 2006 was estimated to be 14% with a total catch of roughly 9,900 mt or roughly 69% of MSY (MSY=14,400 mt). There was very high probability that B_{2006} was above B_{MSY}, a 93 out of 100 chance, and there was a 0 out of 100 chances that the exploitation rate in 2006 exceeded the rate to produce MSY. Based on the 2010 stock assessment update results for the EPO stock only, the exploitable biomass of the EPO swordfish stock was estimated to be about 69,000 mt in 2006, over 200% above B_{MSY}.

338. The exploitation rate on the EPO stock in 2006 was estimated to be 6% with a total catch of roughly 3,900 mt or roughly 78% of MSY (MSY=5,000 mt). There was very high probability that B_{2006} was above B_{MSY}, a 99 out of 100 chance, and there was a two out of 100 chance that the exploitation rate in 2006 exceeded the rate to produce MSY. The exploitable biomass of the WCPO swordfish stock was 31% above B_{MSY} and the exploitation rate was 46% below F_{MSY} in 2006. Similarly, exploitable biomass of the EPO swordfish stock was over two-fold greater than B_{MSY} and the exploitation rate was 62% below F_{MSY} in 2006. Based on results of the updated North Pacific EPO stock assessment and the 2009 North Pacific WCPO stock assessment, the billfish working group proposed that the ISC plenary maintain the existing conservation advice for this species.

341. ISC concluded that both swordfish stocks in the North Pacific are healthy and above the level required to sustain recent catches. No management advice was provided.

342. SC6 recommended that the WCPFC note ISC's conservation advice provided on North Pacific swordfish stocks.

East Pacific Tunas Stock status (2011 IATTC 2nd SAC Meeting)

Skipjack- DOCUMENT SAC-02-08 UPDATED INDICATORS OF STOCK STATUS FOR

SKIPJACK TUNA IN THE EASTERN PACIFIC OCEAN

Conclusions

- The main concern with the skipjack tuna stock is the constantly increasing exploitation rate.
- The indicators have yet to detect any adverse consequence of this increase in exploitation rate.
- The average weight is below its lower reference level in 2009, which can be a consequence of overexploitation, but it can also be caused by recent recruitments being greater than past recruitments.
- The continued decline in average length is a concern and, combined with leveling off of catch and CPUE, may indicate that the exploitation rate is approaching or above the level associated with MSY.
- The trend in many of the indicators changed in 2010, but it is uncertain what this implies.

Bigeye- DOCUMENT SAC-02-07 STATUS OF BIGEYE TUNA IN THE EASTERN PACIFIC OCEAN IN 2010 AND OUTLOOK FOR THE FUTURE

This report presents the most current stock assessment of bigeye tuna (*Thunnus obesus*) in the eastern Pacific Ocean (EPO). An integrated statistical age-structured stock assessment model (Stock Synthesis Version 3.20b) was used in the assessment. This model is the same as the base case model used in the previous assessment (IATTC Stock Assessment Report 11).

Bigeye tuna are distributed across the Pacific Ocean, but the bulk of the catch is made to the east and to the west. The purse-seine catches of bigeye are substantially lower close to the western boundary (150°W) of the EPO; the longline catches are more continuous, but relatively low between 160°W and 180°. Bigeye are not often caught by purse seiners in the EPO north of 10°N, but a substantial portion of the longline catches of bigeye in the EPO is made north of that parallel. Bigeye tuna do not move long distances (95% of tagged bigeye showed net movements of less than 1,000 nautical miles), and current information indicates minimal net movement between the EPO and the western and central Pacific Ocean. This is consistent with the fact that longline catch-per-unit-of-effort (CPUE) trends differ among areas. It is likely that there is a continuous stock throughout the Pacific Ocean, with exchange of individuals at local levels. The assessment is conducted as if there were a single stock in the EPO, and there is limited exchange of fish between the EPO and the western and central Pacific Ocean. Its results are consistent with results of other analyses of bigeye tuna on a Pacific-wide basis. In addition, analyses have shown that the results are insensitive to the spatial structure of the analysis. Currently, there are not enough tagging data to provide adequate estimates of movement between the EPO and the western and central Pacific Ocean.

The stock assessment requires a substantial amount of information. Data on retained catch, discards, catch per unit of effort (CPUE), and age-at-length data and size compositions of the catches from several different fisheries have been analyzed. Several assumptions regarding processes such as growth, recruitment, movement, natural mortality, and fishing mortality, have also been made (see IATTC Stock Assessment Report 11). Catch and CPUE for the surface fisheries have been updated to include new data for 2010. New or updated longline catch data are available for French Polynesia (2009), Japan (2008-2010), the Republic of Korea (2009) and the United States (2008-2009). Longline catch data for 2010 are available for China, Chinese Taipei and Vanuatu from the monthly reporting statistics. New or updated CPUE data are available for the Japanese longline fleet (2008-2010). New purse-seine length-frequency data are available for 2010. New or updated length-frequency data are available for the Japanese longline fleet (2007-2009).

There have been important changes in the amount of fishing mortality caused by the fisheries that catch bigeye tuna in the EPO. On average, since 1993 the fishing mortality of bigeye less than about 15 quarters old has increased substantially, and that of fish more than about 15 quarters old has increased to a much lesser extent (Figures 1 and 2). The increase in the fishing mortality of the younger fish was caused by the expansion of the purse-seine fisheries that catch tuna in association with floating objects. It is clear that the longline fishery had the greatest impact on

the stock prior to 1995, but with the decrease in longline effort and the expansion of the floating-object fishery, at present the impact of the purse-seine fishery on the population is far greater than that of the longline fishery (Figure 3). The discarding of small bigeye has a small, but detectable, impact on the depletion of the stock.

Over the range of spawning biomasses estimated by the base case assessment, the abundance of bigeye recruits appears to be unrelated to the spawning potential of adult females at the time of hatching.

There are several important features in the estimated time series of bigeye recruitment (Figure 4). First, estimates of recruitment before 1993 are more uncertain, as the floating-object fisheries were not catching significant amounts of small bigeye. There was a period of above-average annual recruitment in 1994-1998, followed by a period of below-average recruitment in 1999-2000. The recruitments were above average from 2001 to 2006, and were particularly high in 2005 and 2006. The 2009 recruitment was below average, but the recruitment in 2010 appears to have been particularly high. However, this recent estimate is very uncertain and should be regarded with caution, due to the fact that recently-recruited bigeye are represented in only a few length-frequency samples.

Since the start of 2005, when the spawning biomass ratio (the ratio of the spawning biomass at that time to that of the unfished stock; SBR) was at its historic low level of 0.16, the bigeye stock has shown a recovery trend, to an SBR of 0.24 at the start of 2011 (Figure 5). According to the base case model, this most recent SBR is about 21% higher than the maximum sustainable yield (MSY) level (Table 1). This recent recovery trend is subsequent to the IATTC tuna conservation resolutions initiated in 2004.

Recent catches are estimated to have been 8% greater than those corresponding to the MSY levels (Table 1). If fishing mortality (F) is proportional to fishing effort, and the current patterns of age-specific selectivity are maintained, the level of fishing effort corresponding to the MSY is about 93% of the current (2008-2010) level of effort (Table 1).

According to the base case results, the two most recent estimates indicate that the bigeye stock in the EPO is probably not overfished ($S>S_{MSY}$), but that fishing mortality slightly exceeds the level corresponding to the MSY (overfishing is taking place, $F>F_{MSY}$) (Figure 6). This interpretation, however, is subject to uncertainty as indicated by the approximated confidence intervals around the most recent estimate in the Kobe plot (Figure 6). The addition of new data for 2010 and updated data for earlier years lowered the SBR compared to the previous assessment. Similar retrospective patterns also occurred in previous assessments when adding new and updated data. The changes are generally within the confidence intervals of the estimated quantities and well within the ranges estimated under different sensitivity analyses from the previous assessment.

The MSY of bigeye in the EPO could be maximized if the age-specific selectivity pattern were similar to that of the longline fisheries, because they catch larger individuals that are close to the critical weight. Before the expansion of the floating-object fishery that began in 1993, the MSY was greater than the current MSY and the fishing mortality was less than F_{MSY} (Figure 7).

Under the current levels of fishing mortality, recent spikes in recruitment are predicted not to sustain the increasing trend observed for SBR since 2004. Both the base case and the assessment assuming a stock-recruitment relationship indicate that the population is likely to drop below the level corresponding to MSY under average recruitment conditions (Figure 5). It is estimated that catches will be lower in the future at current levels of fishing effort if a stock-recruitment relationship is assumed, particularly for the surface fisheries (Figure 8).

These simulations are based on the assumption that selectivity and catchability patterns will not change in the future. Changes in targeting practices or increasing catchability of bigeye as abundance declines (e.g. density-dependent catchability) could result in differences from the outcomes predicted here.

Key results

1. The results of this assessment indicate a recent recovery trend for bigeye tuna in the EPO (2005-2010), subsequent to IATTC tuna conservation resolutions initiated in 2004. However,

under the current levels of fishing mortality, recent spikes in recruitment are predicted not to sustain this increasing trend.

2. There is uncertainty about recent and future recruitment and biomass levels;
3. The recent fishing mortality rates are estimated to be slightly above the level corresponding to MSY, and the recent levels of spawning biomass are estimated to be above that level. As described in IATTC Stock Assessment Report 11, these interpretations are uncertain and highly sensitive to the assumptions made about the steepness parameter of the stock-recruitment relationship, the average size of the older fish, the assumed levels of natural mortality for adult bigeye, and the historic period of the bigeye exploitation used in the assessment. The results are more pessimistic if a stock-recruitment relationship is assumed, if a higher value is assumed for the average size of the older fish, if lower rates of natural mortality are assumed for adult bigeye, and if only the late period of the fishery (1995-2009) is included in the assessment;
4. The results are more optimistic if a lower value is assumed for the average size of the older fish, and if higher levels of natural mortality are assumed for adult bigeye.

TABLE 1. MSY and related quantities for the base case and the stock-recruitment relationship sensitivity analysis, based on average fishing mortality (F) for 2008-2010. B_{recent} and B_{MSY} are defined as the biomass, in metric tons, of fish 3+ quarters old at the start of the first quarter of 2010 and at MSY, respectively, and S_{recent} and S_{MSY} are defined as indices of spawning biomass (therefore, they are not in metric tons). C_{recent} is the estimated total catch for 2010.

	Base case	h = 0.75
MSY	80,963	77,473
B_{MSY}	311,247	547,291
S_{MSY}	70,509	137,670
C_{recent}/MSY	1.08	1.13
B_{recent}/B_{MSY}	1.11	0.75
S_{recent}/S_{MSY}	1.21	0.77
$B_{MSY}/B_{F=0}$	0.24	0.33
$S_{MSY}/S_{F=0}$	0.19	0.30
F multiplier	0.93	0.65

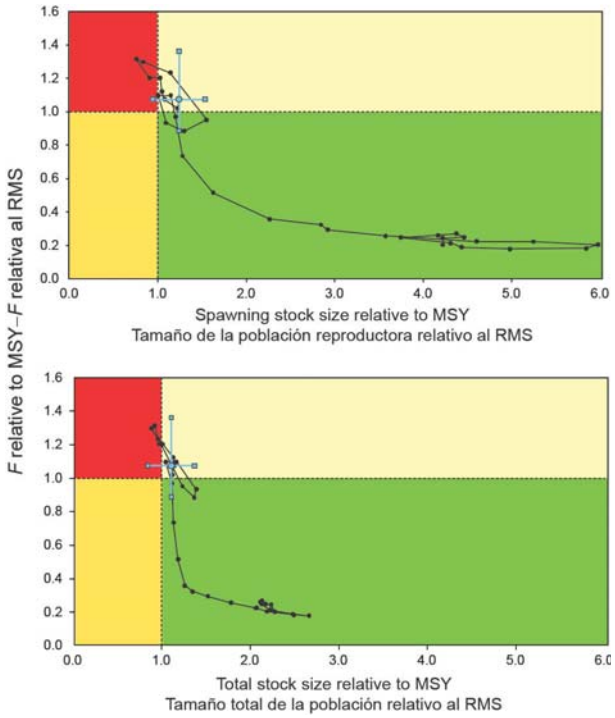


FIGURE 6. Kobe (phase) plot of the time series of estimates of stock size (top: spawning

biomass; bottom: total biomass) and fishing mortality relative to their MSY reference points. Each dot is based on the average fishing mortality rate over three years; the large dot indicates the most recent estimate. The squares around the most recent estimate represent its approximate 95% confidence interval.

Yellowfin- DOCUMENT SAC-02-06 STATUS OF YELLOWFIN TUNA IN THE EASTERN PACIFIC OCEAN IN 2010 AND OUTLOOK FOR THE FUTURE

SUMMARY

This report presents the most current stock assessment of yellowfin tuna (*Thunnus albacares*) in the eastern Pacific Ocean (EPO). An integrated statistical age-structured stock assessment model (Stock Synthesis Version 3.20b) was used in the assessment, which is based on the assumption that there is a single stock of yellowfin in the EPO. Yellowfin are distributed across the Pacific Ocean, and it is likely that there is a continuous stock throughout the Pacific Ocean, with exchange of individuals at a local level, although there is some genetic evidence for local isolation. The bulk of the catches of yellowfin is made in the eastern and western regions, although the purse-seine catches are relatively low in the vicinity of the western boundary of the EPO at 150°W. The movements of tagged yellowfin generally cover hundreds, rather than thousands, of kilometers, and exchange of fish between the eastern and western Pacific Ocean appears to be limited. This is consistent with the fact that longline catch-per-unit-of-effort (CPUE) trends differ among areas. Movement rates between the EPO and the western Pacific cannot be estimated with currently-available tagging data.

The stock assessment requires substantial amounts of information, including data on retained catches, discards, indices of abundance, and the size compositions of the catches of the various fisheries. Assumptions have been made about processes such as growth, recruitment, movement, natural mortality, fishing mortality (F), and stock structure. The catch data for the surface fisheries have been updated, and new data added for 2010. New or updated longline catch data are available for French Polynesia (2008), Japan (2008-2010), Korea (2009) and the United States (2008-2009). Surface fishery CPUE data were updated, and new CPUE data added for 2010. New or updated CPUE data are available for the Japanese longline fleet (2008-2010). New surface fishery size-composition data for 2010 were added. New or updated length-frequency data are available for the Japanese longline fleet (2007-2009).

In general, the recruitment of yellowfin to the fisheries in the EPO is variable, with a seasonal component. This analysis and previous analyses have indicated that the yellowfin population has experienced two, or possibly three, different recruitment productivity regimes (1975-1982, 1983-2002, and 2003-2010). The productivity regimes correspond to regimes in biomass, with higher-productivity regimes producing greater biomass levels. A stock-recruitment relationship is also supported by the data from these regimes, but the evidence is weak, and this is probably an artifact of the apparent regime shifts. A recent sharp decline in the levels of spawning biomass since 2009 follows a series of below-average recruitments from the second quarter of 2007 through the last quarter of 2008.

The average weights of yellowfin taken from the fishery have been fairly consistent over time, but vary substantially among the different fisheries. In general, the floating-object, northern unassociated, and pole-and-line fisheries capture younger, smaller yellowfin than do the southern unassociated, dolphin-associated, and longline fisheries. The longline fisheries and the dolphin-associated fishery in the southern region capture older, larger yellowfin than the northern and coastal dolphin-associated fisheries.

Significant levels of fishing mortality have been estimated for the yellowfin fishery in the EPO. These levels are highest for middle-aged yellowfin. The dolphin-associated and unassociated purse-seine fisheries have the greatest impact on the spawning biomass of yellowfin, followed by the floating-object fisheries. The impact of the longline and purse-seine discards is much less.

There is a large retrospective pattern of overestimating recent recruitment. This pattern, in

combination with the wide confidence intervals of the estimates of recent recruitment, indicate that these estimates and those of recent biomass are uncertain.

Historically, the spawning biomass ratio (the ratio of the spawning biomass to that of the unfished population; SBR) of yellowfin in the EPO was below the level corresponding to the maximum sustainable yield (MSY) during 1975-1983, coinciding with the low productivity regime, but above that level during most of the following years, except for the recent period (2004-2007 and 2010). The 1984 increase in the SBR is attributed to the regime change, and the recent decrease may be a reversion to an intermediate productivity regime. The two different productivity regimes may support two different MSY levels and associated SBR levels. The SBR at the start of 2011 was estimated to be at 0.18, below the level corresponding to the MSY (0.25). The effort levels are estimated to be less than those that would support the MSY (based on the current distribution of effort among the different fisheries), and recent catches are below MSY.

It is important to note that the curve relating the average sustainable yield to the long-term fishing mortality is very flat around the MSY level. Therefore, changes in the long-term levels of effort will change the long-term catches only marginally, while changing the biomass considerably. Reducing fishing mortality below the level at MSY would result in only a marginal decrease in the long-term average yield, with the benefit of a relatively large increase in the spawning biomass. In addition, if management is based on the base case assessment (which assumes that there is no stock-recruitment relationship), when in fact there is such a relationship, there would be a greater loss in yield than if management is based on assuming a stock-recruitment relationship when in fact there is no relationship.

The MSY calculations indicate that, theoretically at least, catches could be increased if the fishing effort were directed toward longlining and purse-seine sets on yellowfin associated with dolphins. This would also increase the SBR levels.

The MSY has been stable during the assessment period (1975-2010), which suggests that the overall pattern of selectivity has not varied a great deal through time. However, the overall level of fishing effort has varied with respect to the level corresponding to MSY.

If a stock-recruitment relationship is assumed, the outlook is more pessimistic, and current effort is estimated to be above the level corresponding to the MSY. The status of the stock is also sensitive to the value assumed for the average size of the oldest fish. If the CPUE of the northern dolphin-associated fishery, rather than that of the southern longline fishery, is assumed to be the most reliable index of abundance, the current spawning stock biomass is estimated to be at about the level corresponding to MSY.

Under current levels of fishing mortality (2008-2010), the spawning biomass is predicted to rebuild, and remain above the level corresponding to MSY. However, the confidence intervals are wide, a retrospective pattern exists in recent recruitment, and there is a moderate probability that the SBR will be substantially above or below this level. Fishing at F_{MSY} is predicted to reduce the spawning biomass slightly from that under current effort and produces slightly higher catches.

Key Results

1. There is uncertainty about recent and future levels of recruitment and biomass, and there are retrospective patterns of overestimating recent recruitment.
2. The recent fishing mortality rates are lower than those corresponding to the MSY.
3. The recent levels of spawning biomass are below those corresponding to the MSY.
4. Increasing the average weight of the yellowfin caught could increase the MSY.
5. There have been two, and possibly three, different productivity regimes, and the levels of MSY and the biomasses corresponding to the MSY may differ among the regimes. The population may have recently switched from a high to an intermediate productivity regime.
6. The results are more pessimistic if a stock-recruitment relationship is assumed.
7. The results are sensitive to the average size assumed for the oldest fish.

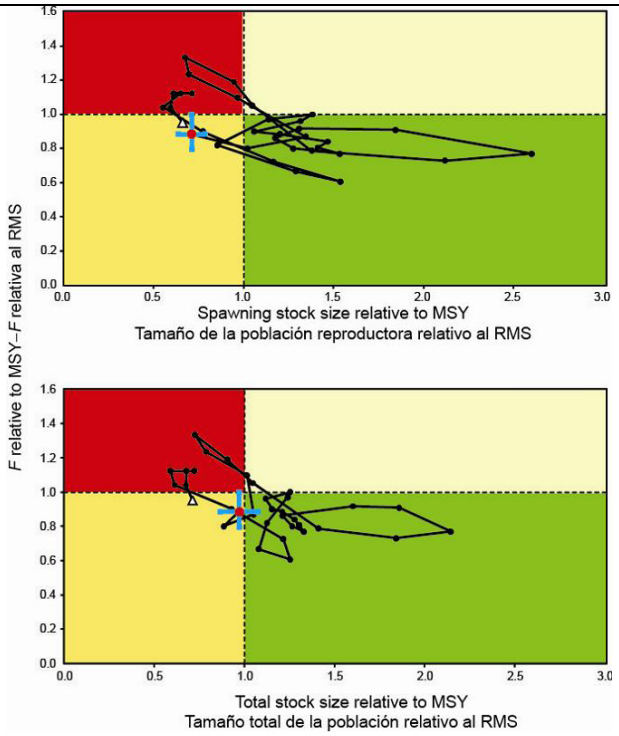


FIGURE 5.3. Phase (Kobe) plot of the time series of estimates for stock size (top: spawning biomass; bottom: total biomass) and fishing mortality relative to their MSY reference points. Each dot is based on the average exploitation rate over three years; the large triangle and the red dot indicate the earliest and most recent estimates, respectively. The squares represent approximate 95% confidence intervals around the most recent estimate.

TABLE 5.1. Estimates of the MSY and its associated quantities for yellowfin tuna for the base case assessment and the sensitivity analyses. All analyses are based on average fishing mortality during 2008-2010. B_{recent} and B_{MSY} are defined as the biomass of fish 3+ quarters old (in metric tons) at the beginning of 2011 and at MSY, respectively. S_{recent} and S_{MSY} are in metric tons. C_{recent} is the estimated total catch in 2010. The F multiplier indicates how many times effort would have to be effectively increased to achieve the MSY in relation to the average fishing mortality during 2008-2010.

Data	Base case	h = 0.75	L=170 cm	L=190 cm	CPUE DEL-N
MSY	263418	289677	272506	264428	266738
B_{MSY}	354737	557185	366631	357984	360749
S_{MSY}	3287	5947	3754	3138	3365
B_{MSY}/B_0	0.31	0.36	0.31	0.31	0.31
S_{MSY}/S_0	0.25	0.34	0.24	0.26	0.26
C_{recent}/MSY	0.88	0.8	0.85	0.88	0.87
B_{recent}/B_{MSY}	0.97	0.62	1.18	0.87	1.26
S_{recent}/S_{MSY}	0.73	0.41	0.99	0.61	1.02
F multiplier	1.16	0.72	1.58	0.98	1.33

TABLE 5.2a. Estimates of the MSY and its associated quantities, obtained by assuming that each fishery is the only fishery operating in the EPO and that each fishery maintains its current pattern of age-specific selectivity (Figure 4.4). The estimates of the MSY and B_{MSY} are expressed in metric tons. OBJ = sets on floating objects; NOA = sets on unassociated fish; DEL = sets on dolphin-associated fish; LL = longline.

Data	All	OBJ	NOA	DEL	LL
MSY	262,857	166,349	221,759	307,523	407,748

B_{MSY}	354,958	208,259	295,992	363,447	380,574
S_{MSY}	3,305	1,607	2,485	3,139	3,137
B_{MSY}/B_0	0.31	0.18	0.26	0.32	0.33
S_{MSY}/S_0	0.26	0.13	0.19	0.24	0.24
C_{recent}/MSY	0.88	1.39	1.04	0.75	0.57
B_{recent}/B_{MSY}	0.96	1.64	1.15	0.94	0.89
S_{recent}/S_{MSY}	0.71	1.47	0.95	0.75	0.75
F multiplier	1.13	8.11	7.79	2.20	138.30

Swordfish- DOCUMENT SAC-02-09 STATUS OF SWORDFISH IN THE EASTERN PACIFIC OCEAN IN 2010 AND OUTLOOK FOR THE FUTURE

SUMMARY

This report presents the status and trends of swordfish (*Xiphias gladius*) in the southeast Pacific Ocean (SEPO). The assessment was conducted with Stock Synthesis using data that were updated as of 22 April 2011.

The stock structure of swordfish is not well known in the Pacific. A number of specific regions of spawning are known, and analyses of fisheries and genetic data indicate that there is only limited exchange of swordfish between geographical areas, including between the eastern and western, and the northern and southern, Pacific Ocean, so it is considered that examinations of local depletions and independent assessments of the swordfish of the eastern Pacific Ocean (EPO) are meaningful. Though this assessment did not include parameters for trans-region movements of this or other stocks, it recognized that there may be limited exchange of fish between the southeast Pacific Ocean and stocks in adjacent regions.

Genetic and fishery data indicate that the swordfish of the southeastern Pacific Ocean (SEPO, south of 5°S) constitute a distinct stock.

Key results

1. The swordfish stock in the southeast Pacific Ocean is not experiencing overfishing and is not overfished.
2. The spawning biomass ratio is about 1.45, indicating that the spawning biomass is about 50 percent above the carrying capacity, and substantially above the level which is expected to produce catch at the level of maximum sustained yield (MSY).
3. Recent annual catch levels (~14,300 t) are significantly below the estimated MSY (~25,000 t).
4. There have been a series of recent high recruitments to the swordfish stock.
5. Catch rates and catches under current levels of fishing effort and fleet configurations will tend to decrease over the coming 10-year period, assuming average recruitment returns to pre-high recruitment levels, as those recruits pass through the fishery.

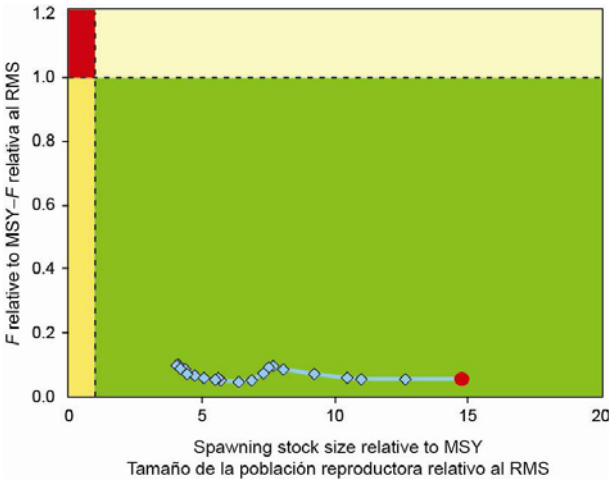


FIGURE 5. The relationship between spawning stock biomass relative to MSY and fishing mortality rate (F) relative to MSY.

TABLE 5. Estimates of selected model outputs and MSY-based parameters from the assessment and from sensitivity analyses in which h = 0.75 and in which the high catch rates observed in the 2007-2010 period were not included in the model.

Estimate	Assessment	h = 0.75	2007-2010 CPUE excluded
MSY	25,044	19,029	21,046
B_{MSY}	40,782	72,717	34,111
S_{MSY}	10,705	26,772	8,920
B_{MSY}/B_0	0.20	0.34	0.20
S_{MSY}/S_0	0.11	0.27	0.11
C_{RECENT}/MSY	0.57	0.75	0.68
B_{RECENT}/B_{MSY}	10.40	5.14	6.40
S_{RECENT}/S_{MSY}	14.76	5.99	10.68
F multiplier	17.92	6.86	11.67

RECENT=average value for the three most recent years.

AGENDA ITEM 4-MANAGEMENT ISSUES THEME*

4.1 Terms of Reference

4.2 Limit reference points for the WCPFC

1. Identify candidate indicators (e.g. $B_{current}/B_o$, SB/SB_{MSY}) and related limit reference points (LRPs) (e.g. $B_{current}/B_o$=X, SB/SB_{MSY}=Y), the specific information needs they meet, the data and information required to estimate them, the associated uncertainty of these estimates, and the relative strengths and weaknesses of using each type within a management framework.
2. Using past assessments, evaluate the probabilities that related performance indictors exceed the values associated with candidate RPs.
3. Evaluate the consequences of adopting particular LRPs based on stochastic projections using the stock assessment models.
4. Undertake a literature review or meta-analyses to provide insights into levels of depletion that may serve as appropriate limit reference points and other uncertain assessment parameters (e.g. steepness).

SC6

Identifying limit reference points for the WCPFC

71. SC6 made the following recommendations:

- SC6 recommended that Project 57 on RPs, identified at SC5, be completed. Specifically, tasks 1 and 4 to be put out to tender and tasks 2 and 3 to be completed by SPC. The results are to be reported to SC7 and, if appropriate, to the proposed Management Objectives Workshop to be held in 2011.
- After reviewing the results of Project 57, that SC7 make a recommendation to the Commission on candidate RPs (both type and value) for each of the key target species in WCPFC.

72. It was noted that the Management Objectives Workshop should occur after SC7 in order to allow the results of Project 57 to be first reviewed by SC.

Project 57. Identifying Provisional Limit Reference Points for the key target species in the WCPFC

WCPFC-SC7-2011/MI-WP-01: Identification of candidate limit reference points for the key target species in the WCPFC (Draft Report: Identification of candidate limit reference points for the key target species in the WCPFC. (Ann Preece, Rich Hillary and Campbell Davies. 30 March, 2011. CSIRO) circulated in 2011 SPC Preparatory Stock assessment Meeting)

EXECUTIVE SUMMARY

The aim of this commissioned project is to provide the Western and Central Pacific Fisheries Commission (WCPFC) and Scientific Committee with a set of candidate limit reference points for

the key target species in the WCPFC, and to review steepness and depletion levels used across the tuna Regional Fisheries Management Organisations (RFMOs). Three categories of limit reference points, with varying data requirements and strengths and weaknesses, are examined: Maximum Sustainable Yield (MSY), spawning potential-per-recruit (SPR) and depletion based limit reference points.

A simulation model of tuna-like species has been developed to evaluate the consistency and robustness of reference points for specific target species of tuna in the Western and Central Pacific Ocean (WCPO). It's parameterised to represent yellowfin/bigeye and skipjack tuna type populations.

One of the key parameters in fisheries stock assessments is "steepness", which is a measure of the productivity of the stock at low stock size. A review of the stock assessments of tunas and tuna like species across the tuna RFMOs highlights the difficulty in estimating or assuming a value for steepness for the majority of tuna stocks. There is commonly insufficient data on recruitment at low stock size and recovery from depletion to enable steepness to be reliably estimated in the tuna stock assessments. Some reference points are sensitive to the value for steepness. Providing stock status and management advice that is robust to the uncertainty in steepness is essential for effective management, and is often understated.

We recommend a three-level hierarchical approach to selecting and setting limit reference points for fishing mortality (F) and Spawning Stock Biomass (SSB) based on decreasing levels of available information. The first level uses F_{MSY} and SSB_{MSY} but only in the case where a reliable and precise estimate of steepness is available. The second level uses FSPR and 20% of SSB_0 for cases in which uncertainty in steepness is high, but the key biological (natural mortality, maturity) and fishery (selectivity) variables are reasonably well estimated. The third level does not include an F-based limit reference point if the key biological and fishery variables are not well estimated, but simply uses a SSB limit of 20% of SSB_0.

As noted in Harley et al (2009) and others, the usefulness of limit reference points is in their implementation through management actions to be taken when pre-specified indicators show that the fishery is reaching or breaching a specified limit reference point. Formal decision rules (or harvest control rules) have been demonstrated to be an important component of effective management in that they define the agreed management action required when a given limit reference point is approached or breached. We recommend that decision rules be formally evaluated via simulation modelling using a Management Strategy Evaluation (MSE) framework. This allows for exploration of differences in species-specific responses to exploitation and other uncertainties associated with implementation of management strategies.

STEEPNESS: A KEY UNCERTAINTY IN STOCK ASSESSMENTS AND REFERENCE POINTS INDICATORS

Steepness is a measure of the productivity of a stock, and can be interpreted as a measure of the resilience of the stock to fishing pressure. It ranges in value from 0.2 to 1.0, for the most commonly used Beverton-Holt model, with higher values equating to more productive and resilient stocks. At the lowest end of this range, 0.2 indicates that at a spawning stock biomass level of 20% of its unfished state (SSB_0), recruitment would be 20% of its virgin level (R_0). That is, essentially a linear relationship between recruitment and spawning biomass. For a steepness of 0.7, if the spawning stock is reduced to 20% of B_0, recruitment should still be on average 70% of its unfished level (R_0).

A review of the stock assessments of tunas and tuna like species across the tuna RFMOs highlights the difficulty stock assessment scientists have in estimating or assuming a value for steepness. A variety of techniques are used: estimating steepness (e.g. Harley et al 2010 (BE)), using informative or uniform priors, fixing steepness at a single value, fixing it at several values to provide sensitivity analyses (e.g. Hoyle et al, 2010 (skipjack); Harley et al, 2010 (bigeye); Langley et al, 2010; Kolody, 2010), and assuming there is no-stock recruitment relationship by setting steepness=1 (e.g. Maunder et al (2010) in some IATTC stock assessments). The RFMO's scientists producing the primary stock assessments that are used for management advice

acknowledge that, in the majority of, if not all, cases, there is not enough information on steepness in the available data, and that the stock-recruitment relationship is weak. This is common across the various tuna and billfish species.

In, addition to the stock assessment work for tunas, theoretical research on steepness and its importance to stock status indicators is ongoing, providing useful reviews of the techniques for handling steepness in stock assessments. According to work by Mangel et al (2010), steepness can be calculated if the demographics of the population are known and there is detailed information on the key dynamics (growth, mortality implicitly assumed to be measured at low population size) of the larval stage of the fish. This means that if natural mortality, detailed larval dynamics, and growth (and the uncertainty in them) are known, then an estimate of the distribution of plausible values for steepness can be made. Unfortunately these quantities are usually not known and stock assessments often use a variety of fixed values for natural mortality at age etc. Mangel et al (2010) also note that because of the relationship between steepness and the "demographics of the population", that when using several fixed values of steepness, other parameters in the model should also be adjusted for these different steepness values to remain internally consistent. This is not something that has been explored in the RFMO stock assessments as far as we know, but sometimes the cross combination effects of various natural mortality and steepness values are explored, but the intention driving this is not the internal consistency issue. In such stock assessments, strong correlation often appears between the steepness and other parameters such as growth and natural mortality. While this is principally more of an indicator of a lack of unambiguous information in the data on the key parameters, it also reaffirms the logical linkage between the various key life-history processes and parameters.

Maunder et al (2010) attempt to handle the weak relationship between spawning stock and recruitment by using steepness set equal to 1, to infer that there is "no stock recruitment relationship". However Mangel et al (2010) argue that in this case it would be better to assume that "any value of steepness could be possible" and that an (almost) uniform prior on all values for steepness would be a better implementation. Where steepness is estimated (e.g. Aires da Silva and Maunder (2010), steepness is estimated to be almost equal to 1. Note that in this assessment they also produce results and stock status advice for a variety of values for steepness. In other stocks (eg Harley et al, 2010,) high values of steepness can also be estimated, but the estimates are very high and the authors express little confidence in these. Conn 2010 notes that in simulation studies, steepness estimates tend to be close to the upperbound (1.0) even though true steepness is much less than 1.0.

Rosenberg and Restrepo (1996) argue from a precautionary approach that if steepness is not known, then recruitment proportional to SSB should be assumed, i.e. that there is no compensation in the stock recruitment relationship. Conn et al (2010) show that where there is contrast in spawning stock biomass estimates (for example from a "2-way trip"- depletion and then rebuilding of a stock), that it may be possible to estimate steepness. Harley et al (2009) state that for the WCPO tuna stocks "it is extremely doubtful that steepness can be estimated within our individual stock assessment models", because there is little information for recruitment at low stock size. Tuna stocks that have been depleted but have not yet recovered (e.g. SBT) also have difficulty estimating steepness, and show high variability in recruitment, indicating some resilience to low stock sizes. Tunas are generally assumed to be in the mid-high but not low range of steepness values, because of the ability to persist given high variability in recruitment and seemingly high estimates of mortality. The general life-history characteristics of tuna-like species indicate medium to high resilience that varies by species. The contributing factors are high fecundity, longevity (for some species), growth rate and age of maturity. The Myers (1999) meta-analyses of steepness showed that an average of 0.7 or higher was common across the species examined including some tunas and billfish. Because of this perception of at least medium resilience, and the Myers (1999) meta-analyses results for steepness, a reduced range of steepness values has been used in many of the tuna RFMOs stock assessments, at the middle to upper end of the range for steepness (table 1).

Table 1: Steepness values used in stock assessments across the tuna RFMOs

RFMO	Species	Authors	Fixed steepness values	Estimate of steepness
IOTC	Yellowfin	Langley et al, 2010	0.6, 0.7, 0.8, (0.9)	
	Bigeye	Kolody et al, 2010b	0.55, 0.75, 0.95	
	Swordfish	Kolody, 2010	0.7 and 0.9	0.61, 0.68.
	Swordfish	Martel, 2010	-	0.98
	Swordfish	Wang & Nishida 2010	0.6, 0.8, 0.9, 0.95	
CCSBT	SBT	Anon, 2010b	0.385, 0.55, 0.64, 0.73 and 0.82	
IATTC	Bigeye	Aires-da-Silva and Maunder, 2010	1.0 and 0.75	
	Striped marlin	Hinton et al, 2010	1.0 and 0.75	0.98
WCPFC	Skipjack	Hoyle et al, 2010	0.65, 0.75, 0.85, 0.95	
	Bigeye	Harley et al, 2010	0.55, 0.75, 0.95	0.98
	Yellowfin	Langley et al, 2009	0.55,0.65,0.75,0.85,0.95	
	Albacore	Hoyle & Davies 2009	0.55 – 0.95	
	Swordfish	Kolody et al 2008, and Davies et al, 2008	0.65 and 0.95	

Harley et al (2009), Kolody et al, (2010) and others have noted that using a single value for steepness for providing stock status advice does not characterise the uncertainty in the advice provided. Several ways for including a broad range of structural assumptions and combinations of structural assumptions (e.g. a cross of fixed values for steepness and natural mortality) has been described and used in the WCPFC and other RFMOs (Harley et al, 2009; Kolody, 2008; Kolody, 2010; Langley et al, 2010; Anon, 2010; Hoyle et al, 2010). In several stock assessments across RFMOs, the practice now is to use a range of values for steepness to provide stock status advice. In some cases attempts have been made to combine the results by weighting alternative hypotheses or by sampling from a grid of the alternative hypotheses (e.g. Langley et al, 2010; Kolody, 2010; Harley et al ,2009; Anon, 2010). The uncertainty in the limit reference point and the indicator of stock status relative to that limit reference point will need to be taken into account by fishery managers in determining the risk level that is acceptable for various limit reference points and, where they exist, their corresponding decision rules. Uncertainties in steepness are unlikely to be resolved in the near term. Langley et al (2010) and others suggest that consideration should be given to adopting reference points that are less dependent on stock recruitment relationship parameters such as steepness.

Conclusions on candidate limit reference points

In general, we recommend a three-level hierarchical approach to setting limit reference points for fishing mortality and SSB. The first level uses F_{MSY} and B_{MSY} but only where a reliable and precise estimate of steepness is available. The second level uses F_{SPR} and 20% of B_0 assuming that steepness is not known well, if at all, but that the key biological (natural mortality, maturity) and fishery (selectivity) variables are reasonably well estimated. The third level does not provide an F-based limit reference point if the key biological and fishery variables are not well estimated or understood, but simply suggests that the SSB limit of 20% of B_0 be used.

In terms of strengths and weaknesses in such an approach, we take each level in turn. For level 1 (MSY essentially) the obvious strength is that it covers productivity directly, maximising yields while maintaining the population level at a safe and productive level. The key weakness of this approach is the difficulty in robustly estimating it, and that such information is not available for the key species of interest. In terms of level 2, a key strength is that it does not require an estimate of steepness and can be done with the information currently available from a reasonably robust assessment (e.g. The current yellowfin and bigeye assessments). Two major weaknesses are that: (i) if there is significant uncertainty in the key life-history and fishery variables (M, selectivity etc.),

and (ii) depending on the true steepness level and the choice of target SPR depletion level, there can be significant inconsistency between the F and SSB-based reference points. For level 3, the key strength is that it is probably the most robust of the three approaches (SSB depletion tends to be one of the most robust status indicators in assessments of this type), but its key weakness is that it does not use information on mortality, which means that it is an effective proxy for a stock being overfished, but not for whether over-fishing is occurring.

For yellowfin and bigeye we recommend using the second level. We suggest that the default level of SPR reduction (the δ parameter) to use should be 0.4 (i.e. a 40% reduction in the per-recruit spawning potential expected for unfished conditions). The reason for this is because, while a value of δ=0.3 is more consistent (in terms of the implied SSB depletion across a range of steepness values) with the SSB limit of 20% of B_0 (see Figure 4), this value can lead to levels of F_{SPR} that exceeded F_{MSY} for steepness values lower than about 0.8 (still fairly high) which could lead to both reduced yields and a higher risk to the stock for less productive populations (i.e. for lower steepness levels).

For skipjack, given the strong sensitivity of the estimates of F_{SPR} to the specifics of the maturity-at-age relationship, we recommend a level-three approach. At present, there is an indication that the uncertainty in the nature of the maturity-at-age relationship may prevent the robust estimation of F_{SPR}. If this relationship becomes better understood then perhaps a tier-two approach may be appropriate, but for now it is perhaps best to simply use the recommended SSB limit reference point only.

SUMMARY

In this commissioned report we provide a review of steepness and depletion drawing particularly from the work in the tuna RFMOs, and recommend a three-level hierarchical approach for setting limit reference points. Maximum Sustainable Yield, Spawner Potential per Recruit and Depletion based limit reference points have been reviewed in terms of their strengths, weakness and data requirements, and information they provide for use in a management framework.

Steepness is a measure of the productivity of the stock at low stock size. It is difficult for the current stock assessments to estimate steepness, and a range of values should be used to provide management advice. Steepness for the tuna and tuna-like species is likely to be in the mid to high range of values.

Depletion based limit reference points measure the level of depletion of the total or spawning stock biomass (e.g. x% of the initial unfished spawning stock biomass (SSB_0). 20% of SSB_0 is considered a threshold for recruitment overfishing for productive stocks (Myers, 1994), and is commonly used as a limit reference point in other RFMOs and fisheries management and conservation organisations. Since the key target species in the WCPFC are considered to be reasonably productive stocks (mid to high steepness), 20% of SSB_0 is considered as a default value for the depletion based limit reference points.

A three-level hierarchical approach to setting limit reference points for fishing mortality and SSB is recommended. Only 1 set of limit reference points, from 1 level of the hierarchy, is used, depending on the understanding of key parameters in the stock assessment models. The first level uses F_{MSY} and B_{MSY} but only when a reliable and precise estimate of steepness is available. The second level uses F_{SPR} and 20% of SSB_0 assuming that steepness is not known well, but that natural mortality, maturity and fishery selectivity variables are reasonably well estimated. The third level does not provide an F-based limit reference point if the key biological and fishery variables are not well estimated or understood, but simply suggests that the SSB limit of 20% of SSB_0 be used.

An age-structured operating model was developed to explore the most appropriate limit reference points for each of the target species. It was parameterised as a yellowfin / bigeye type and a skipjack type population.

For yellowfin and bigeye we recommend using the second level of the hierarchy of reference points. We suggest that the default level of SPR reduction (the δ parameter) to use should be 0.4 (i.e. a 40% reduction in the per-recruit spawning potential expected for unfished conditions).

For skipjack, we recommend the third level of the hierarchy because of the sensitivity of the

estimates of F_{SPR} to the maturity-at-age relationship.

For Albacore and the billfish species, we recommend the third level of the hierarchy be used because of the uncertainties in some of the key life-history and fishery variables required for level 1 or level 2.

Report of the 2011 ISSF Stock Assessment Workshop (Rome, Italy, March 14-17, 2011) circulated in 2011 SPC Preparatory Stock Assessment Meeting

Summary. A workshop was held to examine two issues that significantly affect scientific management advice and which are not always being treated consistently in tuna stock assessments: (1) Assumptions about the stock-recruitment relationship, and (2) evaluating the implications of changing mortality on juvenile and small tunas. The workshop reviewed available information and conducted several preliminary analyses. With regards to the first issue, many assessments either estimate or fix the value of "steepness", a parameter that determines the degree to which average recruitment depends on parental stock biomass. The Workshop concluded that estimated steepness values from individual assessments should be treated with considerable caution and that meta-analyses of the available data for all tuna stocks be continued in order to provide further advice for the estimation of steepness. In addition, the Workshop made recommendations for scientists to better characterize uncertainty in steepness in their stock status determinations, and for managers to consider Harvest Control Rules that are robust to this uncertainty. With regards to the second issue, the Workshop concluded that tuna stocks that have a high fishing mortality rate on juveniles relative to adults tend to have lower spawner-per-recruit levels. However, in terms of absolute spawning biomass relative to SSB_{MSY}, those stocks that have experienced high juvenile fishing mortality are not necessarily more overfished in comparison to stocks that have not. The Workshop recommended that stock assessment reports routinely include Fishery Impact plots so that the effect that gears with different selectivity have on spawning biomass can be readily evaluated. Finally, the Workshop recommended that future meetings be held to compare the basic life history parameters being used in the tuna stock assessments, with a view to reconcile differences or improve consistency.

The stock-recruitment relationship

Many of the estimates of MSY-related benchmarks are calculated by combining (a) yield-per-recruit and spawner-per-recruit values, and (b) a stock-recruitment relationship (SRR). In most stock assessments, the SRR is notoriously difficult to estimate, and scientists end up using assumed values of the "steepness" parameter, h, which defines the degree of dependence of average recruitment on spawning biomass. The estimates of current stock status (F/F_{MSY} or B/B_{MSY}) are therefore dependent on an assumption.

Simulation studies also confirm that steepness is difficult to estimate from a single stock assessment data set, and is often overestimated. Furthermore, most tuna stock assessments result in estimates of stock-recruitment data that are highly variable and that lack sufficient range in biomass levels (including very low ones) that would allow for the estimation of steepness.

The Workshop recommended that estimated values of steepness from individual assessments be treated with considerable caution. Analysts should evaluate the extent to which the stock-recruitment estimation or assumptions influence the estimates of recruitment.

Advice for values of (or Priors for) steepness

It should be noted that these explorations conducted during the Workshop are very preliminary and require further verification and validation of the data sets. Nonetheless, the results suggest the following:

- Steepness for the tropical tuna species is likely to be higher than 0.6;
- There is no obvious relationship between steepness and life history groupings (although steepness among the tropical tunas seem to be more homogeneous relative to the temperate ones). Subsequent analyses should treat tropical and temperate tunas differently, e.g. by linking them as separate groups;
- Future analyses should define data sets in recognition of possible regime shifts;

- Overall, estimated recruitment variability (σ_R) was low. However, stocks with continuous spawning throughout the year tended to show lower inter-annual recruitment variability than stocks with restricted spawning seasons. Further work is needed to corroborate these results (for example, by incorporating estimation errors for recruitment values used in the analyses).

RFMOs should collaborate towards undertaking a meta-analysis of spawner-recruitment data as initiated during this Workshop. It was recommended that analysts continue to develop this work with a view to provide further advice for the estimation of steepness in tuna assessments.

Advice on model- averaging as a method to address uncertainties in steepness (among other things)

All of the tuna RFMOs investigate multiple models (or runs of the same model with different parameter values) during each stock assessment. In some cases, the argument has been made that a single model can be selected to provide an adequate description of the stock status. In other cases, a single model is not sufficient, because: (a) the uncertainty in key parameters cannot be adequately encompassed (such that the assessment is unrealistically precise), and (b) structurally different models may be plausibly consistent with the data and represent considerably different management implications. The workshop recognized that some form of model averaging represented a useful tool for representing the uncertainty encompassed by multiple models, and provided the following guidelines:

- When resources allow, the application of multiple models with different structural assumptions should be encouraged, to ensure a more diverse and robust assessment process. If different models result in different management implications, this should be described in the management advice.
- A range of steepness uncertainty should be reflected in the assessment advice for all tuna species. If the estimates of statistical uncertainty on steepness conditional on a single model specification are dubiously narrow (e.g., CV<15% or some value derived from simulations), then efforts should be made to expand the uncertainty. This can be achieved by integrating the results of several models with a range of fixed steepness values. Where there is evidence for a recruitment regime shift, this should be admitted as one of the structural options.
- Variability in the magnitude and functional form of Mage should be admitted into the analysis and the corresponding uncertainties carried through the management advice.
- Whenever possible, relative plausibility weighting should be assigned to each model (rather than the default of all models weighted equally). The weighting should consider issues of model fit to the data, biological plausibility, and recognized limits for fisheries data to estimate some important parameters. Inappropriate models should be omitted from the management advice. A Delphi approach may be helpful to reach consensus if opinions about weightings are widely divergent.
- Model averaging can lead to polymodal distributions, and the management advice should be clear about whether this is the real perception (e.g. non-overlapping distributions due to different structural assumptions) or an artifact (e.g. due to a coarse grid of steepness values).

The Workshop recommended that stock status advice incorporate stock assessment structural and parameter uncertainty including a range of plausible steepness values.

Advice for improving the presentation of tradeoffs to managers

Decision tables provide information to managers about the tradeoffs of different management actions in the face of uncertainty. Decision tables present quantities of interest (e.g. catch and depletion levels) estimated under alternative states of nature (e.g. steepness) based on different management strategies. The probabilities of the states of nature are presented if available and can be used to determine expected values of the quantities of interest. Decision tables can be used to present the tradeoffs implied by mis-specifying the steepness of the stock-recruitment relationship.

Advice on management and using Harvest Control Rules (HCRs)

It is recommended that options to present management advice in the form of harvest control rules be developed, scientifically evaluated and considered by the relevant decision-making body.

HCRs relate the recommended catch, or other fishery control measure, to the current value of selected control variables. HCRs can be empirical in which the control variables are directly measurable quantities (e.g., catch rate, size composition, tag recovery rate, survey estimates of abundance and species composition). For instance, empirical algorithms have been proposed for southern bluefin tuna to determine Total Allowable Catches using information solely from CPUE indices and fisheries independent index (aerial surveys). HCRs for making management decisions are thus based on a relative procedure that uses year-to-year changes and trends in the empirical indicators. Such procedure will require choosing appropriate reference levels (e.g. an absolute value to initiate the process) that may be based on historical catch and or effort and be tuned to meet management objectives. HCRs can also be model based in which the control variables are quantities estimated from stock assessment or other models (e.g., F, SSB, $B_{current}/B_0$, $B_{current}/B_{MSY}$).

In both cases, it is necessary to test the performance of the HCRs across the plausible range of uncertainty in steepness and other aspects of the population dynamics and observations relevant to the fishery. The performance of different HCRs should be tested for their ability to robustly deliver against a relevant range of desired fishery outcomes (e.g. high catch, high catch rate, low variability in catches, high fishery and population resilience to environmental and other 'shocks', low catches of nominated by-catch or by-product species). Simulation studies should help in determining the performances and the robustness of the different HCRs, especially in a multi-species context (e.g. tropical tunas) or in data-poor situations.

Tuna RFMOs should consider the ability of different tested HCRs to deliver across that range of management outcomes and chose the HCR that they would prefer to be the basis of future 'bases case' management advice. There should be periodic review of the HCR that is used, including proactive identification of 'exceptional circumstances' that would trigger an in-depth review.

The Workshop recommended that RFMO decision-makers consider management measures and/or HCRs that are robust to uncertainty in steepness, noting the precautionary approach and the economic benefits of maintaining stocks at higher stock sizes. RFMOs should collaborate on methods for the incorporation of uncertainty of steepness into stock assessment advice, including approaches such as management strategy evaluation.

GLOSSARY OF TECHNICAL TERMS

B_0	Equilibrium biomass (or spawning biomass, SSB_0) expected when F=0 (also known as "virgin biomass").
B_{MSY}	Average biomass (or spawning biomass, SSB_{MSY}) that results from fishing at $F=F_{MSY}$.
CPUE	Catch-per-unit-effort (or "catch rate"). Stock assessments typically use CPUE as an index of abundance for a component of the population
$F_{0.1}$	Fishing mortality for which the slope of the yield-per-recruit curve is 10% of the value as F approaches 0.0. $F_{0.1}$ is sometimes used as a proxy for F_{MSY}.
$F_{35\%}$	Fishing mortality that results in an SPR of 35%. $F_{35\%}$ is sometimes used as a proxy for F_{MSY}.
F_{MSY}	Fishing mortality that would produce MSY.
h	Steepness: the fraction of recruitment from an unfished population obtained when the spawning stock biomass is 20% of SSB_0.
HCR	Harvest Control Rule. The rule relates a variable over which management has some direct control as a function of some indicator of stock status (for example, how catch could be set depending on the level of SSB).
M	Natural mortality rate.
MCMC	Markov Chain Monte Carlo methods. These are a class of algorithms for sampling from probability distributions based on constructing a Markov chain that has the desired distribution as its equilibrium distribution.
MSY	Maximum Sustainable Yield. The largest amount of yield that could be produced by a stock, on average.
SPR	Spawning potential ratio: The expected value of spawners per recruit (SSB/R) at a given fishing mortality divided by the SSB/R with F=0.

SRR	Stock-recruitment relationship. The relationship predicts the average number of recruits that would be produced at different population sizes. Two functional forms are commonly used in fisheries: The Beverton-Holt and the Ricker models.
σ_R	"Sigma-R" measures the magnitude of recruitment variability around the SRR.

4.3 Review of performance of FAD closures

SC6

391. Following the discussion on this issue, SC6 made the following recommendations:

- The Commission and TCC should note the analysis of fishing activities during the 2009 FAD closure presented in working paper MI-WP-03 when reviewing the implementation of CMM-2008-01.
- Further analyses should be undertaken as additional data and information comes forward to investigate the effectiveness of FAD closures on reducing juvenile bigeye mortality.
- Observer reports that document purse-seine effort during the 2009 FAD closure should be examined to investigate the setting characteristics of unassociated effort in proximity to drifting objects.
- Observer reports should be used to characterize the details of FAD sets made in contravention to CMM-2008-01.
- The Commission should give additional support to allow the timely analysis of observer data, including the analysis of size-trends in the catch to assist with the understanding of the FAD closure.

4.4 Management Objectives Workshop

SC6

403. In supporting this Management Objectives Workshop, SC6 made the following recommendations, and requested that the Commission take these recommendations into consideration when organizing the workshop.

i. That WCPFC7 renew their support and the required funding provided at WCPFC6 for holding a Workshop on Management Objectives.
ii. In order to allow SC7 to first review the results of the intersessional work project on RPs, the workshop should be held between SC7 and WCPFC8.
iii. That an independent international expert(s) be invited to the workshop to provide expert guidance on the use of RPs and other issues of relevance to identifying fisheries management objectives. The science services provider (SPC), with the assistance of other regional scientists, contributes to the Management Objectives Workshop in order to provide technical advice on the adoption of RPs to key WCPFC stocks.
iv. SC6 also noted that in order to assist with the success of the workshop, some preparatory scientific work would need to be undertaken. It identified SPC as the agency in the best position to undertake this preparatory work. The Commission is requested to take this into consideration when addressing the level of funding support required for the workshop.

AGENDA ITEM 5-ECOSYSTEM AND BYCATCH MITIGATION THEME

5.1 Ecosystem effects of fishing

SC6

8.1 Fisheries impacts

a. EB-IP-02 (SEAPODYM applications in WCPO – progress report)

405. J. Hampton (SPC) reported that work on SEAPODYM is continuing, and that applications of SEAPODYM are becoming more extensive. SPC hopes to use this tool to document environmental and fishing impacts in EEZs of member countries, to hone in on impacts occurring in individual subregions, and to discriminate between effects of fishing and the environment.

PROJECT 62: SEAPODYM APPLICATIONS IN WCPO – PROGRESS REPORT (WCPFC-SC6-2010/EB- IP 02 Rev 1)

Conclusion

The new version of the model SEAPODYM now includes a general framework to use catch and size composition data from the fisheries to achieve optimization of parameters for each species. This development is a key step to gain confidence in the model estimates. While there is a small number of parameter to calibrate, achieving a plausible set of biological parameters remains a difficult task requiring a large number of simulations. Several tools for assisting in the optimization experiments and analyses of results have been developed. The qualities of fishing and environmental forcing data are the two main issues to achieve convergence and obtain plausible results. Satisfactory model configurations with optimal parameterization for each tuna species have been completed, except for yellowfin tuna. This allows the development of various applications for fisheries management. In particular we will revise the preliminary work that has been conducted to investigate the impact of High Sea Pockets closure. There is also a strong interest from WCPFC members to assess the biomass of tuna inside their EEZ allowing a better management at local scale and providing key information to establish the level of fishing effort and catch that can be allocated to domestic and distant-water fisheries. Using the model configuration and optimal parameterization achieved for the reference fit above, and higher resolution and more realistic environmental forcing datasets in the future, it is possible to extract model variables in any given EEZ using specified EEZ mask.

5.2 Sharks*

SC6

424. SC6 recommended to the Commission that:

- The shark research plan be approved.
- WCPFC7 add porbeagle (south of 20°S) and hammerhead sharks to the list of key shark species.
- The 'key shark species' listed in CMM 2009-04 be added to relevant sections of the Commission Rules on Scientific Data to be Provided to the Commission, namely: i) Section 1 on estimates of annual catches; ii) paragraphs 1.3 to 1.6 of Annex 1 on operational level data; and iii) where possible, recreational catch and effort information.
- CCMs should endeavour to collect catch and effort data for porbeagle sharks (south of 20°S) and hammerhead sharks that reflect the spatial and temporal extent of their longline and purse-seine fisheries. Together with advice from the Kobe II specialist bycatch working group on data reporting requirement in 2011, SC7 will consider adding these two species to paragraphs 1.3 to 1.6 of Annex 1.
- SPC-OFP develops a process for the nomination of a key shark species for consideration at SC7, and identifies a subgroup of key shark species for which stock assessments will be conducted.
- Any work undertaken on sharks should be in the context of the entire Commission area, given that no shark species have been defined as northern stocks.
- The Commission requested that ISC coordinate shark data sharing and shark stock assessments with SPC-OFP, and present the results of the shark stock assessments in full at SC.

5.3 Seabirds*

SC6

439. SC6 made the following recommendations.

i. SC6 noted that extensive research is currently underway, aimed at providing a scientific basis for additional changes to CMM 2007-04. SC6 agreed that minor proposed amendments to CMM 2007-04, as recommended by the SC, should not be incorporated into the CMM until such time as there are sufficient changes to warrant revision.

ii. On the use of weighted branch lines:

   a. SC6 agreed that line weighting of pelagic longlines is likely to be one of the most effective mitigation measures in reducing or eliminating seabird interactions with baited hooks, and that

further research should be undertaken to refine 'weighted branch lines' specifications contained in CMM 2007-04.

iii. On the use of dead baits versus live bait:
   a. SC6 noted the findings in EB-WP-06, carried out in the southern hemisphere, that indicate the use of live bait in pelagic longline fisheries may increase seabird mortality above that associated with the use of dead bait, based on slower sink rates of live bait.
   b. SC6 agreed that the use of live bait should be discouraged in fisheries operating in areas of high seabird abundance that do not already use live bait.
   c. SC6 recommended that additional research be undertaken to confirm the findings presented in EB-WP-06, and to include different line weighting regimes, in areas north of 23°N and in areas south of 30°S, for consideration by SC. Seabird interaction rates for these experiments should also be reported.

iv. On the use of blue-dyed bait:
   a. SC6 noted that recent research suggests that blue-dyed squid bait may be more likely to decrease seabird bycatch in pelagic longline fisheries than other blue-dyed baits such as fish.
   b. SC6 recommended that additional research be carried out on the efficacy of blue-dyed squid bait over other blue-dyed baits, including during both setting and hauling, for consideration by SC.

v. On the location of the southern latitudinal boundary:
   a. SC6 noted that the purpose of the productivity-susceptibility analysis in EB-IP-01 was to determine the probability of seabird-fisheries interactions and the risk of adverse effects of fishing-induced mortality on seabird populations. The results suggest that the southern boundary (30°S) of the seabird mitigation measure (CMM 2007-04) may need to be moved farther north to ensure adequate spatial protection for seabird high-risk areas.
   b. SC6 recommended that SPC-OFP and ACAP provide advice on observer data and information on seabird distribution to the Secretariat, after which a decision could be made on whether to proceed with a formal new analysis of risk levels of longline fishing to seabirds in the southern hemisphere. Members with observer programmes in this area should collaborate with SPC to assist in improving data holdings for assessing risk levels of longline fishing to seabirds.

vi. On the use of deep setting line shooter:
   a. SC6 noted the findings in EB-WP-07, carried out south of 25°S, which suggest that a mainline deployed with a line shooter (as in deep setting) into propeller turbulence at the vessel stern slows the sink rates of baited hooks.
   b. SC6 recommended that testing of the deep setting line shooter be carried out north of 23°N, to determine its utility in mitigating seabird interactions and other at-risk species (e.g. marine turtles, marine mammals, sharks) in that area.
   c. SC6 noted that there are currently no specifications for the use of deep setting line shooters in CMM 2007-04.
   d. SC6 recommended that TCC consider the development of specifications for 'deep setting line shooter', for inclusion in CMM 2007-04.

vii. On the format of Table 1 in CMM 2007-04:
   a. SC6 noted that there are clear operational differences in longline fleets and seabird species composition in the areas north of 23°N and south of 30°S.
   b. SC6 recommended that when CMM 2007-04 is next modified, TCC should consider the utility of separating Table 1 into two separate tables, one each for the area north of 23°N and the area south of 30°S.

5.4 Sea turtles*

5.5 Other species and issues

   a. Guidelines for the release of encircled animals
   b. FAD bycatch mitigation

AGENDA ITEM 6-DATA AND STATISTICS THEME

6.1 Data gaps

a. Data gaps of the Commission

SC6

452. SC6 recommended that SC6-ST-WP-01 be forwarded to TCC for its consideration.

WCPFC-SC6-2010/ST WP-1(rev. 3)

2. RECENT DEVELOPMENTS IN RESOLVING DATA GAPS

2.4 Number of vessels in the aggregate data

- Chinese Taipei have provided information on the number of vessels per stratum in their provision of 2007, 2008 and 2009 aggregate data for their distant-water (DWLL) and offshore (STLL) longline fleets. This information will therefore allow the production of a public domain version of their aggregate data for these years only but not the entire time series of their aggregate data. A request for clarification was sent to Chinese Taipei in regards to whether the cells representing the activities of "less than 4 vessels" have been removed from their recent data provision or not, noting that the WCPFC rules regarding the filtering of data apply to public domain data dissemination and not data submissions to the WCPFC.

3. STATUS OF DATA GAPS

3.1 The main data gaps related to Stock assessment of target tunas

The following are considered the main data gaps in the historical aggregated catch and effort, and size composition data, used in stock assessments for the target tuna species:

3.1.1 Important data gaps from key fleets

Chinese-Taipei domestic (based in Chinese Taipei) offshore (STLL) longline fleet

- There are no operational (logsheet), aggregated catch and effort, nor size data available for years prior to 2004.

3.1.4 Operational catch and effort data

- Coastal states (which are members of the SPC and FFA) collect operational catch and effort data through bilateral access agreements with foreign fleets fishing in their waters; these data are processed and held by the SPC on behalf of the coastal states. Operational catch and effort data are not available outside the EEZs of FFA member countries for Japanese fleets, the Korean distant-water longline fleet, and the Chinese and Chinese Taipei distant-water longline fleets that target bigeye and yellowfin. (Operational catch and effort data for Chinese and Chinese Taipei distant-water longliners targeting albacore are compiled by port samplers in Pago Pago, American Samoa and Levuka, Fiji).
- Operational catch and effort data, together with fine-scale oceanographic data that may affect catch rates, are required for the development of indices of abundance. Operational catch and effort data are also required to determine the spatial distribution of the catch in relation to EEZs, the high seas areas and other management-related areas.

Progress has been made with the provision of historical operational data over the past two years (See Section 4.3 below and Table 7).

3.1.5 Aggregate catch and effort data

- Certain stock assessments require aggregate catch and effort data that cover the extent of the stock for that species4. In the case of bigeye tuna, for example, stock assessments cover the Pacific Ocean and therefore the provision of aggregated longline data is required to cover the Pacific Ocean. In the case of south Pacific Albacore, stock assessments cover the Pacific Ocean, south of the equator. The following lists the vessel nations and years where aggregate longline catch/effort data does not cover the Pacific Ocean:
  - Chinese distant-water longline fleet for all years;
  - Chinese Taipei distant-water longline fleet for 2002, 2004-2009;
  - Korean distant-water longline fleet for 1998–1999;
  - Japan distant-water longline fleet for 2005–2009.

The requirements for the provision of scientific data to the WCPFC cater for the voluntary submission of data covering the Pacific Ocean:

"Catch and effort data aggregated by periods of month and areas of 5° longitude and 5° latitude that have been raised to represent the total catch and effort, and unraised longline catch and effort data stratified by the number of hooks between floats and the finest possible resolution of time period and geographic area, covering distant-water longliners may also be provided for the Pacific Ocean east of the eastern boundary of the WCPFC Statistical Area"

SC5 considered that this problem could also be resolved through the data exchange MOU with IATTC whereby WCPFC could obtain the balance of the Pacific Ocean data (i.e. EPO data) from IATTC and combine it with the WCPFC data to cover the Pacific Ocean. WCPFC6 (December 2009) subsequently approved the data exchange arrangement with IATTC.

- In some instances, the aggregated catch and effort data provided to the WCPFC for the most recent year of activities have not been raised and represent low coverage of activities. For example, this is the case with the 2009 aggregate longline data provided by Korea where coverage of aggregate data provided was only 29% of the annual catch estimates – these data are typically not loaded into the WCPFC databases used for the stock assessments due to the low-coverage problem.

  Also, the 2008 aggregate Korean longline data (with adequate coverage) were not provided until June 2010 which delayed the 2010 stock assessments.
- In some instances, it is not possible to reconcile the aggregate longline catch data with annual catch estimates. For example, this is the case with the aggregated catch/effort data covering the Japanese distant-water longline fleet, where catch is provided in numbers of fish only
- In some instances, the unit of catch provided in the aggregate longline catch data is not suitable for use in stock assessments. For example, the aggregated catch data provided for the distant-water Chinese longline fleet are in units of "kilograms" only, and the stock assessments require the catch to be in "numbers of fish" by species.

  This problem has been rectified in the data provided for recent years (2008–2009), but is still a problem with the Chinese longline data provided for 2003–2007.

3.3 The main data gaps related to ecosystem approach to fisheries

Gaps in data collection/provision, sampling design and research related to the implementation of an ecosystem approach to fisheries include the following:

- The coverage of catch data for non-target species, including species of special interest (marine reptiles, marine mammals, sharks and sea birds), collected by observers needs to be increased for most longline and purse-seine fleets, and particularly the distant-water longline fleets, for which observer coverage has been negligible. Exceptions to the need for increased coverage are the longline fleets of New Zealand, Papua New Guinea and the United States (based in Hawaii), the purse seine fleet of Papua New Guinea and purse seiners fishing under the United States Treaty and the FSM Arrangement. Coverage of the Australian longline fleet has increased in recent years.
- Biological data covering non-target species are lacking; the types of data required include length and weight, length and age at maturity, longevity, growth rate, fecundity, habitat use (vertical and horizontal range), and trophic interactions.
- Other gaps include quality-controlled ocean bathymetry data, especially regarding seamount definitions and locations, oceanographic data products resolving mesoscale features relevant to fisheries, and acoustic data for the validation of models of mid-trophic components of oceanic ecosystems.

Table 7. Provision of historical operational catch/effort data to the WCPFC

ENTITY	Flag State Data (Convention Area)			Coastal State Data (EEZ only)		NOTES
	GEAR(s)	Date of Notification	Provided by	GEAR(s) / FLEET(s)	Date of Notification	
Australia	LL, PL, PS, TR	16 Apr 2008	SPC-OFP	ALL	16 Apr 2008	SPC authorised to release
Belize	LL		No		Not Applicable	
Canada	TR		No		Not Applicable	
China	LL, PS		No			
Cook Islands	LL	10 Jun 2009	SPC-OFP			SPC authorised to release
Ecuador	PS		No		Not Applicable	
El Salvador	PS		No		Not Applicable	
Federated States of Micronesia	LL, PS	13 Jan 2010	SPC-OFP			SPC authorised to release
Fiji Islands	LL, PL	22 Jun 2009	SPC-OFP			SPC authorised to release
French Polynesia	LL, PL, TR	1 Jul 2010	SPC-OFP			SPC authorised to release
Indonesia	LL, PS, OT		No		Not Applicable	
Japan	PS	17 Apr 2009	Japan (Partial)		Not Applicable	(1) [2001-2004 only]
Japan	LL, PL		No		Not Applicable	
Kiribati	PS, LL		No			
Republic of Korea	LL, PS		No		Not Applicable	
Marshall Islands	LL, PS	9 Jul 2009	SPC-OFP			SPC authorised to release
Nauru	LL	19 Aug 2009	SPC-OFP	ALL	19 Aug 2009	SPC authorised to release
New Caledonia	LL		No			
New Zealand	LL, PL, HL, PS	20 March 2008	SPC-OFP	ALL	20 March 2008	SPC authorised to release
Niue	LL	3 Sep 2009	SPC-OFP			SPC authorised to release
Palau	LL, PL		No			
Panama	PS		No		Not Applicable	
Papua New Guinea	LL, PS		No			
Philippines	PS	*01 Dec 2008*	Philippines (Partial)		Not Applicable	(1) [2004 only]
	HL, RN, OT		No		Not Applicable	
Samoa	LL		No			
Senegal	LL		No		Not Applicable	
Solomon Islands	LL, PS, PL		No			
Spain	LL		No		Not Applicable	
	PS		No		Not Applicable	
Chinese Taipei	LL, PS		No		Not Applicable	
Tonga	LL		No			
United States	LL, TR, PL		No		Not Applicable	
United States	PS	30 Apr 2008	FFA / SPC-OFP		Not Applicable	US Multilateral treaty only (since 1988)
Vanuatu	LL, PS	22 Dec 2008	SPC-OFP			SPC authorised to release

NOTES

1 Flag state data provided in accordance with paragraph 15 and 16 of Conservation and Management Measure for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean (CMM 2008-1).

b. Species composition of purse-seine catches

SC6

473. SC6 recommended that:

i) the current work (Project 60) on paired spill/grab experimental sampling should have continued funding and be extended to include fleets, areas and set types where no representative sampling has taken place. Where possible, the results of the paired sampling should be verified against cannery, unloading and port sampling data. A standard spill sampling methodology should be documented once the trials are complete;

ii) CCMs collect species and size composition data in cooperation with factories and canneries where catch is landed;

iii) a flow diagram, illustrating how sampling biases can affect species composition data, should be made available to participants. This should document the method used to correct historic logsheet data; and

iv) a follow-up workshop on species composition issues to the workshop held in Sete, France in June 2009 should be held, in collaboration with all relevant RFMOs.

c. Data issues with the ISC

SC6

477. SC6:

i. acknowledged the progress made to date, but reiterated the decisions made by the Commission at WCPFC6 on the process of reconciling the different data held by the WCPFC and ISC; and

ii. requested the science services provider to provide specific tables that show provisions of operational level catch and effort data for the North Pacific region from all CCMs.

6.2 Regional Observer Programme (ROP)

SC6

491. SC6:

i) noted the ROP matters raised in ST-WP-01 and ST-WP-06, and emphasised the importance of the timely provision of observer data to support the verification of catch and effort data and for undertaking the evaluation of fishing activities for stock assessment and bycatch mitigation purposes;
ii) encouraged the Commission to finalize the outstanding matters relating to ROP data management and ROP data provision as a matter of priority; and
iii) noted the lack of adequate funding support provided for data compilation and analysis in the current Commission budget and requested that this be addressed at WCPFC7.

6.3 West Pacific East Asia Oceanic Fisheries Management Project (WPEA)

SC6

493. SC6:
i) noted the WPEAOFMP Steering Committee report;
ii) noted the excellent progress achieved by the WPEAOFMP over the past 12 months; and
iii) indicated its continuing support for this project.

6.4 Tagging initiatives (PTTP)

SC6

495. SC6:
i) noted the good progress achieved by PTTP over the past 12 months;
ii) endorsed PTTP's 2010–2011 work plan;
iii) noted and endorsed the tagging programmes underway or planned in Hawaii, the EPO, and the coastal and offshore areas off Japan, Korea, Indonesia, the Philippines and PNG; and
iv) encouraged the science services provider to undertake further analyses to integrate PTTP data into future stock assessments as soon as possible.

AGENDA ITEM 7-COOPERATION WITH OTHER ORGANISATIONS

7.1 The status of cooperation and relations

AGENDA ITEM 8-SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

8.1 Consideration of the special requirements of developing States pursuant to Part VIII of the Convention

AGENDA ITEM 9-FUTURE WORK PROGRAM AND BUDGET

9.1 Strategic Research Plan of the Scientific Committee
9.2 Review of the Scientific Committee Work Programme
9.3 Development of 2012 Work Programme and budget, and projection of 2013-2014

AGENDA ITEM 10-ADMINISTRATIVE MATTERS

10.1 Rules of Procedure
10.2 Peer review of stock assessments*
10.3 Future operation of the Scientific Committee
10.4 Next meeting*

AGENDA ITEM 11-OTHER MATTERS

SC7 may further discuss and develop proposals identified in paragraph 424 of the WCPFC7 Summary Report (i.e., WCPFC7 papers for further discussion and development through SC7 and TCC7). SC7 will consider any additional issues.

AGENDA ITEM 12-ADOPTION OF THE REPORT OF THE SEVENTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

12.1 Adoption of the Summary Report and Executive Summary of the Seventh Regular Session of the Scientific Committee

AGENDA ITEM 13-CLOSE OF MEETING

相關資料

Report on Yellowfin tuna in the Western and Central Pacific Ocean (Jean-Jacques Maguire CIE Reviewer) circulated in 2011 SPC Preparatory Stock assessment Meeting

Executive Summary

The 2009 assessment for Western and Central Pacific Ocean yellowfin tuna resulted in a determination that yellowfin tuna was not overfished and that overfishing was not occurring. Previous assessments had determined that overfishing was occurring.

All available relevant sources of information have been used in the assessment including catch, size and effort information. There appear to remain important uncertainties however about the most basic of these data - catch. This should be rectified.

Having been developed specifically for tuna species in the Pacific Ocean, the assessment method is clearly adequate and appropriate for yellowfin tuna and the fisheries exploiting it, and it is well suited to the data available for this assessment. The method seems to have been properly applied. The results can be assumed to be reasonably reliable, but relatively large changes in important fisheries management parameters in successive assessments suggest that the results should be used with care.

All model assumptions seem reasonable, but it is also clear that none of the assumptions is fully satisfied. Similarly, the data seemed to have been properly used, but data are variable and seem relatively scarce. The fact that all model runs presented show more or less the same trends may give a false sense of security. Exploring what changes would be required to produce radically different results might give a sense of the robustness of the results.

The sensitivity analyses of the base case adequately cover the range of possibilities of the model used.

The determination that yellowfin tuna in the Western and Central Pacific is not overfished and that overfishing is not occurring is consistent with the data and seems reasonable, in a relative sense, based on the analyses and sensitivities. This does not mean, however, that the absolute values of B_{MSY}, SSB_{MSY}, and F_{MSY} are estimated precisely.

Future population status and catches are not projected forward in this assessment. The emphasis is on estimating current stock size relative to reference points and these are used to provide advice in terms of fishing effort or fishing mortality. Projections were done in the 2007 assessment but not in the 2009 assessment.

Modeling for this yellowfin tuna resource is pretty much state of the art for the types of data and information available. While modeling can no doubt be improved, it will not be the main avenue to reduce the major sources of uncertainties. Real progress will not be achieved through more modeling - it is more data and knowledge that are required. Reliable estimates of total catch, increased sampling of the most important gear and areas, and well-designed large scale tagging program to better define stock structure and understand migration pattern.

Review Stock Assessment of Yellowfin Tuna in the Western and Central Pacific Ocean (Malcolm Haddon, CSIRO Marine and Atmospheric Research) circulated in 2011 SPC Preparatory Stock assessment Meeting

Executive Summary

The 2009 stock assessment document for yellowfin tuna in the Western and Central Pacific Ocean was reviewed. To do this appropriately it was necessary to also read through the 2007 assessment and a few other documents.

The authors of the 2009 assessment have made a real effort to pre-empt critical review by including

diagnostics and their own critical review of the strengths and weaknesses of the assessment. They identified where the data were weakest, where the model fits were poorest, and which assumptions and structural decisions were most influential. With this list in mind they were also able to include a list of the most valuable future research and extra data gathering that could be conducted to improve the assessment. This is an excellent assessment that provides a fine example of how to present a complex assessment to a wide audience.

The data sources for the assessment were appropriate and, although there can always be more data at a better resolution and with more detail, it proved adequate to provide an assessment that can be used to assess the status of the yellowfin stock in the western and central Pacific Ocean.

Multifan-CL is the only assessment framework available that could address the complexity of the different data streams and the multitude of fisheries and gear types that make up this fishery. Its design lends itself to generating large amounts of diagnostic output and this lends itself to producing self-critical assessments. The stock assessment methods have been applied properly and are adequate and appropriate for this species and the types of data available. The assessment should be reliable but this will only really be determined through time and repeated assessments.

Many changes were made to the assessment model in 2009 relative to 2007 but these were all adequately defended and the range of sensitivities to the assumptions and structural decisions made were adequate to characterize the models performance and how these decisions and changes affected that performance. The sensitivity analyses conducted appear thorough and sufficiently complete to provide the necessary confidence in the model outputs. Further work is needed to characterize the affect of differences in the growth of younger ages expressed in different regions, in addition, the affect of the new approach to calculating the reproductive potential on the spawning biomass performance measures should be expanded.

A wide range of stock performance measures such as $B_{current}/B_{MSY}$ or $B_{current}/B_{current,F=0}$, were provided and the performance of the fishery summarized in phase plots of some of these ratios. This is a positive direction to go in, but if a decision has to be made about which measures to adopt or to move to then it is recommended that the management decisions that might derive from using the alternatives be considered retrospectively for a number of years so that an informed decision can be made that can be agreed to by all members of the WCPFC.

No projections were made in this current assessment and if such projections are required in future, then these should be specified in some detail so that the implications of specific scenarios can be examined, rather than generalized outputs that may not be particularly informative.

The authors provide a detailed list of research recommendations but a shorter list would include a consideration of the integrity and accuracy of the varied catch and effort time series.

In addition, the methods used to standardize the longline catch rate data and the relationship between longline catch rates and yellowfin tuna abundance would benefit greatly from closer examination. Finally, more work is needed to characterize the growth of the younger age classes across the regions and the means for including that in the assessment examined.

WCPFC Seventh Regular Session (Honolulu, Hawaii, USA 6–10 December 2010)

AGENDA ITEM 5-SCIENCE ISSUES

5.1 Report of the Sixth Regular Session of the Scientific Committee

104. The Chair of the Scientific Committee, Dr Naozumi Miyabe (Japan), provided a summary of the Sixth Regular Session of the Scientific Committee (SC6) which was held 10–19August, 2010 at Nuku'alofa, Tonga.

5.1.1 Stock status of key tuna species and evaluation of CMM 2008-01

105. Dr John Hampton (SPC Oceanic Fisheries Programme Manager) presented an overview of the WCPO fisheries stock status for skipjack, yellowfin, bigeye and South Pacific albacore. The total 2009 catch of 2.48 million mt was a record, and dominated by skipjack and yellowfin. The catch was driven by the purse seine fishery, with skipjack being the predominant species taken. The purse seine catch in 2009 had a typical equatorial distribution. In 2009 the catch included a strong eastern component, as is typical of El Niño years. Purse seine effort has continued to

increase over time. There are two key components: associated sets and unassociated sets; both have continued to increase over time in roughly equal amounts. Bigeye tuna catch by purse seine is concentrated in associated sets. The longline catch in 2009 showed strong concentration of albacore tuna, to about 66,000 mt. There is also decline in tropical longline fishery targeting bigeye tuna and yellowfin; that is consistent with information to be reported on effort in the longline fishery. The highest longline effort is between 20°N to 10°S. The skipjack catch has continued to increase rapidly, and reached approximately 1.7 million mt in 2009, dominated by purse seine catch. The pole and line contribution continues to decline.

106. The WCPO skipjack stock is decreasing slowly, and is now about 50% depleted from an unexploited level. This is a moderate level of depletion: the stock is not overfished, and there is no overfishing. However, at some time in the near future a decision will have to be made as to the acceptable level of depletion and future harvest strategies for this stock.

107. Yellowfin was assessed in 2009. Catch increased in 2008 after a period of stability, but there has not been the same growth in the yellowfin catch as has been seen for skipjack. There is evidence that the full exploitation potential of yellowfin has been reached. The yellowfin stock has decreased steadily, and it is now around 50% of the unexploited biomass. This is considered to be a moderate level of depletion. Depletion is much stronger in the western equatorial zone, where 90% of the catch occurs. In this region there is much steeper decline in biomass, and much larger impacts of fishing.

108. Bigeye was assessed in 2010. The catch has been stable for the past 10 years. The longline catch is mainly of adults, but there is a recent increase in the purse seine catch following FAD introduction. The purse seine catch reported in statistical bulletins is probably underestimated, an issue which is being addressed through ongoing work on purse seine species composition by various methods (grab vs. spill sampling). Bigeye biomass has declined steadily over a long period of time. In the absence of fishing, the assessment suggests that biomass would have increased strongly due to increased recruitment in last 20 years. There is an element of uncertainty in this result, and early stock size and recruitment may be underestimated. In recent years there has been a very high level of depletion compared to what it would be in the absence of fishing.

109. South Pacific albacore was assessed in 2009. The fishery is composed almost entirely of longline vessels catching adult albacore. The catch has doubled since the mid-1990s, and is now in excess of 60,000 mt. There is also a small troll fishery in New Zealand. The South Pacific albacore assessment shows biomass has declined steadily since the mid-1970s. The current level of depletion of the stock due to fishing is ~30% (a moderate level of depletion), and current catches are sustainable. The stock is not overfished, and there is no overfishing.

110. In summary, a composite Kobe Plot of spawning biomass shows concerns for bigeye tuna, and for yellowfin in the western equatorial area.

111. Kiribati spoke on behalf of FFA members, and accepted the conclusions and recommendations on the management of the various stocks as outlined, and proposed that the SC advice on stock status be adopted by the Commission as the basis for work on stock management by the Commission. FFA members noted (i) that the bigeye assessment was more optimistic than the 2009 assessment, but that the status of the stock would have been worse and the recommended reductions greater if the model run with a different value for steepness was used as a basis for the advice; and (ii) the increase in the impact of fishing on the skipjack stock, pointing to the need to give greater priority to addressing skipjack stock status in the Commission's work.

112. Several CCMs noted with concern the condition of bigeye tuna, western yellowfin, and skipjack stocks, and the need for action to preserve stocks.

113. In response to queries from CCMs, Dr Hampton provided the following additional information:

i. in conducting stock assessments SPC makes many model runs using different model configurations, with some much simpler than others. Where possible parallel assessments are also conducted using different modeling platforms;
ii. a rapid change in skipjack biomass is possible, depending on recruitment, as most skipjack

fisheries focus on 1 or 2 age classes. A decline in skipjack fisheries has been observed off Japan, which may reflect reduced availability of skipjack in peripheral areas due to high exploitation in the core equatorial area. There is a need to better understand the links between stocks, and tagging programs should assist in this regard;

iii. the recruitment trend in bigeye tuna is a particular concern, and is driven by a relatively flat or slowly declining longline CPUE trend in combination with the rapid expansion in the catch of juvenile bigeye tuna since the mid-1990s. The credibility of the estimated recruitment trend is therefore related to the credibility of the longline CPUE, particularly in the 1960s and 1970s. This is an issue that needs to be addressed with some urgency;

iv. the bigeye tuna stock assessment indicates that a 29% reduction in fishing mortality is needed to reduce fishing mortality to F_{MSY}.

v. caution is needed when comparing skipjack MSY and catch levels, as there is large variability in recruitment. Recent skipjack recruitment is somewhat higher than the long-term average, which can result in high catches in relation to equilibrium yield;

vi. availability of skipjack in the South Pacific varies significantly from year to year, especially in Australian and New Zealand waters, making it hard to detect long-term trends. SPC is currently examining the issue of possible range contraction in skipjack and other tuna stocks.

114. The Commission accepted the following SC6 recommendations and findings on the status of the key tuna stocks:

i. A minimum 29% reduction in bigeye tuna fishing mortality from the average levels for 2005–2008 with the goal of returning the fishing mortality rate to F_{MSY}.

ii. There was no new information on the stock status of yellowfin tuna in 2010, and management recommendations from SC5 are to be maintained.

iii. There was no new information on the stock status of South Pacific albacore tuna in 2010 and management recommendations from SC5 are to be maintained.

iv. The management advice from SC5 on South Pacific swordfish is to be maintained pending a new assessment or other new information.

v. A new stock assessment was not conducted for southwest Pacific striped marlin and the stock status description and management recommendations from SC2 are to be maintained.

vi. Adoption of the conservation advice provided by ISC9 on North Pacific albacore.

vii. Adoption of the conservation advice provided by ISC10 on Pacific bluefin tuna (that the level of F be decreased below the 2002–2004 levels, particularly on juvenile age classes).

viii. Adoption of the conservation advice provided by ISC10 on North Pacific swordfish stocks (that both swordfish stocks in the North Pacific are healthy and above the level required to sustain recent catches).

ix. For North Pacific striped marlin:
   a) develop/adopt an interim CMM for 2011;
   b) request that the ISC provide estimated catch levels corresponding to average fishing mortality during 2001–2003 and fishing mortality reference points including F_{MSY} and F at various spawning potential ratios; and
   c) that the Scientific Services Provider participate in the north Pacific striped marlin assessment led by the ISC and that the assessment be presented to SC7 for review .

115. The Commission also accepted the following SC6 recommendations and observations:

i. the continuation of the bigeye tuna age and reproductive biology study;

ii. the work plan of the Fishing Technology theme;

iii. a review of South Pacific swordfish data during 2011, will be presented to SC7.

iv. collation of southwest Pacific striped marlin data for a planned stock assessment in 2012;

v. full stock assessments of WCPO bigeye, skipjack and yellowfin tuna, and an update of south Pacific albacore, while noting that the USA facilitated an independent peer review of the 2009 WCPO yellowfin tuna assessment and the review will be forwarded to the Scientific Services Provider for use in the April 2011 stock assessment preparatory

workshop;

vi. the recommendations of the Management Issues theme regarding:
    a) continuation of limit reference points identification;
    b) further analyses of the effectiveness of the FAD closure, including through examination of observer reports; and
    c) implementation of Kobe II joint RFMO workshop outcomes;
i. the recommendations of the Ecosystem and Bycatch Mitigation theme, noting the various research findings relating to seabirds;
ii. that the budget for the collection and evaluation of purse-seine species composition data be increased by US$30,000;
iii. that SC strategic plan contains no requirement for a mandatory external peer review; and
iv. the new SC meeting structure.

116. The WCPFC7 discussed the timing of and required data for a south Pacific swordfish stock assessment. It was noted that a further stock assessment would be difficult to progress until operational level catch and effort and size data was available from vessels fishing in the South Central pacific area, particularly a fleet flying the flag of one of the EU member States, as well as issues with fleets of some other CCMs. The EU drew attention to the suggestions for improving the SC work and structure submitted in intersessional EU correspondence to WCPFC CCMs (WCPFC-2010-IP10)

117. The Commission directed the Secretariat to make written requests to members seeking the cooperation of all CCMs that fish for the species in providing detailed size data and operational-level logsheet data specifying catch and effort, in order to enable a full assessment to be undertaken in 2012.

Management Objectives Workshop

118. CCMs supported the holding of the proposed Management Objectives Workshop as an important necessary step towards the analysis of management strategies and adoption of reference points. They requested that the WCPFC Secretariat ensure in its workshop planning that management objectives are firmly based on and reflect the full range of considerations related to stock management provided for by the Convention. In addition, members noted it was essential that the work on management objectives should also reflect multi-species considerations. It was proposed that the workshop also explore a pilot programme for applying the Kobe II Strategy Matrix for bigeye tuna.

119. The EU requested clarification on how the proposed independent international experts would be selected, suggesting this should be done under the direction of the Commission, and how members and their scientists and managers would be involved in the preparatory work, including in the preparation of TOR. A CCM also indicated limits on the catch of adult bigeye tuna should also be considered.

120. In response to a CCM's question on the impacts of longline catch on bigeye tuna stock, the SC chair noted that SPC, through its analysis, was seeking to capture information on the impact of CMM 2008-01 on adult bigeye catch, and stressed the need to ensure effective measures to reduce juvenile bigeye catch, as it could result in rapid reduction in MSY. He noted that purse seine fishing in association with FADs was impacting spawning stock biomass, and agreed that protection of adult bigeye would also be beneficial.

121. The Executive Director noted that the selection of independent international experts was normally done in consultation with the WCPFC Committee chairs and Members, to reflect a good balance between the interests in the Commission. He also indicated that there was a strong link between management objectives and science, and that both scientists and managers should attend the workshop, but this should not interfere with setting of science-based objectives.

122. The Commission directed the Secretariat to prepare TORs for the Management Objectives Workshop, which is to be held in 2012.

Paired spill / grab experimental sampling

123. CCMs strongly supported the SC recommendation that further work be done to extend paired

spill/grab experimental sampling and verify this data against cannery, unloading and port sampling data. Members noted the importance of improving purse-seine species composition data for the assessments of several major species, and the need to increase the budget for this project in the SC work programme. Some CCMs voiced concern regarding the setting of budget priorities, suggesting a need to periodically reassess Commission funding allocation, and to seek to avoid budget increases.

124. PNG inquired how national-level ROP data from port sampling could be utilized.

125. Dr Hampton (SPC) supported the interventions calling for more work on paired spill/grab experimental sampling, indicating the work was of a very high priority. He noted good prior cooperation from some CCM industries, and requested that such cooperation be extended in the future when paired sampling trials were conducted aboard member's vessels. In response to the query from PNG he noted the desire to use port sampling data collected by members through national programs to the extent possible, but indicated that the best way to determine purse seine species composition is through sampling at sea by observers, as fish may be transshipped and mixed onboard vessels.

126. The Commission agreed to increase the budget for the spill/grab sampling project from $60,000 to $90,000.

Peer review of the bigeye stock assessment

127. The SC Chair recommended that a budget be provided for a peer review of the 2010 bigeye tuna stock assessment in 2011, if required.

128. The USA advised the review deadline for bigeye tuna had passed, and could not be done in 2011.

129. At the FAC4 meeting, it was proposed to conduct a workshop-style review, rather than a desk study review, in early 2012 based on the 2011 bigeye assessment; this will provide an in-depth review that interacts with the stock assessment scientists. The workshop-style review of the 2011 bigeye stock assessment will be convened in early 2012, in consultation with SPC; a relevant budget will be proposed by SC7 to WCPFC8.

130. The Commission endorsed undertaking a workshop-style peer-review of the 2011 bigeye stock assessment in early 2012.

Administration: Outstanding issues from the Independent Review

131. WCPFC7 took note of the responses by SC6 to the issues to be addressed from the Independent Review of the Commission's Transitional Science Structure and Functions including the endorsement of the revised TOR for the Stock Assessment Preparatory Workshop (Attachment L of the SC6 Summary Report).

5.1.2 Shark Assessment and Research Plan

132. Dr Shelley Clarke (SPC) presented WCPFC7-2010-16, summarizing progress toward shark assessments. She noted that the Shark Research Plan (endorsed by SC6) is designed to lay a scientific foundation for further consideration by WCPFC of stock status and sustainability of key shark species within the Convention Area. The information presented in WCPFC7-2010-16 reflects the exploratory analyses of available data initiated as preliminary steps toward stock assessments. While some interesting trends were identified, ongoing data gaps and biases have yet to be fully addressed and conclusions about stock status would be premature. SPC will continue analyses based on existing data, but it is becoming increasingly clear that better information is required. Without additional research and data contributions, it is likely that stock assessments for some species will be severely compromised. She highlighted the importance of decisions to be made by WCPFC7 with respect to:

i. approval of the Shark Research Plan
ii. reallocation of existing funds within the Scientific Services Provider's budget to support shark assessment through 2012, thereby enabling three shark stock assessments (silky, oceanic whitetip and blue) to be completed by the end of 2012; and
iii. inclusion of the eight key shark species listed in CMM 2009-04 in catch reporting to the Commission, including annual catches, operational level data (where applicable), and

recreational catch and effort data (where possible), as recommended by SC6, which would greatly expand the logsheet data available for the shark assessments.

133. The USA noted that undigitized historical data on shark catches from the early days of the observer programme may contain information on haulback fate and mortality and may be made available.

134. Palau, on behalf of FFA members, supported enhancement of the Commission's shark management activities as a high-priority activity, and adoption of the Plan. FFA members also welcomed the review of information on shark stock status requested by the Commission in CMM 2009-04, which illustrates the work needed by the Commission prior to conducting formal stock assessments of key shark species, and supported making use of the available information while the arrangements are put in place to improve data. They supported SC recommendations on improving data for key shark species, which will be assisted by implementation of ROP requirements for observer coverage on longline vessels. FFA members indicated that assessment of shark stocks will need to depend on existing data for the near future, and thanked CCMs for making the data available.

135. A CCM expressed concerns that some longline fishermen had trouble in accurately identifying shark species. It suggested silky shark should not be a priority for data collection.

136. The EU supported the approach outlined, including the reporting requirements, and agreed hammerheads and porbeagles should be added to the list of key shark species. The EU has adopted an action plan for sharks, and is implementing a project that seeks to improve the provision of scientific advice for that action plan, including collation and examination of historical catch and effort data by shark species for EU vessels in all oceans. Once available, the results will be shared with all RFMOs.

137. Japan confirmed that shark data had been submitted to SPC and invited SPC scientists to conduct joint shark data analyses with Japan. They noted with concern a large amount of unreported shark catch by small-scale longliners belonging to one CCM. Japan encouraged the Commission to adopt a CDS to assist with such issues in relation to sharks. Japan requested that the SC address hammerhead sharks, as it is the most prized species in shark fin markets.

138. China supported the need to collect data on shark species, including possibly through a CDS. China noted the need to identify different species, possibly through a genetic database.

139. Australia supported Palau's intervention, and noted the usefulness of observer coverage on longline vessels (from 2012). It suggested that further action by the Commission on mitigation practices relating to sharks, for example consideration of the use of wire traces, need not wait for the outcomes of the shark research plan. Australia proposed adoption of the recommendation of the SC regarding key shark species by amending CMM 2009-04 to include porbeagle and hammerhead sharks.

140. Korea noted the importance of shark research, but advocated prioritizing SC projects within the Commission budget. Korea also urged careful consideration of whether a CDS would be applied to all shark species, and how it could be made cost effective.

141. New Zealand supported the research plan, noting the work was constrained by the low quality of available data. New Zealand supported data reporting requirements for sharks, addition of porbeagles and hammerheads to the list of key shark species, and the need for minimum standards for collection of bycatch data.

142. PNG supported the shark research work, indicating it has a shark fishery that makes use of the entire shark, and has had a management plan in place for the last 10 years. Data is supplied to SPC.

143. The Secretariat noted that expansion of the list of key shark species in CMM 2009-04 would result in expansion of the list of species that CCMs are asked to report on from 8 to 13 species. However, assessments under the Shark Research Plan would for the time being be limited to the original 8 key species, until such time as additional funding is agreed by the Commission.

144. WCPFC7 approved the shark research plan and the reallocation of existing funds within the Scientific Services budget to support shark assessments during 2011 and 2012. WCPFC7 agreed

to add porbeagle and four species of hammerhead sharks to the Commission's key shark species in CMM 2009-04 (Attachment DD). This amendment raises the number of key shark species to be reported to the Commission to 13 but maintains the original 8 key species as the focus of the Shark Research Plan until further funding is made available.

5.2 Kobe II Workshop recommendations on Science and Bycatch

145. The Commission accepted the Kobe II science and bycatch recommendations (as contained in Attachment M of the SC6 Report), and recommended that the WCPFC Secretariat take the lead in working with the other tuna RFMOs to establish a bycatch working group to meet at the earliest opportunity. Kobe III may present an opportunity for a meeting of this group. The Secretariat will consult with members on the representation on this working group.

5.3 Programme of Work for the Scientific Committee in 2011

146. The SC Chair presented the programme of work for the Scientific Committee in 2011, with a total proposed budget of US$1,066,000. Within the proposed work programme, the work on seabirds to continue the ERA analysis of areas of high seabird interactions (US$10,000) was deferred. The FAC approved funding for a workshop on management objectives for 2011 however subsequent discussion in WCPFC7 decided that due to a heavy schedule of meetings the workshop should be deferred to 2012. The secretariat has noted the need to quarantine the funding for use in 2012.

147. Tonga spoke on behalf of FFA members and thanked Dr Miyabe and his Vice Chair and team of conveners for the SC6 report and for the efficient conduct of the SC meeting. FFA members noted the benefits of the new meeting structure, and the clarity of the summary report, and drew attention to the continuing advice from the SC that data deficiencies are affecting the quality of the scientific analysis and advice, and the WCPFC7 working papers that demonstrated the implications of incomplete, late or inaccurate data for the production of timely and reliable stock assessments. FFA members requested WCPFC7 record its concern regarding the continuing failure of CCMs to provide timely complete and accurate data and the effect of this failure on the Commission's scientific advice.

148. The Commission approved the 2011 SC work programme, and total budget of US$1,086,000, including the following specific elements, noting that $30,000 will be carried forward to fund the management options workshop in 2012:

i. three full stock assessments of bigeye, yellowfin and skipjack tuna, one updated assessment of south Pacific albacore, and key shark stock assessments (to be conducted by the Scientific Services Provider [SPC-OFP], in addition to other regular services as described in the previous services agreement), noting that if the yellowfin assessment does not occur $70,000 would need to be carried forward till 2012.;
ii. continuation of the WPEA OFM Project;
iii. refinement of bigeye parameters Pacific-wide;
iv. continuation of the Pacific-wide tagging project;
v. identification of provisional reference points work for key tuna species;
vi. collection and evaluation of purse-seine species composition data
vii. collation of South Pacific striped marlin data for a planned stock assessment in 2012; and
viii. support for the 2012 Management Options workshop.

WCPFC Northern Committee Sixth Regular Session (Fukuoka, Japan. 7–10 September 2010)
AGENDA ITEM 2 -CONSERVATION AND MANAGEMENT MEASURES
2.1 Report from the 10th International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

5. G. Sakagawa, the outgoing ISC chair, provided an overview of ISC's results from its 10th meeting, held in Victoria, British Columbia, Canada, from 21–26 July 2010. The results are contained in the ISC meeting report, which is posted on ISC's website at: http://isc.ac.affrc.go.jp. This document was also made available to WCPFC in accordance with the requirements of the ISC-WCPFC memorandum of understanding. G. Sakagawa noted that progress was made on

many projects of ISC's work plan as well as on tasks that were requested by NC5. Work is progressing on a full stock assessment of North Pacific albacore and striped marlin stocks in 2011, and Pacific bluefin tuna and blue marlin stocks in 2012. ISC's objective is to conduct a full stock assessment for each species every three years. Progress with administrative matters included: i) dissolving the Bycatch Working Group because other science committees of regional fisheries management organizations (RFMOs) were meeting that need; 2) forming a Shark Working Group to conduct shark stock assessments, initially for blue shark and shortfin mako; iii) employing a full-time data administrator and webmaster by the National Research Institute of Far Seas Fisheries to provide needed services; iv) postponing a planned world blue marlin symposium because of higher priority projects; v) concluding a memorandum of cooperation with the International Commission for the Conservation of Atlantic Tunas (IATTC); and vi) starting the process of clarifying and updating the ISC operations manual. ISC also completed a document (NC6-WP-09 or ISC/10/Plenary/04) in response to NC5's request for advice on candidate biological reference points (BRPs) for an NC workshop.

6. G. Sakagawa completed his presentation by recognizing ISC's new leaders: G. DiNardo newly elected ISC chair for 2011–2013; M. Dreyfus, vice-chair; S.K. Chang, Statistics Working Group (STATWG) chair; J. Holmes, Albacore Working Group (ALBWG) chair; and Y. Takeuchi, Pacific Bluefin Tuna Working Group (PBFWG) chair. Chairs for both the Billfish Working Group (BILLWG) and Shark Working Group are currently vacant. The 11th meeting of ISC will be hosted by the USA in July 2011 at a venue to be announced.

7. J. Holmes, ALBWG chair presented the ISC's results of the albacore stock assessment. He reported that ISC is on schedule for completing a full assessment of the North Pacific albacore stock before the next NC annual meeting. During the year, ISC examined recent fishery data to determine if there was a signal or trend in the spawning stock biomass (SSB), but did not detect a strong upward or downward trend. The estimated catch in 2009 was 78,000 mt, about 9,000 mt higher than in 2008 and near the long-term (i.e. 1971–2000) mean of 77,000 mt. Analysis of longline fishery data did not provide a strong positive or negative signal in the age 6–9+ SSB index to indicate a specific trend in SSB since the last stock assessment. ISC noted, however, that the estimated value of $F_{SSB\text{-}ATHL}$[1] -NC's interim BRP- is 0.75/year for a 25-year projection period using fishery data through 2008. This value is similar to the $F_{2002–2004}$=0.75/year estimated in the last stock assessment. ISC concluded that its 2009 conservation advice is still valid, and restated it with the following minor clarification:

> Previous scientific advice, based on the 2004 stock assessment, recommended that current fishing mortality rate (F) should not be increased. It was noted that management objectives for the IATTC and WCPFC are based on maintaining population levels which produce maximum sustainable yield. Due to updating and improvements and refinements in data and models used in the 2006 stock assessment, it is now recognized that F (2002–2004; 0.75) is high relative to most of the F reference points [commonly used in fisheries management](see Table 5a in Annex 5) [of the ISC7 Plenary Report].
>
> On the other hand, the same analysis indicates that the current (2005) estimate of the SSB is the second highest in history but that keeping the current F would gradually reduce the SSB to the long-term average by the mid-2010s. Therefore, the recommendation of not increasing F from current level ($F_{2002–2004}$=0.75) is still valid. However, with the projection based on the continued current high F, the fishing mortality rate will have to be reduced.

8. In response to the USA's concerns regarding the large time interval between albacore stock assessments, the ALBWG chair noted that it will be discussed in the working groups but that ISC has the general aim of conducting a stock assessment every three years. He also noted that another reason for the delay was the need to control the workload imposed on the scientists who conduct both albacore and bluefin assessments. In response to the NC Chair's question on the level of current fishing mortality, the ALBWG chair noted that F_{2009} might be less than 2002–2004 (F=0.75)

[1] $F_{SSB\text{-}ATHL}$= spawning stock biomass above the average level of its 10 historically lowest points.

based on recent trends in nominal catch and effort or, alternatively, F_{2009} may be as high as 2002–2004 because recruitment after 2005 is not known. The ALBWG had no way to assess these alternatives in the absence of a new stock assessment.

9. Y. Takeuchi, PBFWG chair, reported on the stock status and conservation advice of Pacific bluefin tuna from the ISC10 plenary in July 2010. After NC5, ISC's PBFWG updated the 2008 stock assessment with data through 2007. Results indicated that the assumption of adult natural mortality (M) is particularly influential to the estimate of absolute SSB and F. In contrast, relative measures of these metrics were less sensitive to the assumed M. The estimate of SSB in 2008 (at the end of the 2007 fishing year) declined from 2006 and is estimated to be in the range of the 40–60th percentile of historically observed SSBs. Average fishing mortality during 2004–2006 ($F_{2004–2006}$) increased from $F_{2002\text{-}2004}$ by 6% for age-0, approximately 30% for ages 1–4, and 6% for ages 5+ fish in the stock. Future projections predict that at $F_{2004–2006}$ median SSB is likely to decline to levels around the 25th percentile of the historical SSBs, while at $F_{2002–2004}$, median SSB is likely to decline in subsequent years but recover to levels near the median of historically observed SSB levels. The conservation advice from ISC10 was simplified and revised as follows:

> Given the conclusions of the July 2010 PBFWG workshop (Annex 7), the current (2004–2006) level of F relative to potential biological reference points, and the increasing trend of F, it is important that the level of F is decreased below the 2002–2004 levels, particularly on juvenile age classes.

10. In response to questions from Japan about why M was changed and how the new M was derived, Takeuchi responded that i) M was changed because the huge, unfished biomass estimated initially was considered implausible; ii) there were small changes in juvenile M; and iii) M for age-0 was based on tagging data conducted by IATTC in the 1970s and 1980s; M for ages 1–2 was based on tagging data conducted for southern bluefin tuna because fish in these stocks have similar size ranges at this age interval; and M for age-3 and older was based on life history methods that are commonly used to estimate M. In response to Chinese Taipei's question on the impact of uncertainty and improving the quality of assessment, the PBFWG chair answered that the absolute level of biomass is highly uncertain but does not have much impact on conservation advice put forward, and that the working group will hold a workshop to improve the stock assessment model by investigating issues identified in previous workshops (model structure, catch per unit of effort, other fishery data, and biological parameters).

11. Regarding a question from the USA on what would be the most appropriate BRP for Pacific bluefin tuna in view of robustness to sensitive dynamics of the fish to M, the PBFWG chair answered that F_{med}[2] and F_{loss}[3], the less sensitive BRPs, would be more appropriate for managing Pacific bluefin tuna stocks. The reason why many BRPs are highly sensitive to M will be reviewed at a workshop in 2011. Japan noted that a large decline in SSB occurred in the 1960s, and that SSB remained at the lowest level in the time series in both the 1970s and 1980s, and asked the reason for the sharp decline and stable catches during the periods when SSB was at its lowest level. The PBFWG chair replied that there was no specific discussion of the decline by the working group, but that F during this period was stable and comparable to other periods, while F at age-0 was somewhat lower. As for the stability of the fishery during that period, it probably was not stable because the catch was reduced to 10,000 mt during these periods. However, while the catch by eastern Pacific Ocean (EPO) purse-seine vessels was small during the 1950s, the catch of juveniles increased after that period and leveled off, and that might be one of the reasons. Regarding Korea's question on the location and season of juvenile catches, the PBFWG chair answered that small-sized fish are taken by a troll fishery in the western part of the Pacific coast of Japan in autumn, and then taken around Tsushima Island in winter. Age-0 fish are taken by purse seine around Tsushima Island, East China Sea and south of the Korean Peninsula. Age-1 fish are taken by purse seine in the EPO in summer and East China Sea. Age-2 fish are caught by purse

[2] Fishing mortality rate corresponding to observed 1/SPR

[3] Fishing mortality rate expected to keep biomass at minimum observed stock biomass (or SSB)

seine in the EPO and rarely caught in the western Pacific side. In response to a question by the USA about the level of SSB before the 1950s, the PBFWG chair answered that the PBFWG only have nominal catch data prior to World War II, and the quality of these data is low relative to data post-1952. For example, there could be mis-identification of species for EPO catch data, and there were no species identification in Japan prior to 1950; all species were recorded as tuna.

12. G. DiNardo, BILLWG chair, presented ISC's results on the stock assessment of North Pacific swordfish. He reported that ISC conducted a revised stock assessment for the EPO stock only in 2010. The revision was necessary because additional catches from Spain, which were not included in the 2009 stock assessment, became available, as well as catch data from Japan, Chinese Taipei and Korea. For the revised EPO assessment, the 2009 stock assessment model (Bayesian surplus production model) was used. The results indicated that the exploitation rate in 2006 was 6% and the catch (3,900 mt) at roughly 78% of the estimated MSY level of 5,000 mt. The estimated exploitable biomass in 2006 was 69,000 mt and over 200% above B_{MSY}[4]. ISC concluded that there is no conservation concern for both EPO and western and central Pacific Ocean (WCPO) stocks of swordfish in the North Pacific. The conservation advice put forth by ISC10 was the same as in 2009: "The WCPO and EPO stocks of swordfish are healthy and above the level required to sustain recent catches" (in the North Pacific).

13. Japan asked why the stock synthesis model used for the Pacific bluefin tuna and albacore assessments, was not used for swordfish. The BILLWG chair answered that the Bayesian surplus production model was used because fewer data were available for swordfish than Pacific bluefin tuna and albacore. The working group attempted to use the stock synthesis modeling platform but was unsuccessful. In response to Cook Islands' question about the region for the swordfish stock assessment and data source for the stock assessment, the BILLWG chair answered that assessments were done for the North Pacific, and the time series data were provided by Japan, Korea, Mexico, Taiwan and Spain. In response to Japan's question about estimating MSY-related parameters in the swordfish assessment (although it is reported from ISC working group chairs that MSY-related BRPs are difficult to estimate for Pacific bluefin tuna and albacore), the BILLWG chair answered that MSY is a natural output of the surplus production model for swordfish assessment.

2.2 Report of the Sixth Regular Session of the Scientific Committee

14. N. Miyabe, Chair of WCPFC's Scientific Committee (SC), presented a summary report on the outcomes of SC6, which was held in Nuku'alofa, Tonga. He briefly highlighted the status of fisheries in the WCPO and the results of the 2010 full stock assessments for bigeye and skipjack tunas. He also noted other key issues, including SC's response to recommendations from the joint tuna RFMO workshops, the process for the external review of stock assessments by the Oceanic Fisheries Programme of the Secretariat of the Pacific Community (SPC-OFP), and SC's work programme and budget.

15. Japan stated that skipjack is an important stock for its coastal fishermen; however, there has recently been poor migration of skipjack, with subsequently low catches, and Japan asked about the reason for this. The SC Chair responded that it is not an easy question to answer, and that other countries, such as Australia and New Zealand, also had similar experiences. Once the spatial ecosystem and population dynamics model (SEAPODYM) is fully developed, it might be used to address this issue. Citing paragraph 314 of the SC6 Summary Report ("…high catches in the equatorial region could result in range contractions of the stock, thus reducing skipjack availability to higher latitudes [e.g. Japan, Australia, New Zealand fisheries.]"), and concerning the age composition of the catch, Japan asked about the kinds of effort that will be undertaken to reduce the uncertainty. The SC Chair responded that this is the first year of collaboration between SPC and Japan, and this investigation will identify skipjack migration at the end of the analysis. Regarding the reduction in bigeye F, WCPFC responded that the 29% reduction in F from average levels for 2005–2008 is equivalent to a minimum 31% reduction in F from 2004 levels, and a minimum 20% reduction from average 2001–2004 levels. Regarding a question by the USA on the high catch of

[4] B_{MSY}= biomass that will support the maximum sustainable yield

South Pacific albacore, the SC Chair responded that it may be due to many fleets operating in the South Pacific's Subtropical Convergence Zone.

2.3 Conservation and management measures for the northern stocks

16. L. Donihee, Canada, introduced delegation paper WCPFC-NC6-DP-02, which explores a potential management framework for stocks under the mandate of NC, based on a precautionary approach. The WCPFC Convention text requires members to determine stock-specific RPs, to take measures to ensure points are not exceeded, and to take action without delay if these reference points are exceeded. WCPFC-NC6-DP-02 also outlines one way to adopt a precautionary approach regime -through the establishment of control rules that identify three stock status zones: healthy, cautious and critical- based on pre-determined RPs. A removal rate is set, and decisions and management actions are decided on in advance, which come into effect as the stock approaches the critical zone. Canada welcomed comments from other delegations and asked that NC members consider the basic concepts contained in this paper as a way forward for WCPFC when considering conservation and management measures and the need to identify appropriate RPs. The workshop on BRPs supported this concept.

2.3.1 Pacific bluefin tuna (CMM-2009-07)

17. Japan presented its work on implementing CMM 2009-07 -the WCPFC conservation and management measure (CMM) on Pacific bluefin tuna- which comprises: i) a control on the number of vessels fishing for Pacific bluefin tuna under a licensing system; ii) administrative instructions to the purse-seine industry to not catch or land small Pacific bluefin tuna less than 2 kg and to ensure that the total catch in the Northern Kyushu area will not exceed the average catch of 2000–2004; and iii) administrative instructions to local governments to not increase the number of licenses of set nets for Pacific bluefin tuna and to pay due consideration to not increasing bluefin tuna catches in other set nets. Japan also highlighted that its Ministry of Agriculture, Forestry and Fisheries (MAFF) announced on 11 May 2010 that it is now preparing for comprehensive management directions for its Pacific bluefin tuna fisheries (composed of offshore fisheries, coastal fisheries and aquaculture) by establishing a "Resource Recovery Plan" together with the introduction of an income assurance system. Japan is now preparing for the implementation.

18. Japan reported on its artisanal fishery, described characteristics of the Japanese coast, and provided various statistics regarding the islands, underlining that more than 20,000 artisanal vessels operate and seasonally catch Pacific bluefin tuna. The Pacific bluefin tuna fishery in Japan uses various kinds of fishing methods, is small-scale and operated by family-owned businesses, and has landing ports scattered across the country. Trolling is one of the main fishing methods for Pacific bluefin tuna. Japan launched an artisanal fisheries management directive in May 2010. The announcement by MAFF on actions toward the effective conservation and management of Pacific bluefin tuna included a vessel registration system and mandatory catch reporting system.

19. Regarding the USA's question on the level of Pacific bluefin tuna caught by Japan's artisanal fisheries, Japan responded that while the artisanal catch ranges from 2,000–3,000 mt, the level of catch data is not accurate enough to be used in scientific analysis, which is why Japan is introducing a registration system with a mandatory reporting system, including total catch by vessel, volume of catch, and size of fish. Regarding Chinese Taipei's question on the implementation of the new management system, Japan responded that by the end of March 2011, Japan will establish the Pacific Bluefin Tuna Resource Recovery Plan and that under this plan, Japan will implement specific management measures beginning in April 2011. Regarding Chinese Taipei's question on other fisheries catching Pacific bluefin tuna, Japan responded that they include jigging, handlining, and a hybrid type of jigging and trolling. Data collection from most other fisheries, including all artisanal fisheries, will be covered by the new system. Regarding Korea's question on data collection from artisanal fisheries, Japan responded that it currently estimates artisanal catches using sales slips from fish markets.

20. Korea introduced document NC6-DP-04 regarding Korea's Pacific bluefin tuna catch. The catch of Pacific bluefin tuna started in 1982 as a non-target species, mostly by large-scale purse-seine vessels (>50 gross registered tonnage, GRT) that target mackerel, and also by

small-scale purse-seine vessels, set nets, small-scale compound gear and other gear types used in artisanal fisheries. No scientific research on Pacific bluefin tuna had been conducted until 1999, due to the lack of interest in Pacific bluefin tuna among fishermen. However, the recent increase in Korean catch and fishermen's interest in the species has resulted in policy-makers providing funding to support biological and ecological research on Pacific bluefin tuna, in addition to supporting the strengthening of the data collection system. Domestic statistics indicate that the Pacific bluefin tuna catch increased steadily to a maximum of over 2,100 mt in 2003, although interannual variability is high. As Korea's fisheries monitoring and management body, the Ministry for Food, Agriculture, Forestry and Fisheries (MIFAFF) has requested the National Fisheries Research and Development Institute (NFRDI) to conduct more systematic research on various aspects of the Pacific bluefin tuna stock. The research is aimed at preparing a tuna fishery management plan, including the establishment of domestic management measures to be imposed on fishermen. The research will continue over five years beginning in 2010, and progress will be reported to ISC.

21. In response to the NC Chair's question on the progress of Korea's management plan, Korea responded that it will begin preparing a management plan along with a progress report on research. Japan stated that Korea failed to answer several matters, including the improvement of catch data quality and submission of target or bycatch issue. Korea responded that its Pacific bluefin tuna statistics in the past depended on figures from Korea's exports and Japan's imports, and that recently, Korea started collecting purse seiners' cooperative auction data from fish markets. In addition, NFRDI initiated a pilot project in 2008 to collect data from smaller fisheries such as set net and small compound gear in Busan, but has not fully completed this work. The target species of large purse-seine vessels operating in Korean waters is mackerel, which are caught during the nighttime. However, sometimes Pacific bluefin tuna are caught during daytime sets if the fish is migrating up to the fishing grounds. Recently, Pacific bluefin tuna has become a very important species to Korean fishermen. Japan asked again about the timeline for Korea to produce some reliable catch estimates of Pacific bluefin tuna from purse seine and other gear types, noting that the fishery types between Korea and Japan are very similar. Japan will be producing all catch data, including artisanal data from early next year. Japan noted that regarding the bycatch issue, if Pacific bluefin tuna are caught during the daytime, then it can be considered to be a target fishery. Korea clarified that Pacific bluefin tuna catches include target catches because they target it during daytime, and confirmed that the interest of Pacific bluefin tuna catch among fishermen is increasing. The NC Chair noted that if it is a target catch, then the catch is manageable. Regarding Chinese Taipei's question on the contents of research and a detailed description of catch sources, Korea responded that the research includes a study on spawning area and period, development of a monitoring system of catch information, and validation of such catch information with research results conducted by NFRDI or any intermediate outputs during the process of the research, if necessary. The purpose of the research is to establish a management plan for the Pacific bluefin tuna fishery. Korea will prepare a management plan that will include fishing controls, input/output controls, fishing gear restrictions, creation of appropriate fishing gear, time/area closures, and identification of Pacific bluefin tuna fishing ground(s). Korea has had three workshops to educate fishermen and to introduce international management concerns and efforts on this species. Korea explained that it would be a time-consuming process to improve fishermen's awareness so that they could cooperate with international efforts for fisheries management. Korea expects to provide more reliable data in the near future. Chinese Taipei expressed its concern about the targeting of Pacific bluefin tuna, especially the targeting of juvenile Pacific bluefin tuna. Regarding Korea's request for more time, Japan noted that since 2007, Korea has repeatedly requested more time, and that Korea seems to want another five years until their research project is complete, which will be too late.

22. Japan presented a preliminary analysis of Pacific bluefin tuna imports from Korea. In 2009, WCPFC adopted CMM2009-07 for Pacific bluefin tuna, but the measure was not applicable to Korea's exclusive economic zone (EEZ), and Korea did not adopt the measure because of

uncertainty concerning Pacific bluefin tuna catches in Korean waters. In order to reduce this uncertainty and help Korea adopt the measure, Japan started collecting trade information on imports from Korea in 2010. From 1 January–30 June 2010, 24 Korean purse-seine vessels caught 1,283.9 mt of Pacific bluefin tuna in Korea's EEZ, and 911.5 mt were exported to Japan. About 885 mt (about 69%) were caught by five purse-seine vessels. Over 50% of these tuna (457.0 mt) were imported in March, followed by 171.5 mt in April and 159.8 mt in June. Regarding size composition, 430 mt (47%) were in the 3–5 kg category and 428.4 mt (47%) were in the 5–50 kg category. On average, it takes 2.5 days for catches to reach Japanese fish markets. Busan is the major landing port for Korean purse-seine vessels and the port of shipment of Korean tunas. Fukuoka is the port where more than 95% of the Pacific bluefin tuna imported from Korea are auctioned. About 90% of exports were handled by four major exporters in Korea, and 86% of imports were handled by four major importers in Japan.

23. The USA noted that it is vitally important to get the best information and produce reliable data very quickly, and encouraged Japan and Korea to accelerate data collection as soon as possible. Korea responded that in principle, Korea would like to join international efforts for conservation and management of Pacific bluefin tuna, and expressed appreciation to Japan for introducing the very elaborate and analytical import data from Korea. However, basically, Korea's catch of Pacific bluefin tuna is very small compared with Japan's catch, but noted that Pacific bluefin tuna data collection is Korea's first priority. It makes every effort to accurately calculate Pacific bluefin tuna catches; and now, statistics and figures are collected based on Korea's catch documentation and data from scientific observers dispatched to Busan Port. The Korean Pacific bluefin tuna catch in 2009 (submitted to ISC10) is provisional and, after review of various data sources, the catch might be updated and reported to ISC11. Japan noted that if the Korean catch is smaller, then there should be no difficulties introducing management measures adopted by WCPFC. Korea commented that because Pacific bluefin tuna was not an important species for its fisheries economy until around 2000, Korea did not pay much attention to managing Pacific bluefin tuna. Pacific bluefin tuna research this year is the first medium-size research project in Korea, which is itself a remarkable step forward for Pacific bluefin tuna fishery management. Korea will try to provide more information about Pacific bluefin tuna in the future. The NC Chair clarified that Korea's various efforts toward Pacific bluefin tuna reporting will be much appreciated; however, the important matter here is the delay of Pacific bluefin tuna management by the Korean government.

24. The Philippines reported on its Pacific bluefin tuna fisheries according to the reporting requirement of CMM 2009-07. It noted that the Philippines has no Pacific bluefin tuna fishery at all, but is ready to apply any measures for tuna management.

25. The USA explained that it has no fisheries targeting Pacific bluefin tuna in the WCPO. The total Pacific bluefin tuna catch across the entire North Pacific by USA fleets is around 500–600 mt a year and almost all are taken outside of the Convention Area; catches in the Convention Area are less than 20 mt a year. Japan asked the USA whether it can implement any measure (as a WCPFC member) specific to Pacific bluefin tuna fisheries in the EPO where currently no Pacific bluefin tuna measure has been adopted by IATTC. The USA answered that it has no plan to increase the catch of Pacific bluefin tuna caught opportunistically from fisheries directed to other species, and at this point, the USA does not envision that the catch will significantly increase beyond the range of the past 10 years.

26. Chinese Taipei reported on actions taken in 2010 for managing its Pacific bluefin tuna fishery. The first action was to control fishing effort. The number of vessels allowed to fish for Pacific bluefin tuna in the North Pacific was set at 660, and only 562 vessels were authorized to fish in 2010. The second action was to implement a catch document scheme (CDS). This scheme requires that fishermen attach specially designed tags to the catch, report information on the catch over radio to a designated fishery radio station, and apply for CDS while entering port for landing. Considering the usefulness of this scheme, members using the same resource were urged to adopt the same measure to protect the fish stock. The third action was to increase the monitoring of fishing locations and catch information through vessel monitoring scheme (VMS) on vessels, and

port inspection of the catch. Lastly, every Pacific bluefin tuna landed in Chinese Taipei is now inspected and its length and weight recorded. Using CDS information helps improve the quality of catch statistics. Nearly 100% coverage has been achieved since last year.

27. Regarding Chinese Taipei's Pacific bluefin tuna report, Japan asked about the information collected from CDS and the CDS implementation date. Chinese Taipei responded that a CDS was implemented in March 2010, and that it collects information on fishing location, tag number, weight and length of fish. All information is contained in NC6-WP-03 (Rev. 1). Regarding a study on spawning grounds, Chinese Taipei has collected otoliths and is planning to collect gonads in order to understand the biological parameters of Pacific bluefin tuna. Regarding Japan's question on the compliance with 100% coverage of CDS and vessel size fishing for Pacific bluefin tuna, Chinese Taipei responded that almost all Pacific bluefin tuna are landed in three domestic ports and port officials check whether the catch has come with CDS. Fishermen violating this regulation will receive punishment. Vessels fishing for Pacific bluefin tuna are mostly 20–24 m in length. Regarding Korea's question on fish size, Chinese Taipei noted that the major size composition ranged from 172–260 cm (based on 2009 data)

28. The NC Chair opened the floor for the revision of CMM 2009-07 based on the conservation advice from ISC10. Japan proposed that the revised CMM be targeted for 2011–2012, considering that there will be a new stock assessment in 2012. Korea announced its willingness to remove the exemption for Korea's EEZ from the current measure in force, but stated that it could not accept such an ambiguous term as "stay below" in the CMM with respect to the proposed limit on fishing effort. The USA suggested that a decrease in catches from 2002–2004 levels of 5–10% would satisfy the ISC's advice that F be reduced below 2002–2004 levels. Japan wanted to follow exactly the ISC's advice (i.e. that it is important that the "level of F is decreased below 2002–2004 levels"), and suggested that the specific level of decrease should be determined by individual members. Chinese Taipei emphasized the importance of reducing fishing mortality of juvenile Pacific bluefin tuna and the need to take some substantive measures. The USA commented that controlling fishing effort may not be effective for controlling F and that consideration should be given to alternative approaches, particularly controlling catch. The USA pointed out that the inclusion of language to "reduce" from 2002–2004 levels, if not accompanied by a specific level of reduction, would not be substantively different from the language in the current measure to maintain levels "no greater than" 2002–2004 levels. In order to ensure that the measure is effective, the USA recommended that it include sufficiently detailed reporting requirements that would allow implementation of the measure to be adequately evaluated. Chinese Taipei expressed concern about how to control fishing effort, and proposed that the measure be developed to control catch. In response to questions from Japan about Pacific bluefin tuna management actions that the USA has taken in the EPO, and a request that the USA report back to the NC on any such actions, the USA said it would do so, but that it would expect other members to do the same in similar circumstances.

29. Korea expressed reservation regarding deleting the exemption of Korea's EEZ in the draft CCM but said that it would not block the consensus. While appreciating Korea's effort, other members asked Korea to reconsider and withdraw the reservation by the December 2010 Commission meeting. NC6 adopted the recommendation (Attachment C) by consensus, with Korea's reservation.

30. In relation to paragraph 4 of this recommendation, the Cook Islands expressed its concern over the possible duplication of reporting with the part 2 report. It was noted that each CCM should avoid such duplication in its reporting to the Commission.

2.3.2 North Pacific albacore (CMM-2005-03)

31. Regarding RPs for North Pacific albacore, Japan proposed $F_{SSB\text{-}ATHL}$ with a 10-year projection period as a precautionary RP, and B_{loss} as a LRP. However, the ALBWG chair noted that B_{loss} was not well estimated for this species, and so it would be very risky to actually use. Japan stated that it considers B_{loss} to be a good candidate for RPs, although an absolute number of the RPs can be determined at the next stock assessment. The USA repeated its position that the most appropriate

LRP for F is F_{MSY}, but that it is open to considering appropriate proxies for F_{MSY}, particularly some of the points in the family of $F_{\%SPR}$. The US noted that $F_{SSB\text{-}ATHL}$ is, in effect, as an interim RP, but not with a 10-year projection period. The USA was not supportive of any shortening of the projection period used in estimating $F_{SSB\text{-}ATHL}$, and as it emphasized during the Reference Points Workshop, the fact that many subjective decisions are needed to use a simulation-based RP such as $F_{SSB\text{-}ATHL}$, including the projection period, is a big disadvantage of those types of RPs.

32. Japan said that SSB for Pacific bluefin tuna has fluctuated greatly and that during the lowest level of SSB in the 1970s and 1980s, catch and recruitment were stable. The USA noted that when an RP is crossed, immediate action should be taken, and that action should be pre-agreed upon. Japan noted that an immediate action is needed before the stock reaches the level of historically the lowest level, so $F_{SSB\text{-}ATHL}$ is necessary.

33. With respect to the interim management objective, the USA and Canada suggested that a specific timeline for action be included in the event that $F_{SSB\text{-}ATHL}$ is exceeded.

34. NC6 confirmed that it will continue to use "the interim management objective for North Pacific albacore" agreed upon at NC4, and agreed to replace Attachment J to the NC4 report by the following in order to establish a clear time line for management actions.

1) The interim management objective for North Pacific albacore is to maintain SSB above the average level of its 10 historically[5] lowest points (hereinafter referred to as "the Level"). The fishing mortality rate that would likely[6] cause SSB to fall below the Level is referred to as "interim reference point" (IRP).
2) In the event that ISC finds that the current fishing mortality rate exceeds IRP, NC shall, at its next meeting, formulate conservation and management recommendations that are designed to reduce the fishing mortality rate below IRP within one year of adopting the measures. In formulating such measures, NC shall consider relevant socioeconomic factors and any relevant information from ISC, including its latest conservation advice.

The interim management objective and IRP will be reviewed every three years to develop more permanent objectives and RPs that fulfill the provisions of the Convention, in particular Article 6. Achieving the interim management objective will not preclude NC from formulating and recommending CMMs that would achieve additional objectives, particularly those stipulated in the Convention or otherwise adopted by the Commission.

35. Canada noted that using $F_{SSB\text{-}ATHL}$ as the IRP is a risky way of managing the stock considering current advice from ISC.

36. NC6 discussed how to evaluate the implementation of CMM 2005-03, and agreed that members should report back on the measures they have taken to implement it. NC6 agreed that for the purpose of evaluating the implementation of paragraph 2 of CMM 2005-03, CCMs shall include the following information in their 2011 annual reports, part 2:

a. a list of their specific fisheries or fleets that they have determined to be "fishing for" North Pacific albacore in the Convention Area; and
b. a description of the particular measures, as well as monitoring mechanisms, that they have established to ensure that fishing effort in each of the fisheries or fleets does not increase above 2002–2004 average levels.

37. In relation to the 0–20°N area, the Chair suggested that NC could submit a separate recommendation to WCPFC, recommending that it adopt equivalent measures for the 0–20°N area. Japan urged NC members to take the same measures between 0°N and 20°N.

38. Japan also proposed an amendment to CMM 2005-03, but NC6 agreed not to recommend any changes to the CMM until 2011, when a new stock assessment will be available.

2.3.3 North Pacific swordfish

38. Japan proposed that management action be considered to ensure that fishing effort on

[5] Here, "historically" means the time series of annual SSB levels from 1966 through 2005, as estimated in the latest formal ISC stock assessment.

[6] Here, "likely" means greater than 50% probability.

swordfish does not move from other fisheries into the North Pacific. Korea commented that fishing effort could be moved from place to place along with the location of fish abundance within the level of total effort. The USA noted that paragraph 3 of CMM 2009-03 states that "CCMs shall not shift their fishing effort for swordfish to the area north of 20°S, as a result of this measure." Although that provision does not cover Japan's concern entirely, it was agreed to rely on that provision for the time being.

2.4 Conservation and management measures for other species

2.4.1 Bigeye and yellowfin tuna (CMM-2008-01)

39. Japan noted that this measure includes no transfer of effort into archipelagic waters and territorial seas (para 5). In the same manner, Japan requested that NC recommend to the Commission a prohibition on that further transfer of fishing effort from south to north, as was recommended at NC4 and NC5.

2.4.2 Sharks (CMM-2009-04)

40. Japan noted that ISC will conduct stock assessments on shortfin mako and blue shark sometime in the future and NC6 welcomed and supported the initiation of this work on sharks. The USA advised that additional stock assessments of key shark species should not delay the stock assessment of key tuna species, such as North Pacific albacore. In addition, ISC should collaborate with SPC-OFP and other interested parties when conducting stock assessments. Japan expressed its serious concern about poaching activities of one member that is engaged in shark fining operations. Cook Islands also commented that they have noticed changing gear configurations and that catch composition onboard some vessels consists of 70% blue shark.

2.4.3 Seabirds (CMM-2007-04)

41. There was no discussion, but this agenda item will be kept for future NC meetings.

2.4.4. Skipjack tuna

42. Japan recommended that NC should convey a clear message to all Commission members that coastal fishermen in NC member countries, particularly Japan, are suffering from poor catches of skipjack tuna, which should be fully taken into account when the Commission considers skipjack or purse-seine issues. NC6 expressed its concern over the decline of the skipjack migration level to the northern area, and requested that the Commission take full account of this issue.

2.5 Striped Marlin Working Group

43. G. DiNardo presented a status report on the activities of NC's Striped Marlin Working Group (SMWG), and a proposal for future activities. While SMWG's work plan identifies five research tasks, most of the working group's activities were focused on longline gear modifications. In particular, expected reductions in striped marlin catch relative to the fishing target (bigeye or yellowfin tuna) associated with the removal of the two shallowest hooks. These gear modifications result in significant reductions in striped marlin catches with no significant reductions to bigeye tuna catches and slight reductions in yellowfin tuna catches. These findings are consistent with similar research in other areas. It was reported that the USA will fund gear development aimed at reducing striped marlin catches, but this research is being conducted outside the purview of SMWG. While progress has been made, it continues to be hindered due to the need for broader scientific and technical support to complete the tasks than is currently available within NC, as well as the lack of financial support. It was also noted that the current SMWG chair will be resigning effective immediately, which hampers future progress. Given these concerns, it was proposed that SMWG be abolished and that the research tasks be assigned to the Commission.

44. NC6 agreed to abolish the SMWG but also agreed that it should continue to work on striped marlin. NC7 may prepare a draft CMMs based on the outputs of stock assessment in 2011. The USA reminded meeting participants that striped marlin is on TCC6's agenda, at which time there will be another opportunity to discuss appropriate actions.

附件二、WCPFC SC7 會議報告初稿

Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Seventh Regular Session

Pohnpei, Federated States of Micronesia
9-17 August 2011

SUMMARY REPORT
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SUMMARY REPORT

AGENDA ITEM 1 - OPENING OF THE MEETING

1.1 Welcome address

1. The Chair of the Scientific Committee, N. Miyabe (Japan), welcomed delegates to the meeting of the Seventh Regular Session of the Scientific Committee (SC7), which took place in Pohnpei, Federated States of Micronesia from 9 –17 August 2011. The list of participants is appended as Attachment A.

2. G. Hurry, Executive Director of the Western and Central Pacific Fisheries Commission (WCPFC), gave welcome remarks (Attachment B).

3. The Honourable John Ehsa, Governor of Pohnpei, gave the keynote speech (Attachment C).

4. The following countries attended the session as WCPFC Members, Cooperating Non-Members, and Participating Territories (CCMs): Australia, China, Cook Islands, European Union (EU), Federated States of Micronesia (FSM), Fiji, French Polynesia, Indonesia, Japan, Kiribati, Korea, Marshall Islands (RMI), Nauru, New Caledonia, New Zealand, , Palau, Papua New Guinea (PNG), Philippines, Samoa, Solomon Islands, Chinese Taipei, Tonga, Tuvalu, United States of America (USA), Vanuatu and Vietnam. The following CCMs were unable to attend: American Samoa, Belize, Canada, Commonwealth of the Northern Mariana Islands, Ecuador, El Salvador, France, Guam, Kiribati, Mexico, Niue, Panama, Senegal, Thailand, and Wallis and Futuna.

5. Birdlife International, Greenpeace, Inter-American Tropical Tuna Commission (IATTC), International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), International Sustainable Seafood Foundation (ISSF), Pacific Islands Forum Fisheries Agency (FFA), Secretariat of the Pacific Community (SPC), Pew Charitable Trust (PEW), Parties to Nauru Agreement (PNA), Southeast Asian Fisheries Development Center (SEAFDEC), and United States Development Programme (UNDP) attended as observers.

6. Key matters considered by the SC7 and its thematic groups — Ecosystem and Bycatch Mitigation (EB), Management Issues (MI), Data and Statistics (ST), and Stock Assessment (SA) — included:

a) a review of the fisheries in the western and central Pacific Ocean (WCPO) and the eastern Pacific Ocean (EPO);

b) a review of the status of stocks of bigeye tuna, yellowfin tuna, skipjack tuna and South Pacific albacore tuna in the WCPO;
c) a review of the most recent information and assessments for tuna and billfish stocks in the North Pacific Ocean;
d) a review of research into the status and assessment of pelagic key shark stocks in the WCPO;
e) bycatch mitigation issues associated with seabirds, sharks, other animals, and Report of Kobe Joint Technical Working Group on Bycatch;
f) issues associated with the data available to the Commission and initiatives to address data gaps;
g) the status of the West Pacific East Asia Oceanic Fisheries Management (WPEAOFM) Project, the Japan Trust Fund (JTF), and the Pacific Tuna Tagging Project (PTTP);
h) developing Strategic Research Plan 2012-2016;
i) recommendations for the 2012 SC Work Programme and Budget; and
j) functioning and structure of future SC meetings.

1.2 Meeting arrangements

7. The Secretariat outlined the meeting schedule and administrative arrangements.

8. The SC endorsed the convenors and co-convenors for the following theme sessions:
a) Stock Assessment: J. Brodziak (USA) and N. Miyabe (Japan)
b) Management Issues: R. Campbell (Australia)
c) Ecosystem and Bycatch: P. Dalzell (USA) and J. Amoe (Fiji)
d) Data and Statistics: Pamela Maru (Cook Islands)

9. During SC7, there were side sessions for a tutorial of TUMAS and the following steering committee meetings:
a) West Pacific East Asia Oceanic Fisheries Management Project;
b) Pacific Tuna Tagging Project; and
c) Japanese Trust Fund.

10. Informal small groups were convened to address matters related to:
a) Developing the terms of reference and an indicative budget for the peer review of the 2011 stock assessment for bigeye tuna
b) Developing the Strategic Research Plan 2012 - 2016
c) Preparation of the scientific terms of reference for a workshop on management objectives
d) Formulating recommendations for the SC 2012 work programme and budget, and projection of the 2013-2014 provisional work programme and indicative budget

1.3 Issues arising from the Commission

11. The Commission's Science Manager introduced GN-WP-03 (Issues arising from the Commission) and highlighted key issues and tasks to be addressed by SC7.

1.4 Adoption of agenda

12. The provisional agenda was adopted after the addition of a new agenda item,10.5 (Selection of SC officers), to consider the new vice-chair and theme conveners (Attachment D).

1.5 Reporting arrangements

13. The SC agreed to adopt a Summary Report on the last day of the meeting, with the SC's recommendations to the Commission approved during the course of the meeting (following each thematic discussion) whenever possible. An Executive Summary, which would serve as the basis for the report, advice and recommendations of the SC to the Commission, would be prepared by the Secretariat following the meeting.

14. A list of abbreviations and acronyms used in this report, and a list of documents for SC6 are included as Attachment E and Attachment F, respectively.

1.6 Intersessional activities of the Scientific Committee

15. The Science Manager presented a brief report on the SC's intercessional activities for the last 12 months (GN-IP-01), highlighting the outputs and services of the Commission's science services provider (SPC-OFP), publication of the SC6 Summary Report, WPEA OFM Project and JTF activities, and progress of the SC work programme.

AGENDA ITEM 2 - REVIEW OF FISHERIES

2.1 Overview of Western and Central Pacific Ocean (WCPO) fisheries

16. P. Williams (SPC-OFP) and C. Reid (FFA) co-presented an "Overview of tuna fisheries in the western and central Pacific Ocean, including economic conditions — 2010" (WCPFC-SC7-2011/GN-WP-01). The provisional total WCP–CA tuna catch for 2010 was estimated at 2,414,994 mt, the second highest annual catch recorded and 80,000 mt lower the previous record in 2009 (2,494,112 mt). During 2010, the purse seine fishery accounted for an estimated 1,820,844 mt (75% of the total catch), with pole-and-line taking an estimated 171,604 mt (7%), the longline fishery an estimated 239,853 mt (10%), and the remainder (7%) taken by troll gear and a variety of artisanal gears, mostly in eastern Indonesia and the Philippines. The WCP–CA tuna catch (2,414,994 mt) for 2010 represented 84% of the total Pacific Ocean catch of 2,875,909 mt, and 60% of the global tuna catch (the provisional estimate for 2010 is 4,017,660 mt, which is the lowest for 8 years).

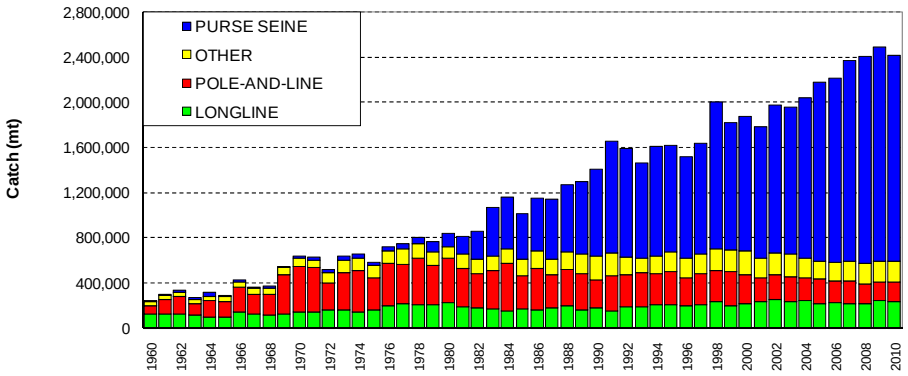

Figure 1. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP–CA, by longline, pole-and-line, purse seine and other gear types.

17. The 2010 WCP–CA catch of skipjack (1,706,166 mt – 71% of the total catch) was the second highest recorded and 115,000 mt less than the previous record catch of 2009 (1,821,770 mt). The WCP–

CA yellowfin catch for 2010 (470,161 mt – 19%) was more than 50,000 mt higher than the 2009 catch level, but still 70,000 mt lower than the record catch taken in 2008 (541,262 mt). The WCP–CA bigeye catch for 2010 (108,997 mt – 5%) was the lowest since 1996, mainly due to a drop in 2010 provisional estimates for the longline fishery. The 2010 WCP–CA albacore catch (129,670 mt - 5%) was the second highest on record, with very good catches from the longline fishery.

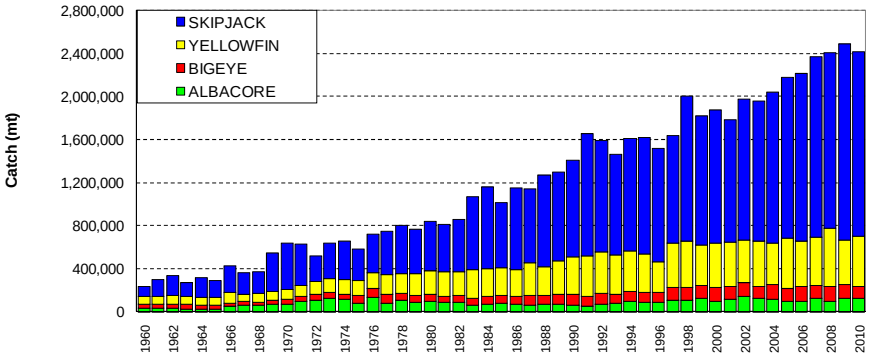

Figure 2. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP–CA.

18. The provisional 2010 purse-seine catch of 1,820,844 mt was the third highest on record for this fishery, at more than 80,000 mt lower than the record attained in 2009. The 2010 purse-seine skipjack catch (1,476,819 mt) was the second highest on record, but significantly lower (130,000 mt) than the record catch in 2009; the proportion of skipjack tuna in the logsheet-reported total catch (81%)[1] was in line with the average for recent years. The 2010 purse-seine catch of yellowfin tuna (300,339 mt – 16%) rebounded (by 54,000 mt) from the relatively low catch of 2009, but was still significantly lower than the record catch taken in 2008 (391,152 mt). The provisional catch estimate for bigeye tuna for 2010 (43,389 mt) was the third highest on record but may be revised once all observer data for 2010 have been received and processed.

19. The 2010 pole-and-line catch (171,604 mt) was a slight improvement (6,000 mt) on the catch level in 2009, which was the lowest annual catch since the mid-1960s. The Japanese distant-water and offshore (110,612 mt in 2010) fleets, and the Indonesian fleets (60,415 mt in 2007), account for most of the WCP–CA pole-and-line catch. The catches by the Japanese distant-water and offshore fleets in recent years have been the lowest for several decades and this is no doubt related to the continued reduction in vessel numbers (in 2009/2010 reduced to only 96 vessels, the lowest on record). The Solomon Islands fleet recovered from low catch levels experienced in the early 2000s (only 2,773 mt in 2000 due to civil unrest) to reach a level of 10,448 mt in 2003. This fleet ceased operating in 2009, but there are expectations of it resuming activities in 2011.

20. The provisional WCP–CA longline catch (239,853 mt) for 2010 was the fourth highest on record, at around 17,000 mt lower than the highest on record attained in 2002 (256,582 mt). The WCP–CA albacore longline catch (104,482 mt – 44%) for 2010 was the highest on record, 12,000 mt higher than the previous record (92,539 mt in 2009). In contrast, the provisional bigeye catch (58,324 mt – 24%) for 2010 was the lowest since 1996, but may be revised upwards when final estimates are provided. The yellowfin catch for 2010 (76,067 mt – 32%) was slightly higher than the average catch level for this species over the period 2000-2010.

[1] However, recent studies using observer data (e.g. Lawson, 2007, Lawson, 2010, Hampton and Williams, 2011a) show that the logsheet-reported catch, mainly for associated sets, should contain higher quantities of yellowfin and bigeye tuna that have been misreported as skipjack tuna.

21. The 2010 troll albacore catch (2,141 mt) was slightly higher that the catch in 2009 which was the lowest since 1986, and was apparently due to poor catches experienced in the New Zealand domestic fishery. The New Zealand troll fleet (136 vessels catching 1,834 mt in 2010) and the United States troll fleet (6 vessels catching 307 mt in 2010) typically account for most of the albacore troll catch, with minor contributions coming from the Canadian, the Cook Islands and French Polynesian fleets when their fleets are active (which was not the case in 2010).

Economic overview of WCPO tuna fisheries

Purse seine fishery

22. It was noted that Bangkok skipjack prices averaged around US$1,220/mt in 2010 an increase of 11% on 2009 and further increased in 2011 averaging over US$1,600/mt over the period January to July to be 28% per cent higher than over *the* same period in 2010. At Yaizu purse seine caught skipjack prices were steady in JPY terms at ¥124/kg but as a result of the depreciation of the US$ against the JPY in US$ terms prices rose by 6% on 2009 levels to US$1,410/mt. It was also noted that Bangkok prices over the period January 2007 to July 2011 averaged US$1,320/mt 63% higher than that average over the period 2002-2006. With respect to yellowfin prices Bangkok prices averaged around US$1,560/mt in 2010 an increase of 4.5% on 2009 and further increased in 2011 averaging over US$2,050/mt over the period January to July to be 32% per cent higher than over the same period in 2010. At Yaizu prices rose 18% in JPY terms to ¥252/kg. The value of the purse fishery in 2010 was estimated to be US$2,480 million, an increase of 5% on 2009 and the 2nd highest on record. This was driven by a 39% increase in the value of the yellowfin catch to US$500 million while the value of the skipjack catch remained steady at around US$1.9 billion.

Pole and line fishery

23. It was noted that the value of the pole and line fishery in 2010 remained steady at around US$340 million.

Longline fishery

24. It was noted that longline caught yellowfin and bigeye prices were generally higher in 2010 continuing a recent trend of increasing prices. Longline caught yellowfin prices at Yaizu averaged ¥634/kg (US$7.22/kg) up 3% (10%) on 2009 while fresh yellowfin import prices from Oceania averaged ¥895/kg (US$10.20/kg) up 6% (13%) on 2009. Prices for frozen bigeye imports into Japan in 2010 were ¥968/kg (US$11.02/kg) up 8% (15%) on 2009 levels. It was noted that the Bangkok albacore market price (10kg and up, c&f) averaged around US$2,500/mt over 2010 similar to that seen over 2009 with prices in the 1st half of 2011 rising significantly to reach around US$3,000 at the end of June. The estimated delivered value of the longline tuna catch in the WCPFC area for 2010 is US$1,487 million. This represents a marginal increase of US$27 million or 2% cent on the estimated value of the catch in 2009 with the value of the albacore and yellowfin catch increasing by US$35 million (14 per cent) and US$24million (4 per cent) respectively while the value of the bigeye catch declined by US$32 million (5 per cent).

Discussion

25. It was requested in the future that, if the Scientific Committee considers that the adjusted catch figures represent the best available estimates of the catch, that this report use the adjusted catch figures which are currently only reflected in the Annex of this report. It was also suggested that it may be worth

including a small section in the report to document relevant environmental changes over time and that the report include an additional figure demonstrating the percentage of total purse seine catch by school type.

26. It was noted that the increasing trend in the prices of yellowfin and bigeye tuna from the longline and pole and line fisheries has largely been due to changes in the Yen:USD exchange rates. However the SC was advised that other factors, such as increasing fuel prices, also impact the market price of tuna.

27. It was also noted that the impacts of the March 2011 Japanese tsunami upon the price structure in Japanese markets are likely to become more evident this year. Some CCMs considered it significant that the paper showed reductions in the total catch of the fishery and particularly from purse seining. It was suggested that the reduction in the total catch from the fishery in 2010, particularly from purse seining, along with the large decrease in the number of sets on FADs and the associated decline in skipjack CPUE, may represent evidence of fishery changes which have occurred largely as a result of CMM 2008-01. However, further research to fully understand recent declines in skipjack catches in the face of increased purse seine effort would be useful. Some members expressed concern about the recent increased catch of albacore outside, but close to the EEZs of South Pacific Island countries, whose longline fisheries are dependent upon this species.

2.2 Overview of Eastern Pacific Ocean (EPO) fisheries

28. K. Schaefer (IATTC Secretariat) presented a summary of the fishery and assessments of major stocks of tuna exploited in the eastern Pacific Ocean (EPO) in the 2010 review of EPO fisheries (WCPFC-SC7-2011/GN-WP-02). The fishing capacity of the purse-seine fleet fishing in the EPO has increased over the last 10 years, but stabilized in mid-2006. The reported nominal longline effort has fluctuated between about 300 and 100 million hooks set annually between 1981 and 2005, and declining since then. Total tuna catches increased starting in 1996, peaked in 2003, and declined in 2010 to a level of about 15 years previously.

29. Yellowfin tuna catches have remained fairly stable since the mid-1980s, except for a peak in 2001 through 2003 followed by a substantial decline in 2006 through 2008, followed by a slight increase in 2009 and 2010. The 2010 catch on dolphin associated schools, is similar to the average of the past 15 years. In contrast, the catches of yellowfin in unassociated schools have been decreasing over the past 10 years. The current stock assessment method being used for yellowfin is STOCK SYNTHESIS III. Since 2004 recruitment has been relatively low, though not quite as low as it was during 1977 through 1983. The spawning stock size is below the level corresponding to MSY, but fishing mortality rates are slightly below those corresponding to the MSY level. The current status of the stock is considerably more pessimistic if a stock recruitment relationship is assumed.

30. The status of the skipjack stock has been evaluated using eight different data and model based indicators. The purse-seine catch has been significantly increasing since 1994, in 2008 was above the upper reference level, but in 2010 was close to the 1975-2010 average. Except for a large peak in 1999, the catch per days fished (CPDF) on floating objects has been relatively stable since 1992. The biomass and recruitment have been increasing over the past 10 years, although both these indices decreased in 2010. The exploitation rate has been increasing over the past 20 years with a peak in 2002 and above average rates since that year. The main concern with the skipjack stock is the above average exploitation rate.

31. There have been substantial historical changes in the bigeye fishery in the EPO. Beginning in 1994 purse-seine catches increased substantially to targeting tunas associated with drifting FADs in the equatorial EPO. Longline catches have been significantly less during the past 15 years, versus the previous 20 year period. The current stock assessment method being used for bigeye is STOCK

SYNTHESIS III. Recruitment estimates were above average since around 2001. Recent estimates indicate that the bigeye stock may not be overexploited, since spawning biomass ratio levels are above those corresponding to the MSY, but that overfishing may be taking place. The current status of the stock is considerably more pessimistic if a stock recruitment relationship is assumed.

32. A tuna conservation resolution was adopted by the IATTC in June 2011, for the three-year period (2011-2013). This includes an EPO wide closure for purse-seine (>182 mt) fishing of 62d in each of those years, along with a 30d closure of a core offshore FAD fishing area. There is a special provision for class 4 vessels (182-272 mt) which permits 30 days of fishing during the EPO closure provided an observer is aboard. For longline vessels (>24 m) the resolution includes fixed bigeye catch limits for China, Japan, Korea, and Chinese Taipei, and other CPCs not to exceed 500 t or their respective catches in 2001, whichever is greater.

Discussion

33. SC7 was advised that a decline in the 2010 catch of skipjack was due to relatively low recruitment in this period. Annual catches of skipjack tuna in the EPO have commonly varied by a factor of three. It is believed that this is due to variations in recruitment that are linked to environmental factors. Research has been conducted to look at the influence of environmental factors upon survival of early life history stages of yellowfin tuna at the IATTC Panama laboratory, however the results of this research have not yet been used to quantitatively assess recruitment impacts. Other research has indicated that El Nino periods are followed by higher yellowfin recruitment.

34. Concern was expressed regarding the use of a steepness value of 1 in the base case EPO yellowfin and bigeye tuna assessments, and it was suggested that a more realistic value could be applied following appropriate reproductive ecology studies or that the assessments might use steepness values determined for related teleost species. SC7 was advised that IATTC applied a steepness value of 1 due to a lack of empirical evidence for a more appropriate value. The question of whether it is appropriate or not to apply differing values of steepness to the same species in the EPO and the WCPO was deferred to the stock assessment theme session. SC7 was advised that the decrease in longline catches in the EPO from 2003 to 2010 is largely due to a dramatic decrease in nominal fishing effort by the large industrial fishing fleets, especially Japan.

35. Finally, one CCM recommended that, in their annual stock assessment papers to the SC, SPC might provide a similar figure to Figure B4 (of WCPFC-SC7-2011/GN-WP-02) as this would facilitate better understanding of fishery impacts upon the stock.

2.3 Annual Report (Part 1) from Members, Participating Territories and Cooperating Non-Members (CCMs)

Australia

36. Australian commercial fisheries for highly migratory species in the Western and Central Pacific Fisheries Commission (WCPFC) Convention Area are managed as part of the Eastern Tuna and Billfish Fishery (ETBF) (a mainly longline fishery with a small minor line component) and the Eastern Skipjack Fishery (a purse seine fishery). The majority of fishing occurs in the longline sector of the ETBF and as such, is the focus of the annual report.

37. Total catches reported in logbooks for the ETBF decreased from 5403 t in 2009 (5271 t longline, 132 t minor line) to 5034 t in 2010 (5031 t longline, 2.8 t minor line). This is a decline from a peak of 8229 t in 2002. Longline fishing effort in the fishery has fallen from a peak of 12.40 million hooks in

2003 to 7.84 million hooks in 2010. The decrease in fishing effort from 2003 levels is the result of the strength of the Australian dollar, increased operating costs and the surrender of permits under the structural adjustment component of the recent Australian Government *Securing Our Fishing Future* package, as well as the introduction of hook limits in 2009. In 2011, catch limits were introduced for albacore, bigeye and yellowfin tuna, for striped marlin and for swordfish. Fifty-four vessels reported longlining in the WCPFC Convention Area during 2010. Forty-eight of these caught swordfish south of 20S. Longline logbook catches of albacore tuna decreased from 1344 t in 2009 to 725 t in 2010. Longline catches of bigeye tuna decreased from 509 t in 2009 to 436 t in 2010. In contrast, longline catches of yellowfin tuna increased from 1183 t in 2009 to 1310 t in 2010. Longline catches of swordfish decreased from 1111 t in 2009 to 916 t in 2010, including 884 t caught south of 20S. Longline catches of striped marlin decreased from 326 t in 2009 to 244 t in 2010. Longline catches of skipjack decreased from 10 t in 2009 to 3 t in 2010. There were four minor line vessels in 2010 actively targeting tuna and billfish species. The number of vessels reporting using minor line has steadily decreased from a peak of 52 vessels in 2001. This is partly due to the surrender of 49 per cent of permits under the structural adjustment component of the Australian Government *Securing Our Fishing Future* package. Annual minor line effort decreased from 168 lines in 2009 to 13 lines in 2010. In the 2009–10 fishing season, there were no active vessels in the Eastern Skipjack Fishery.

38. The Australian Fisheries Management Authority (AFMA) observer program has deployed observers on domestic longliners since 2001 as part of a program to test the efficacy of seabird mitigation devices. Since July 2003, observers have been deployed more broadly across the fishery with the aim of collecting additional fishery data, including information on fishing gear and the size and species composition of catches. In 2010, observers monitored 284 731 hooks in the longline fishery (3.6 per cent of the total number of hooks deployed). AFMA introduced quota based management in the form of individually transferable quotas (ITQs) into the ETBF in February 2011 for the 2011–12 fishing season which began 1 March 2011. This provides for total allowable catches (TACs) for the five main target species.

Belize

39. Belize's longline tuna fishing fleet operating in the WCPFC Convention Area has shown a steady decrease in its catch and effort from 2004 to 2010. There has been a reduction from 30 vessels fishing exclusively in 2004 to 6 vessels in 2010. All 6 of these vessels were licensed exclusively for operation in the WCPFC area. We also have 2 reefer carriers currently operating in the WCPFC Area. Due to the reduction in fishing effort, all our catches have decreased when compared with earlier years. There has been a 96% reduction in our overall catches from 3445.99 m/t in 2003 to 140.10 m/t in 2010. However, this reduction is as a result of 5 of the vessels being laid up for most of the year due to socio-economic costs. Albacore was the main target species from 2003 to 2006. However, our catches of yellowfin tuna exceed those of albacore in 2007 and up to 2009. Bigeye tuna catch exceeded that of yellowfin tuna in 2010. The average size of our vessels has also risen from 191 GT in 2003 to 497 GT in 2008 and then 576 GT in 2010. The majority of the vessels that operated during the period 2003-2006 were between 51-200 GT. In 2010, 6 of our vessels were over 500 GT.

40. Blue marlin is the most common non-tuna by-catch in our longline fishery, followed by striped marlin and blue shark. The large reductions in our long line effort have also resulted in the reduction in catches of our major by-catch species. We did not receive any reports of seabird and sea turtle interactions by our vessels in 2010. In 2008, we introduced measures to mitigate the impact of fisheries for highly migratory fish stocks on seabirds and sea turtles and advised the Secretariat of the measures currently being utilized by our vessels. Our fishing vessel owners/operators are required to submit data relating to their fishing operations based on our format for such reporting and in compliance with the WCPFC's reporting guidelines. For the purposes of ensuring compliance, surveillance is conducted on a regular

basis or as a result of an investigation. In the future, we intend to re-expand our longline fishing fleet to 10 fishing vessels which will fish exclusively in the Convention Area and within the limits set by the WCPFC.

Canada

41. Catch, effort and catch per unit of effort (CPUE) data for the Canadian albacore (*Thunnus alalunga*) fishery in the WCPFC Convention Area for 2010 are summarized in this document. The Canadian tuna fishery is a troll fishery that uses jigs and targets albacore exclusively. The Canadian fishery was inactive within the WCPFC convention area in 2010, with no effort or catch reported in statistical zones within the convention area in either the north or south Pacific Oceans. Annual albacore tuna catches by the Canadian troll fleet in the convention area between 2002 and 2008 have ranged from 83 t in 2005 to 453 t in 2003 and effort has ranged from 56 v-d in 2007 to 408 v-d in 2002. Both catch and effort by the Canadian fleet in the WCPFC convention area have declined since 2002. Two Canadian scientists participated in and chaired two ISC-Albacore Working Group workshops in 2010.

China

42. China has two types of tuna fishery in the WCPFC Convention Area: a longline and a purse seine fishery. The longline fishery consists of ice fresh tuna longline (IFLL) and deep frozen tuna longline (DFLL). In 2010, total tuna catch from the longline fishery and the purse seine fishery were estimated to be 31,806 t and 53,716 t respectively. There are a total of 244 longliners and 12 purse seiners operating in these two fisheries. Catches by the Chinese deep longline fishery for bigeye are exported to Japan for sashimi and catches of albacore by longline are sold for cannery products. Catches by the purse seine fishery for skipjack are also sold for cannery products. During 2010, 4 observers were trained and dispatched to Chinese longline vessels in the high seas of Central and Eastern Pacific Ocean. The first observer trip collected fishery data and biological data from Aug 26, 2010 to Dec 19, 2010, covering the areas N10°21′～S9°46′，E178°58′～W152°15′. The second trip was taken from Sep 25, 2010 to Jan 17, 2011, covering areas S03°46′～S09°26′，W149°52′～W154°19′. The third trip was taken from Oct 2, 2010 to Jan 13, 2011, covering the areas of N6°00′～S10°49′，W169°05′～W146°50,. The fourth trip was taken from Oct 13, 2010 to Feb 19, 2011, covering the areas of N4°38′～S14°45′, E178°01′～W130°07′. Size data for BET, YFT and SWO has been submitted to WCPFC. Data coverage of catch and effort was 100%. 100% logbook coverage collection for longline fishery has been carried out and this shall promote China data collection quality.

Cook Islands

43. The majority of Cook Islands vessel catches are taken within the Cook Islands EEZ, with under 4% taken beyond the EEZ in 2010. Total effort for the WCPF-CA is approximately 6 million hooks, with 5.5 million hooks of effort attributed to the CK EEZ. Total raised catch estimates for 2010, in the WCPF-CA is 3,156.6 t. Albacore remains the primary catch species accounting for 75% of the total 2010 catches. Total albacore catch estimate for 2010 is 2,423 t. Total catches for yellowfin and bigeye in 2010 are 319.2 t and 192 t, respectively. The majority of catches are taken in the northern Cook Islands by the fleet based out of Pago Pago, American Samoa. A total of forty-one longline fishing vessels were licensed to fish within the WCPF-CA in 2010. Thirty seven licenses were issued for vessels to fish within national waters, and three licenses issued sole authorisation for fishing activity on the high seas within the WCPF-CA. An observer training workshop was held in early 2011 to improve observer data coverage in the northern Cook Islands fishery and the WCPF-CA.

Ecuador

44. NO SUMMARY AVAILABLE/PROVIDED

El Salvador

45. El Salvador is a state with a coast bordering the Pacific Ocean. In this country, the tuna industry fleet is only purse seine, and consists of four vessels. The main catches of tuna take place in the Eastern Pacific Ocean. This report represents a summary of the information handled by the General Directorate for Fisheries and Aquaculture, on the catches made by the tuna fleets with the Salvadorean flag, specifically in the area of the Western and Central Pacific Fisheries Commission (WCPFC). This information comes from the records obtained in collaboration with the Inter American Tropical Tuna Commission (IATTC), under the on-board observer program and Vessels Monitoring System, where the vessel Monterocio y Montelucia are permanently monitored by our Directorate. Therefore El Salvador, a non-member state, is working to maintain the level of compliance and cooperation of all measures that the Commission set out and is searching for better management of resources.

European Union

46. There are two EU-Spain fishing fleets operating in the Pacific Ocean: a purse seine fleet targeting tropical tuna, and a surface longline fishery targeting swordfish. In 2010, four EU-Spain purse seiners, all with a gross register tonnage (GRT) over 1500, fished in the WCPFC Convention Area. Data from the observers of the Agreement on the International Dolphin Conservation Program (AIDCP) and, in the case of two trips of one of the vessels, data from logbooks, (100% coverage), indicate a total landed catch of 29468 t (4911 t BET, 20517 t SKJ and 4040 t YFT). Effort, aggregated catches, discards and bycatch data are also presented.

47. During the year 2010, a total of 5 EU-Spanish flagged longline vessels targeting swordfish were fishing in the WCPFC Convention Area. The gear used is the monofilament surface longline (Florida style modified), using an average of around 1100 hooks per set. The average characteristics of the vessels involved in the fishery were the same as in previous years - 291.8 GTR, 861.8 HP and 40.8 m in length. The 2010 swordfish landings, bycatch and effort distribution, are provided. The estimates of landings available for 2010 indicate a total SWO catch of 994 t from the WCPFC Convention Area (381 t from the WCPFC-CA east of 150º W).

Federated States of Micronesia

48. The current estimate of the total catch by the 30 FSM purse seine and longline vessels (national fleet) within the WCPFC Convention Area for the year 2010 is 24,014 t. Skipjack, yellowfin and bigeye, the key target species accounted for 97% of the catches with the remaining 3% of non-target species catch. The total number of purse seine vessels employed by FSM is 7 purse seiners and 23 longline vessels in 2010. By species composition, skipjack accounted for 81% (19,395 t) with yellowfin at 13% (3,264) and bigeye 5% (1,094t), and other species accounted for 1% (261 t). In general, catch for our domestic fleet within the Convention Area has increased 15% generally over 2009, primarily by our purse seine fleet, but our longline fleet has showed a decreased total catch compared to last year's (2009).

49. At the present time, data for the artisanal fishery are not available as these fall within the states responsibility. The total FSM EEZ catch in 2010 by all gear types is recorded as 155,753 t (96% by purse seine ,<2% by longline, >2% pole and line), comprising of 87% skipjack, 7% yellowfin, 2% bigeye tuna, and 4% other species. Japan accounted for 30% followed by the FSMA with 23% and Chinese Taipei with 18 %, making them the three main purse seine fleets with the most effort in the zone in 2010. The

total longline EEZ catch is reported as 2,831 t with bigeye accounting for 57%, yellowfin 40%, and other species for 3%. By flag, Japan accounted for 41% of the total longline catch followed by FSM 25% and Chinese Taipei 25%, and China 9%.

50. In terms of effort, both purse seine and longline effort within the FSM EEZ increased slightly in 2010, compared to 2009. In contrast, the domestic purse seine effort within the WCPO area increased slightly, whereas the domestic longline fleet catch has decreased slightly, compared to 2009. The FSM Observer program operated with a pool of 74 observers in 2010. The FSM National Fisheries Observer Program made 385 successful placements; with longline accounting for 1 trip, 3 pole and line, and 381 purse seiners. The increase in the number of observer trips by the FSM National Observer Program is mainly due to the increased number of employed fisheries observers recruited in 2009 and 2010 for monitoring the FAD Closure Periods, 100% Observer Coverage, and Catch Retention measures by the WCPFC.

51. The port sampling coverage for 2010 was 97% (about the same as in 2009) for the purse seiners and 81% for the longliners. There were a total of 166 purse seine vessels reported to transship in FSM port in 2010 with a total volume of 146,220 of tuna trans-shipped. By species, skipjack accounted for 97% with 3% of mixed yellowfin and bigeye. Pohnpei remains the most active port in FSM. The majority of the purse seine vessels unloading in FSM were Chinese Taipei purse seiners accounting for 79 transshipments, followed by Korea with 35, China with 19, FSMA with 18, 11 FSM, and 4 by US vessels unloading in 2010. A total of 486 unloadings for longline was reported in 2010 for a total of 1,981 t. This catch comprised 43% bigeye tuna, 24% yellowfin tuna, 19% billfish and 14% other bycatch species. Most of the unloaded volume by longliners was by FSM flagged vessels (46%), followed by Chinese Taipei (39%), and China (15%).

Fiji

52. In the early 1990s, when fishing activity was relatively low, albacore accounted for about 50% of the tuna catch but then this increased to around 70% - 80% from 1995 onwards. Yellowfin catch throughout the years has remained at 15-25% of total tuna catch with the highest catch recorded in 2004. Bigeye tuna has generally comprised around 8% of the total catch. The 2010 catches of these 3 tuna species totalled 9,955 t.

53. The nominal CPUE for albacore increased steadily from 1.03 fish per 100 hooks in 2003 to 1.93 fish per 100 hooks in 2006 before dropping down to 1.47 fish per 100 hooks in 2010. Bigeye nominal CPUE appears relatively stable over the time series. Yellowfin nominal CPUE remained consistent at and around 0.2 fish per 100 hooks in 2005 and 2006 before increasing to an average of 0.33 fish per 100 hooks in recent years.

54. The national observer records for the interaction rates of Species of Special Interest showed a higher level of interaction in 2009 compared to the previous years. This is attributed to improved reporting by the national observer programme. In 2010 there were 5 loggerhead sea turtles, 3 Hawksbill, and 6 Leatherback Turtles observed caught in the fishery.

French Polynesia

55. The French Polynesia professional tuna fleet in 2010 comprised 61 longliners (ranging from 13 m to 24 m) operating only within the French Polynesia Economic Zone and 368 small boats (5m to 11 m) using artisanal gears (pole and line, handlines, trolling…) and operating inside the territorial waters. The overall nominal catch for these fleets in 2010 is estimated at around 8 770 metric tons, with albacore accounting for 47 %, yellowfin tuna for 11 %, skipjack for 13 % and bigeye tuna for 5%. Effort and total

catch by the longline fleet decreased since 2005 after a steady increase since the beginning of this fleet in the early 1990's. In contrast, the trends for the artisanal nearshore fishery show a slow and steady increase partly driven by the increase of the population. Since 2006, all sharks except mako sharks are fully protected inside the entire French Polynesia Economic Zone. It is also planned to include mako. Accidental catches of turtles and sea birds by the longliners are extremely rare.

Indonesia

56. The number of active fishing vessels operating in the Indonesian Economic Exclusive Zone (Fisheries Management Area No. 716/IEEZ of Sulawesi Sea and 717/IEEZ of Pacific Ocean) in 2010 by fishing gear were 156 purse seiners (PS), 166 longliners (LL), 18 pole and line vessels (PL), and 92 vessels with other gears (troll and gillnet). The fishing boats varied in size from 10 – 500 GT.

57. The nominal catches for the three species in the Fisheries Management Areas 716 (IEEZ Sulawesi Sea) and 717 (IEEZ Pacific Ocean) in 2010 were 105,296 t with breakdown by species: 75,656 t (71.85 %) for skipjack (SKJ), 26.283 t (24.96%) for yellowfin and 3,357 t (3.19%) for bigeye tuna (BET). Catch proportion by gear was 15.262 t (14.49 %) for LL, 32.586 t (30.94 %) for PS, 33.811 t (32.11%) for PL, 1.685 t (1.60 %) for HL, and 21.952 t (20.85 %) for other gears.

58. Species composition based on fishing gear was in the range of 10-25% for BET and 75-90% for YFT in the LL catch; 65-80% for SKJ, 20-30% for YFT and 2-5% for BET in the PS catch; 80-90% for SKJ, 5-15% for YFT and 2-5% for BET in the PL catch; and 96-98% for YFT and 2-4% for BET in large tuna HL. There was a highly variability of species composition caught by troll and others gears, which require further observation. This species composition estimation was obtained as preliminary conclusion from *2nd Indonesia Tuna Fisheries (WCPFC Area) Annual Catch Estimates Workshop* using RCFMC-WCPFC Port sampling results.

59. The Research Center for Fisheries Management and Conservation (RCFMC) and WCPFC in the frame of WPEA-OFM project are continuing the port sampling program in Bitung and Kendari. The port sampling activities implemented in 2010 took 597 samples among 2,288 total landings observed in Bitung and took 362 samples among 1,775 landings in Kendari. Up to June 2011, 200 samples were taken from port sampling out of 972 total landings observed in Bitung and 76 samples were taken out of 565 landings observed in Kendari.

Japan

60. This paper describes recent trends in the Japanese tuna and billfish fisheries, e.g., longline, pole-and-line, purse seine and other miscellaneous coastal fisheries in the WCPFC Convention Area (WCP-CA), including fleet size, catch and fishing effort statistics. The total number of commercial longline vessels (larger than 10 GRT) was 433 in 2010. This was 11 vessels (2%) less than that in 2009. Total number of pole-and-line vessels (larger than 20 GRT) was 92 in 2010 which was 5 vessels (5%) less than that in 2009. For the purse seine vessels, the number of vessels over 200 GRT was 37 in 2010, which was the same number as that in 2009. Out of the 37 vessels over 200 GRT, the number of vessels which are allowed to operate in tropical waters was 35 in 2010 and has been stabilized since 1995.

61. The total 2010 WCP-CA catch of tunas (Pacific bluefin, albacore, bigeye, yellowfin and skipjack) by the Japanese fishery was still provisional and estimated to be 432,657 t. This corresponds to 104% of 2009 total tuna catch (414,299 t). In 2010, the total tuna catch by the purse seine fishery was 250,427 t (58% of the total), with 110,720 t (26%) by the pole-and-line fishery, 59,252 t (14%) by the longline fishery, and the remaining (3%) by the other gears.

62. Japan has conducted several research activities in relation to biological and stock assessment studies on tuna, billfish and other bycatch species in the WCP-CA in 2010, such as tagging study for tropical tunas and sharks, several research cruises to sample Pacific bluefin tuna larvae and a research cruise to investigate ways to reduce the catch of juvenile bigeye during purse seine fishing. In addition, bycatch species related research was conducted, including tori-line experiments using commercial longline vessels to mitigate sea birds and experimental use of circle hooks in reducing hooking mortality of sea turtles.

Kiribati

63. The tuna fishery in Kiribati is composed of foreign fishing fleets licensed to fish tuna in the country's EEZ and the artisanal fishery, which is important in providing food security for the local people. The major gear types used to fish for tuna in Kiribati's waters are purse-seine and pole and line which mainly target skipjack and yellowfin tuna. Longlining is also employed by foreign fleets, targeting bigeye tuna. The artisanal boats, often less than 7 meters in length, are fishing within the vicinity of the 12 nm of the islands of Kiribati. These small boats used trolling and handlining to catch shallower tuna species like skipjack and yellowfin. In 2010, Kiribati licensed a total of 527 foreign fishing vessels including support vessels like reefer carriers and tankers. The fees of these foreign fishing vessels contributed to 44% of the total revenue and it is largely responsible for subsidizing the Government budget that year.

64. Kiribati have flagged vessels active within the WCPFC area. The number of national fleets increased from 1 in 2008 to 8 in 2010 due to an influx of foreign fishing vessels changing their flag to Kiribati. Consequently the total catches of Kiribati's fleet improved to over 25,000t which is five times bigger than the average catch for the last 13 years (1994-2008). Tuna remain the most important resource to Kiribati and therefore the sustainable development and management of the resource is critical for the country. Kiribati is keen to work in collaboration with other nations to ensure the sustainable management of this resource.

Korea

65. Korea has purse seine and longline fisheries for fishing tunas and billfishes in WCPFC Convention Area. In 2010, 29 purse seine vessels and 122 longline vessels were engaged in fishing and caught 277,312 mt and 28,513 mt, respectively. While the number of vessel was increased, the catch was decreased in both fisheries. Purse seine catch was higher in region 3 in 2010 than in region 4 where it was higher in 2009. Longline catch was higher in region 4 in 2010 than in 2009. In species composition of purse seine catch, skipjack was lower in 2010 than in 2009, while those of yellowfin tuna and bigeye tuna were higher in 2010 than in 2009. In longline catch, there was no apparent change in species composition from the previous year. In 2010, the coverage rates of logsheet were 95.4% for purse seine and 71.2 % for longline in 2010. The longline bycatch of key shark species was reported in logsheet in 2010. No scientific observation was carried out for longline fishery in 2010, due to a national observer systematic reason. Data collection and reporting was improved in accordance with the recent CMMs. A pilot research on species composition of purse seine catch at cannery site was conducted in 2010.

Mexico

66. NO SUMMARY AVAILABLE/PROVIDED

Nauru

67. The Nauru EEZ is a major purse seine fishing ground in the WCPF-CA and in 2010 produced a total of 106,420mt of tuna catches in its EEZ. This is the second highest on record for the EEZ. 75% of the total catch is made up Skipjack tuna. The yellowfin total catch of yellowfin tuna of 24,003 is the highest in a single year for the stock. Effort in 2010 also increased by over 40% and this concluded what was a very productive year for the fishery. The number of fishing vessels decreased slightly to 182 Purse seine vessels and in addition to these, 4 longline vessels also operated in the EEZ during the year.

New Caledonia

68. Fishing for tuna and associated species by New Caledonian vessels started in 1981 with a pole-and-line fishery (less than 3 vessels) operating for only three years (1981: 228 t; 1982: 998 t; 1983: 492 t). Longliners started operating at the same time and it took almost 20 years before this domestic fleet had significant activity. In 2010, 20 domestic longliners fished in the New Caledonian EEZ. No licenses have been issued to foreign vessels since early 2001. A 12% increase in the catch was reported last year. The 2010 annual catch of 2860 t was mainly composed of albacore tuna which is the target species of all the vessels and accounts for 68% (1939 t) of the total catch. Yellowfin was second with 505 t (18%). Striped marlin and swordfish remain by-catch in this fishery (65 t and 8 t respectively). Catches of sharks have been decreasing since 2006, due to an increasing use of monofilament branchlines.

69. In 2010, port sampling and observer activities carried out under the SciFish project reached 52% and 9% coverage, respectively, of the longline sets. The objectives of these activities are to collect information to be checked with the other sources of data, and to provide accurate data to the stock assessments. Through the ZoNéCo program, New Caledonia also continues to participate in the regional efforts to improve the knowledge of the tuna behaviour, in particular the South Pacific albacore as the species of major interest for its fishery.

New Zealand

70. Since 2002, skipjack (23,622 t in 2010), which is nearly all taken by purse seine, has comprised the greatest part of the New Zealand catch of all tuna species, both within and beyond New Zealand fisheries waters. Yellowfin (770 t in 2010) makes up most of the balance, and is mostly taken outside New Zealand waters. Yellowfin are rarely part of the purse seine catch within New Zealand fisheries waters because the domestic purse-seine fishery targets only on free schools of skipjack. The second most important component of New Zealand's domestic fisheries is albacore (2,290 t) which are taken mostly by troll gear, but are also landed as target and bycatch in the longline fishery. The domestic longline fleet targets both bigeye and southern bluefin tuna and more recently swordfish, but the greatest part of the catch consists of albacore. Almost 143 t of striped marlin are caught annually by the recreational fleet, with 80t tagged and released and 63 t retained. Most highly migratory species caught in New Zealand waters are exported; the destination of exports varies depending on the species.

71. New Zealand has four Class-6 purse seiners fishing offshore in the EEZs of Pacific Island States and in high seas areas of the equatorial western and central Pacific Ocean (WCPO). These vessels have also fished domestically from time to time along with up to seven smaller capacity domestic-based purse seiners. The number of purse-seiners has declined from 11 vessels in 2005 to 7 vessels in 2010. The New Zealand longline tuna fleet consists of domestically owned and operated vessels (mostly between 15 to 25 m in length) and a limited number of foreign owned vessels that operate under charter. The number of longline vessels operating in New Zealand has declined from 151 vessels in 2002 to 44 in 2010.

72. Blue shark is the most common non-tuna bycatch species in the longline fishery followed by Ray's Bream and moonfish. Reductions in longline effort since 2002 have resulted in reductions in catches of the major bycatch species to their lowest levels in 2008, but there has been some subsequent increase.

73. Longline vessels fishing for tuna or swordfish in New Zealand fishery waters are required to use tori lines, and may only set their lines at night unless using approved line weighting. New Zealand longline vessels fishing on the high seas south of 30°S must use two mitigation measures as specified in CMM 2007-04. New Zealand longline vessels have been provided with turtle dehooking and mitigation equipment. As the purse seine fishery in New Zealand fishery waters is based on free schools of skipjack, bycatch is minimal (e.g. 1% by mass). No interactions with non-fish bycatch (e.g. seabirds, turtles, and marine mammals) have been observed in the purse seine fishery.

74. New Zealand has an Observer Programme and two active domestic port sampling programmes for highly migratory species. In 2010, 19% of the longline effort (hooks) was observed, and almost 9% of the New Zealand purse seine sets were observed, in addition seven troll trips were observed. A considerable amount of research is directed at tunas, tuna-like and bycatch species in New Zealand. Fishers and fish receivers are required to furnish returns (monthly reports) to the Ministry of Fisheries. New Zealand has four data collection systems in place to collect catch and effort data. New Zealand also has a system for collecting information on non-fish bycatch from fishers.

Niue

75. NO SUMMARY AVAILABLE/PROVIDED

Palau

76. NO SUMMARY AVAILABLE/PROVIDED

Panama

77. NO SUMMARY AVAILABLE/PROVIDED

Papua New Guinea

78. The Papua New Guinea (PNG) tuna fishery is made up of both the purse-seine and longline sectors with a small, but important handline sector. The longline and handline sector is a citizen- only activity and all vessels fish exclusively in the waters under PNG national jurisdiction. The purse-seine sector is a mix of both domestic and foreign access vessels. The domestic sector comprises the PNG flag vessels and PNG chartered vessels which support processing facilities onshore in PNG. While the PNG flagged vessels fish primarily in PNG waters, but occasionally in the adjacent high seas, the chartered vessels fish both in PNG waters and waters outside of PNG. Foreign vessels under access arrangements fish in PNG EEZ waters (but not territorial or archipelagic waters) whenever there is fish to catch.

79. Total catch in 2010 within PNG waters was 702,969 mt, a 55 % increase from the 2009 catch of 453,129 mt. The increase in total catch is attributed to the increase in total fishing effort relative to the increase in number of fishing vessels, mainly purse seiners. The catch contribution was 78.7% by foreign vessels that fish under access arrangements, 16.7% from PNG chartered vessels (locally based foreign (LBF)) and 4.1% from the PNG flag vessels. Small amount ≈0.5% (3120 mt) is from the longline sector. Almost all the catch from PNG Flag vessels was caught inside PNG waters as result of closure of the

neighboring high sea pockets. The catch by PNG chartered vessels outside of PNG waters was 63,397 mt and was taken mainly in the waters of the other PNA member countries.

80. A total of 256 vessels were active in the PNG waters in 2010. Thirty-two (32) were longline and handline vessels and 224 were purse-seine vessels. Nine (9) of the 224 vessels were PNG flagged, 39 were PNG chartered and 176 were foreign vessels fishing under access arrangements. The total purse-seine effort in 2010 by foreign vessels was 15,796 days fishing and searching inside national waters, an 18% increase from 13,348 days in 2009. Longline effort also increased from 36, 574 hundreds of hooks in 2009 to 62,605 hundred hooks in 2010. Catch by purse-seine vessels in PNG were mainly on free schools which accounted for about 72% of the total catch. The remaining 28% was associated with FADs (drifting = 11.9%, anchored = 8.2%), logs (7.8%) and mammals (0.5%). About 82% of the free school catch was by foreign vessels and the other 28% by PNG flagged and PNG chartered vessels.

81. Data collection in PNG is comprehensive with above 80% catch & effort data coverage for all fleets. For size and species composition data, PNG runs a port sampling program as well as an observer program that covers the vessels based out of PNG and foreign vessels fishing the PNG fisheries Zone. The PNG observer program runs program involving over 200 man/women with the aim to beef up this strength to 400 observers over the next 3-4 years. Observer coverage on vessels fishing in PNG waters on average (2004 - 2009) ranges from 30% on foreign vessels to 83% on PNG flag vessels. PNG chartered vessels have a 58% observer coverage on average.

82. PNG is striving towards building its fishing industry; therefore fishing licenses are linked to onshore investment. At full capacity PNG is looking to processing all fish caught in PNG waters, back in PNG. The rights to fish in PNG will also be linked to onshore investment in the near future.

Philippines

83. The Philippines expresses its strong commitment to promote effective management in order to achieve the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean (WCPO) in accordance with the 1982 Law of the Sea Convention, the UN Fish Stocks Agreement, and the WCPF Convention. In giving effect to the provisions of the WCPF Convention, the Philippines upholds that conservation and management measures developed by the Commission, including CMM 2008-01 on the conservation and management of bigeye and yellowfin, would need to embody the principles and measures adopted under the Convention.

84. The ongoing research activities of the National Stock Assessment Program (NSAP) has continued to collect data on species composition, length frequency, vessel catch and effort information on key tuna landing sites around the country. The West Pacific East Asia Oceanic Fisheries Management Project (WPEA-OFMP) funded by UNEP-GEF-WCPFC which started in January 2010 will help strengthen national capacities and international cooperation on priority transboundary concerns relating to the conservation and management of highly migratory fish stocks in the West Pacific Ocean and East Asia (Indonesia, Philippines and Vietnam).

85. The Bureau of Fisheries and Aquatic Resources (BFAR) strongly encourage the tuna industry to continue supporting the catch documentation scheme which includes the catch and effort logsheet system for all purse seine and ringnet vessels. Aside from this BFAR also requires canneries to submit monthly cannery unloading data. All these efforts are geared towards improving tuna statistics/data gathering.

86. The Bureau regularly conducts observer training (twice in a year). There are currently 106 trained observers ready to board the vessels especially to those vessels intending to fish during the FAD closure

period (1 July to 30 September 2010). The VMS has already been operationalized, although on a limited scale, but the Bureau is in close collaboration with the industry to increase coverage.

87. The provisional catch estimates for the three species of concern of the WCPFC in 2010 are as follows: skipjack – 228,178 t; yellowfin – 147,276 t and bigeye – 11,645 t (BAS, 2009). Although a much lower catch estimate was obtained during the 4th Annual Tuna Catch Estimates Review Workshop with the following breakdown: skipjack – 131,448 t; yellowfin – 75,638 t and bigeye – 4,432 t. The discrepancies between the two (2) estimates could be due to the difficulties in estimating the diverse municipal fisheries and could be explained as possible bias in the probability surveys due to very low coverage. The Philippines, through the BFAR-NFRDI and other concerned agencies together with the tuna industry is doing a lot of efforts to improve data collection and to strengthen its national capacity and international cooperation on transboundary concerns in relation to the sustainable conservation and management of highly migratory fish stocks.

Republic of the Marshall Islands

88. The tuna fishery in the Republic of the Marshall Islands (RMI) is comprised of foreign flagged purse seine, pole-and-line and longline vessels and RMI-flagged purse seine and longline vessels. Most of the foreign flagged longline vessels operate in support of domestic development activities and are based locally. As part of the RMI's ongoing domestic development aspirations, four additional purse seine vessels were introduced into the national fleet while the longline fleet remained at four vessels.

89. During 2010, estimated total catch of the RMI's purse seine fleet operating throughout the Western and Central Pacific Ocean (WCPO) was just over 56,800 t, an increase of around 24% compared to the previous year although the new vessels only entered the fishery during the second half of the year. Furthermore, provisional estimates from the national longline fleet which fished primarily in the RMI EEZ indicate just under 450 t of catch.

90. Overall catch estimates from licensed foreign fleets operating in the RMI EEZ in 2010 amounted to just over 25,400 t with 69% of the catch attributed to the purse seine fleets and a majority of the catch comprising of skipjack tuna. Unfortunately, there has been no observer coverage on longline vessels since the 100% purse seine coverage came into effect. There is, however, an observer training scheduled for late 2011 that will hopefully reverse the situation. RMI observers did manage to undertake 176 trips totalling around 5,268 sea days on both national and sub-regional trips.

Samoa

91. Samoa's tuna fishery is comprised of the troll fishery and the longline fishery. Both fisheries operate within Samoa's Exclusive Economic Zone (EEZ) of approximately 120,000 km2, and involve vessels raging from nine meters to over 20 meters in length. Over 103 MT of Skipjack was landed from the troll fishery in 2010, an increase of over 21% from the 85 MT landed in 2009. Yellowfin tuna constitute around 10% of the troll catch which is a slight increase from the 2009 catch. Other pelagic species including dolphin fish, barracuda, kawakawa and rainbow runner are also caught by the troll fishery, but to a lesser amount, making up the rest of the 2010 troll catch.

92. A decline of over 10% in albacore catches was observed from the longline fishing fleet in 2010 compared to the amount caught in 2009. An estimated 7 MT of swordfish was landed in 2010, the highest recorded over the past six years. Yellowfin, Bigeye and Skipjack tuna all show decreasing catches in 2010 relative to 2009 catches. The increase in the number of troll fishing vessels is mostly attributed to the number of new alia fishing vessels that were constructed and distributed to affected areas in the September 2009 Tsunami. An increase in the number of longline vessels was observed in 2010 from

2009. This increase is mainly attributed to the increase in the number of alia fishing vessels participating in the fishery which in previous years were either engaged in full time bottom fishing or trolling, or were out of operations.

93. Samoa is in the final process of developing its sea turtle and shark plans. Both of these plans are scheduled to be approved in 2011. Port sampling activities and catch logsheet continue to provide the main data for the estimation of annual catches and effort levels for the domestic longline fleet.

Senegal

94. NO SUMMARY AVAILABLE/PROVIDED

Solomon Islands

95. The tuna fishery of Solomon Islands is very important as it contributes significantly towards the national economy as well as the social wellbeing of the people. However management of the fishery is quite complex as it consists of various fleets with diverse gear and vessel sizes, as well as the multi species. In 2010 more than 400 vessels were licensed to operate in Solomon Islands EEZ. These include 180 purse seine, 216 tuna longlines, 13 shark longlines, and 16 pole and line vessels. The fleet composition is dominated by the foreign fleets which operate more than 98.6% of the vessels and the domestic fleet with only 1.4%.

96. The provisional total annual catch estimates within the Solomon Islands EEZ for 2010 is approximately 128,842 t, with skipjack dominating the catch with about 95,229t followed by yellowfin tuna with 23,136t, albacore with 6,357t and bigeye tuna with 2,140t. From the total catch estimated, more than 89% were landed outside of Solomon Islands and approximately 11% landed locally. The Government of Solomon Islands is trying to turn this figure around by encouraging investors to invest more in the value adding and processing sector. As such the Government has taken the initiative by acquiring 2 proposed processing sites on Guadalcanal, and 1 on Malaita. The Government recognizes that the economic and social benefits for the people of Solomon Islands could be maximised if a larger proportion of the catch is processed locally.

Thailand

97. NO SUMMARY AVAILABLE/PROVIDED

Tokelau

98. NO SUMMARY AVAILABLE/PROVIDED

Tonga

99. Tongan commercial fisheries for highly migratory species continued its operation with only a longline fleet in 2010, as in previous years. However, the fishery continued to be affected by various factors, particularly economic problems impacting fishing companies. In 2010, only 5 fishing vessels had valid licenses to fish in the Tonga EEZ, compared to 7 vessels in 2009. Tonga has continued to operate its tuna fishery with a full domestic longline fleet since 2005 and mainly operates within Tonga's EEZ, but sometimes extends to the high seas south of Tonga.

100. The tuna fishery total catch in quantity and value for 2010 further declined from 2009 and became the lowest in the history of this fishery in Tonga, peaking over the last 5 years in 2007. The

continuous annual reduction in the tuna fishery production is due to various reasons including, a considerable reduction in fishing effort (no. of hooks) by 83.8 % compared to 2007. This is consistent with the decline in the number of active fishing vessels. The decline in catches is also attributed to the opening of the beche de mer fishery in 2008 in which some tuna fishing companies switched to beche de mer fishery. Furthermore, the variations in environmental and oceanographic conditions have had significant impacts on the fishery too.

101. For the five year up to 2008, the total catch rates (CPUE) for the fishery continued increasing and then declined in 2009 and again in 2010. It is evident that the trend for the total CPUE was attributed to the decline in the CPUEs for albacore and yellowfin for the last 3 years. Albacore maintained the highest percentage composition in the total catch of 2010 with high percentage of yellowfin and bigeye. Catch composition indicated that most longline vessels and the structure of the fleet were targeting bigeye and yellowfin tuna for fresh fish market with a high proportion of albacore tuna. Dolphinfish and moon fish dominated the bycatch composition. From observer reports, the Tonga tuna fishery has no impact on species of special conservation interest (e.g. turtle, marine mammals and birds).

102. Tonga Fisheries Division continued to work closely with the Offshore Fisheries Program (OFP) of SPC on issues regarding the status of tuna resources in the Tonga EEZ relative to the whole stock in the Western and Central Pacific Ocean (WCPO). The total tuna harvested by the Tongan fleet in 2010 was still too insignificant to pose any major impact on the whole stock in the region and the WCPO. Despite the ample room for improvement and development of tuna fleet in Tonga, high operation costs have restricted the operation of fishing vessels mainly to areas near the main fishing port, Nuku'alofa.

103. The Tonga research program for tuna, such as data collection and observer deployment has continued in 2010 with great improvement. The port sampling coverage increased from 86 % in 2009 to 91 % in 2010 and the observer coverage remained at 12 % as in 2009. At the same time, measures and resolutions of the Commission are being implemented and monitored by Tonga Fisheries.

Chinese Taipei

104. There are 3 Taiwanese tuna fishing fleets operating in WCPFC Convention Area: large scale tuna longline fleet (LTLL, previous named FTLL), distant-water purse seine fleet (DWPS) and small scale tuna longline fleet (STLL, previous named CTLL). In 2010, total catches of the main tuna and tuna-like species for these 3 fleets were 24,246 t for LTLL, 198,851 t for DWPS and 45,783 t for STLL, respectively. In 2010, 31 observers (including 25 on LTLL vessels and 6 on DWPS vessels) were deployed in the Pacific Ocean.

Tuvalu

105. 2010 has been a good year with respect to the development and review of national fisheries policies and legislation, with a small increase in investment through licensing and thereby revenues earned and an expansion of the domestic fleet. Key trends of tuna fisheries in Tuvalu for 2010: (i) Increased number of Tuvalu flag vessels from 1 to 3; (ii) Purse seine effort by the national fleet has doubled and so has the catch in 2010 relative to 2009; (iii) Skipjack dominate purse seine catches followed by yellowfin tuna (iv) Tuvalu's two flag longline vessels commenced operations at the end of the first quarter in 2010, and fishing occurred mainly in areas outside Tuvalu's EEZ; (v) Longline efforts and catches decreased for longline activities in 2010 in Tuvalu's EEZ; (vi) Record high numbers of fishing licenses issued for purse seine, longline and pole and line for 2010; (vii) Pole and line activities were lowest in 2010; (viii) Artisanal catches showed improvements in 2010 with yellowfin dominating.

106. There remain challenges with respect to having sufficient resources to ensure the implementation of data collection, management, analyses and reporting. Furthermore, logsheet reporting and reporting from Tuvalu licensed fishing vessels remains poor; while, observer coverage and VMS reporting appears to be making good progress. Tuvalu intends to seek direct budgetary support from the government's national budget, or if that is unsuccessful, seek alternative funding support from elsewhere. That said, Tuvalu has benefitted from routine assistance from SPC and FFA with respect to an update of the TUFMAN dbase and with ongoing training of local staff in data management and the maintenance of a national database.

USA

107. Large-scale fisheries of the United States and its Participating Territories for highly migratory species (HMS) in the Pacific Ocean include purse seine fisheries for skipjack tuna (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*); longline fisheries for bigeye tuna (*Thunnus obesus*), swordfish (*Xiphias gladius*), albacore(*Thunnus alalunga*), and associated species; and a troll fishery for albacore. Small-scale fisheries include troll fisheries for a wide variety of tropical tunas and associated species, handline fisheries for yellowfin and bigeye tuna, a pole-and-line fishery for skipjack tuna, and miscellaneous-gear fisheries. Associated species include other tunas and billfishes, mahi-mahi (*Coryphaena hippurus*), and wahoo (*Acanthocybium solandri*). The large-scale fisheries operate on the high seas, within the U.S. exclusive economic zone (EEZ), and within the EEZs of other nations. The small-scale fisheries operate in nearshore waters off Hawaii and the U.S. Territories of American Samoa and Guam, and the Commonwealth of the Northern Mariana Islands (CNMI).

108. Overall trends in total landings by U.S. and U.S. associated-Participating Territory fisheries in the Western and Central Pacific Fisheries Commission (WCPFC) statistical area in 2010 are dominated by the catch of the purse seine fishery. Preliminary 2010 purse seine estimates total 215,587 t of skipjack, 25,686 t of yellowfin, and 4,251 t of bigeye tuna. U.S. purse seine landings in 2009 have been revised upwards to 283,219 t from last year's preliminary estimate. Longline landings in 2010 decreased after peaking in 2007. Bigeye tuna and albacore landings by longliners declined from record highs in 2007 to 4,067 t and 4,273, respectively, in 2010. Excluding landings by the U.S. Participating Territories (i.e., American Samoa), longline landings of bigeye tuna declined to 3,576 t in 2010 from 5,381 t in 2007. These bigeye tuna landings by the U.S. longline fishery in the North Pacific Ocean were in 2009 and 2010 below the limit of 3,763 t established in U.S. fishery regulations (74 FR 63999, December 7, 2009) pursuant to the provisions of CMM 2008-01. Longline landings of swordfish in the North Pacific Ocean decreased to 1,022 t in 2010, down from their peak of 1,428 t in 2007.Small-scale (tropical) trollers and handliners operating in nearshore waters represented the largest number of U.S. flagged vessels but contributed only a small fraction of the landings. The longline fleet was the next largest fleet, numbering 147 in 2010, while there were 37 purse seine vessels.

109. The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries Service) conducted a wide range of research on Pacific tuna and associated species at its Southwest and Pacific Islands Fisheries Science Centers and in collaboration with scientists from other organizations. NOAA Fisheries conducts fishery monitoring and socio-cultural research on tunas, billfishes, and animals caught as bycatch in those fisheries. In 2010, the International Billfish Angler Survey continued to provide fishery-independent information on billfish catch and angler effort in a variety of recreational fisheries across the Pacific. Shark CPUE in the Hawaii-based longline fishery was summarized from observer data. Socioeconomic studies included market impact of longline bigeye closure, consumer preference surveys, catch shares economics, and analyses of time-area closures in the longline fishery. Stock assessment research was conducted almost entirely in collaboration with members of the WCPFC and the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC).

110. The stock assessment work is not described in this report (Brodziak and Ishimura, 2010, 2011; Brodziak and Piner, 2010; Lee et al., 2011). NOAA Fisheries biological and oceanographic research on tunas, billfishes, and sharks addressed fish movements, habitat preferences, post-release survival, feeding habits, abundance, maturity, and age and growth. Research on north Pacific albacore focused on otolith analysis for age and growth, and archival tagging for migration and stock structure. Tagging projects also continued for billfish, sharks, and bigeye tuna. Bycatch mitigation studies in the longline and gillnet fisheries focused on sea turtles, pelagic sharks, and false killer whales.

Vanuatu

111. Vanuatu is a member of the regional fisheries management organizations (RFMOs) such as IATTC, ICCAT, IOTC and the WCPFC. The membership of Vanuatu in these RFMOs has enabled Vanuatu's fishing fleet to fish these RFMOs' waters for tuna and other highly migratory fish species. The Vanuatu fleet comprises 18 purse seiners and 76 long-liner fishing vessels. Catch and Effort coverage for the Vanuatu fleet has been good but the size data coverage is uncertain due to a lack of observers on board vessels, particularly the distant long-liners, and also due to a lack of unloading data sought from the landing ports.

112. In the Vanuatu EEZ the only foreign fleet with high catch and effort data coverage is the Taiwan fleet. Catch estimates for Vanuatu EEZ acquired from SPC have shown that less fish was caught in 2008 and 2010 which may have been due to climate effects. In the period 2006 – 2010 the annual catch estimates of the Vanuatu fleet active in WCPFC have generally been stable as was the fishing effort (sets) and the number of fish per 100 hooks, whereas for the purse seiners, there were more sets on unassociated than associated schools. The purse seine fleet's total catches have declined from 37,907t in 2009 to 23,721 in 2010, comprising 93% skipjack, 7% yellowfin and 0.2 % bigeye. Unraised and provisional 2010 data show that catches of all major tuna species have increased to around 15,092 t of skipjack, 871 t yellowfin and 35 t of bigeye harvested. Some of these purse seine vessels fished under the FSM Arrangement 'home party' criteria as Papua New Guinea, and therefore may have been included in the PNG-fleet catch statistics. The major tuna species in the longline fleet catch was dominated by albacore (50%), then yellowfin (14%). Unraised and provisional estimates for the longline fleet in 2010 were 6,071t, 985t and 402t for albacore, bigeye and yellowfin respectively but if raised they could be higher.

113. Data for the Vanuatu EEZ were based on unraised logsheet data. Fishing in the Vanuatu EEZ was conducted by foreign fleets from China, Fiji, and Taiwan. The number of Taiwanese vessels has dropped but the Chinese and Fiji fleets have increased rapidly, based on the number of license issued in 2009-2010. In 2009 Vanuatu had a 100% Observer coverage for the locally based foreign fishing vessels and 100% port sampling during port unloading and transhipments.

114. The Vanuatu observer progamme started in 2008 up until now when we have 100% observer coverage for the locally based Foreign Fishing Vessel together with 100% sampling operation during unloading and transhipments in port. There have been 18 transhipments in port since 2008.

Vietnam

115. There are three main fisheries in Vietnam targeting tuna species and tuna-like species. These fisheries are tuna longline, gillnet and purse seine fisheries which are mostly catching bigeye, yellowfin and skipjack tuna species in the Vietnamese water. Over the past some years, data collection system for Vietnamese tuna fisheries was insufficient and thus total catches of tuna and other related species were not available. However, since 2010 under the framework of

West Pacific East Asia Oceanic Fisheries Management project (WPEA OFM) funded by GEF throughout WCPFC as an executive implementation, tuna longline fishery data collection systems have been developed and implemented at three main provinces of Vietnam (Binh Dinh, Phu Yen and Khanh Hoa) since July 2010. Total longline vessels estimated were around 1000 units and these vessels creating annual total catch for bigeye and yellowfin tuna species was around more than 11,000 tons in 2010.

116. Moreover, observer trips in the tuna longline vessels have been carried out in 2010 with budget of both WPEA OFM and WWF-Vietnam. The main aims of these observer trips are to provide scientific data for stock assessment and trials for replacement of "J" hooks into the circle hooks. A total of 12 observer trips have been conducted in 2010 that initially provided useful scientific data sources for cross-checking with collected data under WPEA OFM project.

117. In 2010, Vietnamese Government has also paid more attentions on assessment and management of tuna fisheries in Vietnam. Under these considerations, Ministry of Agriculture and Rural Development has allocated a project to investigate and assess marine resources in Vietnamese waters (a 5 year-project). The project will be implemented from 2011 with high priority of the first year is to assess large pelagic species especially tuna and tuna-like species. Tuna fisheries data and information will also be collected using both fisheries independent and dependent data in the framework of this project.

Wallis and Futuna

118. NO SUMMARY AVAILABLE/PROVIDED

Discussion

119. The following discussions and clarifications were offered during the presentation of national reports.

120. Concern was expressed over the failure of the EU to report operational longline data for its fleet operating in the WCPO.

121. In response to an enquiry as to why New Zealand was concerned over the status of their domestic yellowfin fishery, New Zealand indicated that recent data from their domestic recreational and commercial longline fisheries indicates that recent yellowfin catches have declined consistently since 2001 and are at historic lows. New Zealand is concerned that this may be due to potential range contraction of the yellowfin stock or due to the high level of regional fishing effort to the north and east of New Zealand. Australia noted that in contrast to this trend in New Zealand, the year 2011 is proving to be an exceptional catch year for yellowfin tuna off its east coast.

122. In response to an enquiry, New Zealand also indicated that its longline fishery takes a very small bycatch of Pacific Bluefin tuna and they have a small recreational fishery for that species. They indicated that some Pacific Bluefin size data is available from these fisheries.

123. A concern was raised that the recent observer coverage of 3.6% in Australia's Eastern Tuna and Billfish Fishery (ETBF) would make the estimation of turtle interactions highly uncertain. Australia acknowledged this problem and indicated that they are actively investigating potential solutions including

the use of onboard mounted cameras as a means to collect much of the same data currently collected by observers. Australia noted that as envisaged under the ETBF sea turtle mitigation plan approved by WCPFC6, a working group was formed to further consider turtle interactions in that fishery. Approximately AUD 25,000 was used to provide additional turtle release equipment to longline fishers.

2.4 Reports from regional fisheries bodies and other organizations

124. There were no reports provided by regional fisheries bodies or other organisations

AGENDA ITEM 3 - STOCK ASSESSMENT THEME

125. N. Miyabe (Japan) and J. Brodziak (USA) served as conveners of the theme, with S. Harley, S. Bishop, S. Nicol, H. Kiyofuji, T. Lawson, S. Teo, P. Dalzell, D. Itano, D. Bromhead, T. Beeching and H. Kiyofuji serving as rapporteurs.

3.1 WCPO bigeye tuna

126. Two Working Papers addressed the review of Project 35 (WCPFC-SC7-SA-WP-01) and bigeye tuna stock assessment (SC7-SA-WP-02).

3.1.1 Review of research and information

a. Review of Project 35

127. S. Nicol (SPC) presented ―Bigeye tuna age, growth and reproductive biology (Project 35) , Revision.1 (WCPFC-SC7-SA-WP-01), which reported on the completion of Project 35, a two-year pilot study in "Region 3" of the WCPO stock assessment for bigeye tuna to determine the sampling requirements for the implementation of Pacific-wide bigeye age, growth and reproductive biology project in the WCPO.

128. The study collected 282 gonads and 313 otoliths. Matching gonads and otoliths were only collected for 120 individuals. The maturity ogive for females was estimated from 100 gonads. The estimated length at 50% maturity was 105.9 cm which was consistent with other estimates of the female maturity ogive from the WCPO. The inclusion of the maturity ogive in the 2011 assessment model for bigeye altered the $SB_{current}/SB_{MSY}$ by 4% and the $F_{current}/F_{MSY}$ by 2%. The results of the pilot study suggest that variation in the maturity ogive may have greater influence on a Pacific wide assessment of bigeye than it has on the WCPO assessment. Greater priority towards understanding variation at the ocean basin scale rather than within the regions of the WCPO was recommended.

129. A comparison of daily and annual ageing techniques for bigeye tuna indicated that annual ageing methods are appropriate however additional validation of methods should be included in future studies. Variation in growth was detected between regions using growth curves derived from otoliths and MULTIFAN-CL. The inclusion of the growth curve in the 2011 assessment model for bigeye altered the $SB_{current}/SB_{MSY}$ by 38% and the $F_{current}/F_{MSY}$ by 26%. The implementation of the age and growth component for the full pacific wide study was recommended as a higher priority than the reproductive biology component. To implement the Pacific-wide study on age and growth a minimum sample size of approximately 2500 otoliths is required collected from 8 strata of 32° longitude x 20° latitude (approx. 300 per strata).

130. Training modules and standards have been developed and implemented within the PIRFO observer programs providing the capacity for observer based collection of biological samples across all fisheries in the WCPO. Collection of otoliths from fresh-fish longline vessels is likely to be restricted to sampling at ports. Coordination between observers, vessels, agents and processing facilities to allow otoliths to be matched with the gonads, fishing and sample details of the individual. In addition to the collection of samples by observers a budget of approximately USD90,000 per year for 3 years would be required to implement the full study.

Discussion

131. The SC noted the importance of research into the life history characteristics of tuna, in particular bigeye tuna given its current stock status. The SC noted with appreciation the contribution of such a wide range of organizations, including industry, in the successful implementation of the pilot study and also the active contribution of three Pacific Island scientists in the research project. It was considered that the effective inclusion of scientists from within the region in this project should be encouraged in the development of future research into tunas.

132. The results of the research presented were consistent with findings from IATTC assessments that the stock assessment results can be sensitive to assumed biological parameters, in particular growth, but also maturity profiles. The SC noted that comparisons between the maturity results of the pilot study and other studies needed to carefully consider the methodologies used in the studies.

133. There was general support for continuation of this work and the SC provided the following guidance for project design:

- that there should be an emphasis on the central equatorial region (150W – 170 W) for future sampling, but that sampling across the WCPO (30N – 30S) should be done;
- for this central equatorial region, there may be some value in collecting additional samples for maturity studies, but that up to 300 samples might be needed;
- consideration be given to a simulation-based approach to get a better understanding of the potential impact of regional patterns in growth and implications for stock status; and
- the importance of providing training to fishery observers on the collection of biological samples; and a detailed breakdown of the proposed budget should be given to allow the cost of particular activities and sampling in particular areas.

134. The SC requested that SPC include the new ageing estimates in the assessment figures that compare estimated growth with tagging and direct ageing data.

b. Review of 2011 stock assessment

Summary of SC7-SA-WP-02 (Stock assessment of bigeye tuna in the western and central Pacific Ocean)

135. N. Davies (SPC) presented "Stock assessment of bigeye tuna in the WCPO". The excerpts from the Executive Summary of this paper are provided below as are several figures and tables regarding stock status that reflect the model runs selected by SC for the determination of current stock status and the provision of management advice.

136. This paper presented the 2011 assessment of bigeye tuna in the WCPO. This assessment is supported by several other analyses which are documented separately, but should be considered when reviewing this assessment as they underpin many of the fundamental inputs to the models. These include

evaluation of paired spill / grab sample trials leading to observer-based species composition estimates with spill sampling correction for purse seine catch histories and size compositions (Lawson 2011; Lawson and Sharples 2011), reviews of the catch statistics of the component fisheries (Williams 2011; Williams and Terawasi 2011), standardised CPUE analyses of operational level Japanese longline catch and effort data (Hoyle & Okamoto 2011), standardised CPUE analyses of Taiwanese longline CPUE (Chang et al. 2011), an analysis of tag reporting rates for the RTTP and PTTP programs (Hoyle 2011), and the guidance of the Pre-Assessment Workshop held in April, 2011 (SPC 2011).

137. The assessment includes a series of model runs describing stepwise changes from the 2010 assessment (run 3d) to develop a new ―reference case model (Run3j – Ref.case) and then a series of ―one-off sensitivity models that represent a single change from the Ref.case model run. A sub-set of key model runs was taken from the sensitivities that represent a set of plausible model runs and were included in a structural uncertainty analysis (grid) for consideration in developing management advice.

138. Besides updating the input data, the main developments to the inputs compared to the 2010 assessment were: including tagging data from the 2007-2010 PTTP program; standardised CPUE time series derived from operational-level catch-effort data for Japanese longline fisheries; weighting the Japanese longline size frequency data according to the estimated population relative abundance within regions; adjusting purse seine size frequency data using spill-samples to correct for grab-sample bias; and, including more reliable size composition data for Philippines and Indonesian domestic purse seine catches in offshore waters. The main developments to model structural assumptions were to define a separate Indonesian Philippines-based domestic purse seine fishery that operates beyond the national archipelagic waters and to the east of 125° E longitude.

139. During the Pre-Assessment Workshop held in April 2011 (PAW, SPC 2011), the key assumptions from the ―base case‖ model from the 2010 assessment were reviewed in light of the developments proposed for the Ref.case model for the 2011 assessment. These and the alternative assumptions in the other key model runs are provided below:

Component	2010 assessment (run 3d)	2011 assessment (run 3j)	2011 alternatives
Longline CPUE	Aggregate indices	Operational indices, temporal weighting of standardised effort	- Exclude all CPUE prior to 1975 - Aggregate indices
Steepness	Estimated	Fixed = 0.8	0.65, 0.95, and estimated
Purse-seine catches	Spill sample corrected	Spill sample corrected (including size data)	Grab sample (SBEST)
Tagging data	Excluded PTTP	Included PTTP	Exclude PTTP
Longline size data	Down-weighted	Full weight	Down -weighted
Natural mortality	Base	Base	Increased for juveniles

140. In comparing the 2011 Ref.case model results with the 2010 assessment, the decision to fix steepness at a more plausible value (0.8) to that estimated in recent assessments must be considered. Whereas, the Ref.case estimates of stock status are not dissimilar from the 2010 base case estimates, the 2011 model most comparable to an update of the 2010 base case was Run15 in which steepness was estimated, and which provided a more optimistic stock status. This difference indicates the effects of the new inputs (in particular the operational CPUE indices). If one compares $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ between a straight-forward update of the 2010 model (Run2b) and Run15, the values are 1.49 and 1.33 versus 1.13 and 1.54, respectively.

141. The main conclusions of the current assessment (based upon the median of the uncertainty grid estimates, and the sensitivity model runs) are as follows:

a) The estimated increasing trend in recruitment from recent bigeye assessments appears to have been addressed to a small extent in the current assessment, but remains an issue in region 3 and is primarily the result of conflict (disagreement) among the various data sources, in particular between the longline CPUE indices and the reported catch histories, and between and within some of the size composition data sets. The current assessment has indentified some of these conflicts and includes some model runs that begin to address them.

b) As in previous assessments, recruitment in almost all models is estimated to have been high during 1995–2005. As suggested in the 2010 assessment, an analysis is presented that estimates the stock-recruitment relationship (with steepness fixed) for this latter period and applied it in the yield analyses. If one considers the recruitment estimates in the second half of the time series to be more plausible and representative of the overall productivity of the bigeye stock, the results of this analysis (Run21) could be used for formulating management advice. In this case $F_{current}/F_{MSY}$ was 1.58 and $SB_{current}/SB_{MSY}$ was 0.61 indicating that we would conclude that the stock is overfished and overfishing is occurring under this productivity assumption. The main reason for the much lower estimate of $SB_{current}/SB_{MSY}$ is that SB_{MSY} is approximately doubled because of the higher levels of recruitment being used to estimate it.

c) Total and spawning biomass for the WCPO are estimated to have declined to about half of their initial levels by the mid-1970s, with total biomass remaining relatively constant since then ($B_{current}/B_0$ = 44%), while spawning biomass has continued to decline ($SB_{current}/SB_0$=35%). Declines are larger for models that exclude the early periods of the CPUE time series.

d) When the non-equilibrium nature of recent recruitment is taken into account, we can estimate the level of depletion that has occurred. It is estimated that spawning potential is at 26% of the level predicted to exist in the absence of fishing considering the average over the period 2006-09, and that value is reduced to 23% for the 2010 spawning potential levels.

e) The attribution of depletion to various fisheries or groups of fisheries indicates that the purse seine and other surface fisheries have an equal or greater impact than longline fisheries on the current biomass. The purse seine and Philippines/Indonesian domestic fisheries also have substantial impact in region 3 and to a lesser extent in region 4. The Japanese coastal pole-and-line and purse-seine fisheries are also having a significant impact in their home region (region 1). For the sensitivity analysis with lower purse seine catches, the longline fisheries are estimated to have a higher impact.

f) Recent catches are well above the *MSY* level of 74,993 mt, but this is mostly due to a combination of above average recruitment and high fishing mortality. When *MSY* is re-calculated assuming recent recruitment levels and recent mix of fisheries persist, catches are still around 7% higher than the re-calculated *MSY* (131,400 mt). **Based on these results, we conclude that current levels of catch are unlikely to be sustainable in the long term even at the recent [high] levels of recruitment estimated for the last two decades**.

g) Fishing mortality for adult and juvenile bigeye tuna is estimated to have increased continuously since the beginning of industrial tuna fishing. For all of the model runs $F_{current}/F_{MSY}$ is considerably greater than 1. For the grid median, the ratio is estimated at 1.42 indicating that a 30% reduction in fishing mortality is required from the 2006-09 level to reduce fishing mortality to sustainable levels. Using the Ref.case, if we consider historical levels of fishing mortality, a 39% reduction in fishing mortality from 2004 levels is required, and a 28% reduction from average 2001-04 levels. Larger reductions in fishing mortality are indicated when lower values of steepness are assumed. **Based on these results, we conclude that overfishing is occurring in the bigeye tuna stock**.

h) The reference points that predict the status of the stock under equilibrium conditions are $B_{F_{current}}/B_{MSY}$ and $SB_{F_{current}}/SB_{MSY}$. The model predicts that biomass would be reduced to 65% and 60% of the level that supports *MSY*. In terms of the reduction against virgin biomass the declines reach as low as 15% of spawning potential. Current stock status compared to these reference points indicate the current total and spawning biomass are higher than the associated MSY levels ($\frac{B_{current}}{B_{MSY}} = 1.34$ and $\frac{SB_{current}}{SB_{MSY}} = 1.37$). The structural uncertainty analysis indicates a 13% probability that $SB_{current} < SB_{MSY}$. **Based on these results above, and the recent trend in spawning biomass, we conclude that bigeye tuna is approaching an overfished state. We note however, that if recent recruitment is assumed to represent the true productivity of the bigeye stock (Run21), then the higher levels of B_{MSY} and SB_{MSY} implied would mean that bigeye tuna is already in an overfished state ($B_{current}/B_{MSY}$ = 0.67 and $SB_{current}/SB_{MSY}$ 0.61).**

i) Analysis of current levels of fishing mortality and historical patterns in the mix of fishing gears indicates that MSY has been reduced to less than half its levels prior to 1970 through harvest of small juveniles. Because of that and overfishing, considerable potential yield from the bigeye tuna stock is being lost. **Based on these results, we conclude that MSY levels would rise if mortality of small fish was reduced, which would allow greater overall yields to be sustainably obtained.**

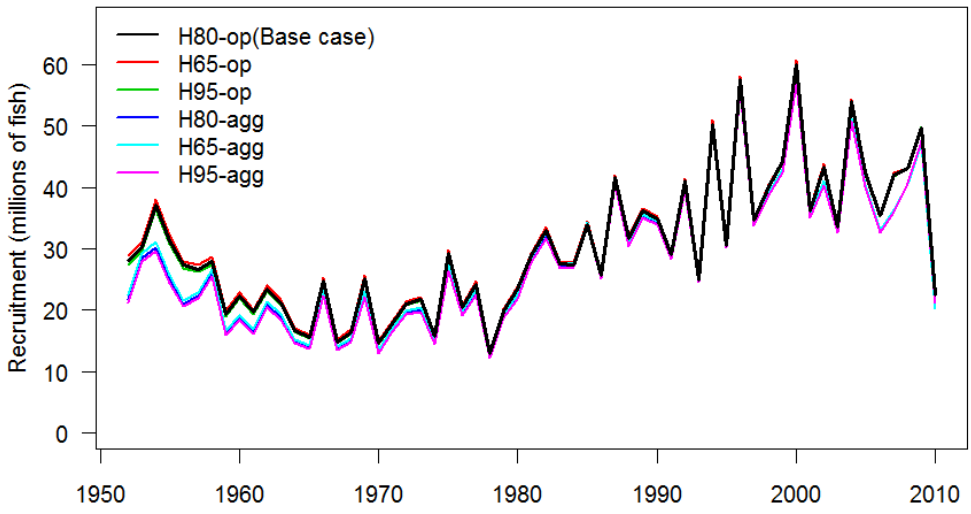

Figure BET1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the base case model (run 3j – H80-opp (black line)) and the five combinations of steepness and longline CPUE series.

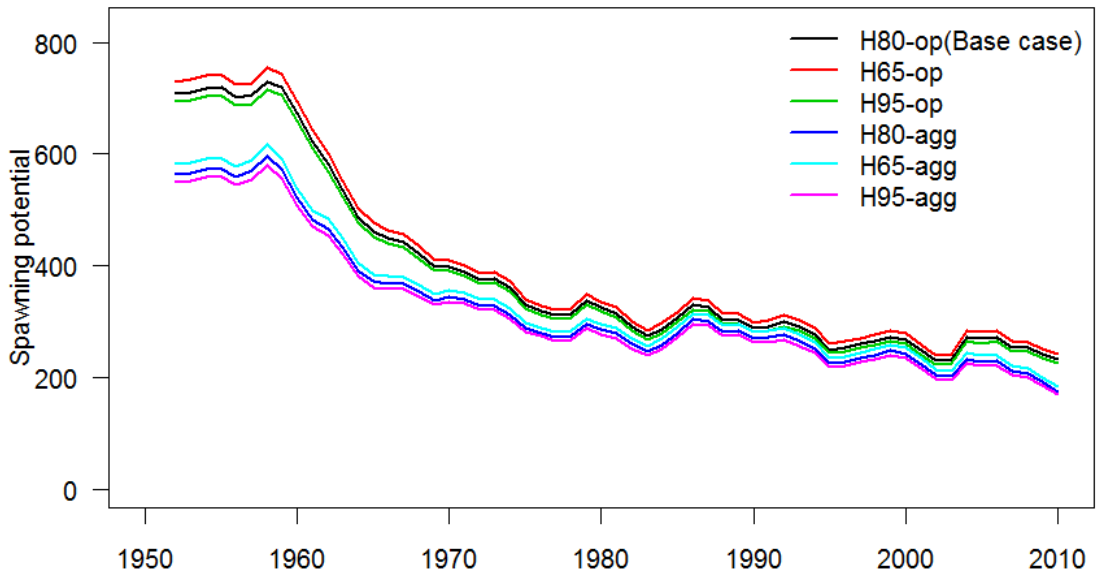

Figure BET2: Estimated average annual average spawning potential for the WCPO obtained from the base case model (run 3j – H80-opp (black line)) and the five combinations of steepness and longline CPUE series.

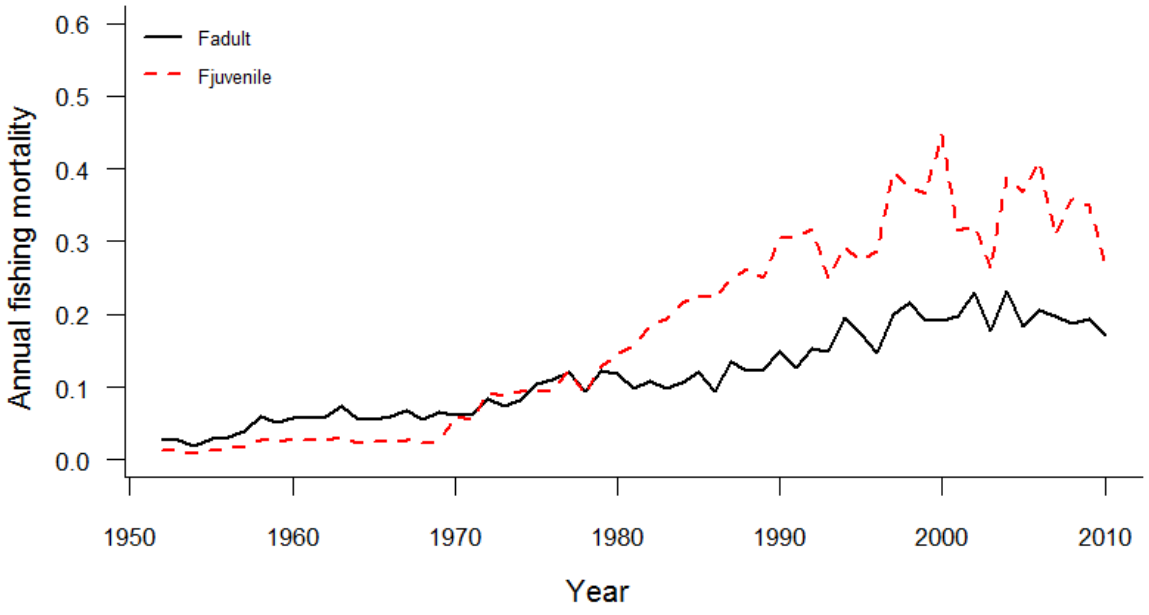

Figure BET3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the base case model (run 3j - H80-op).

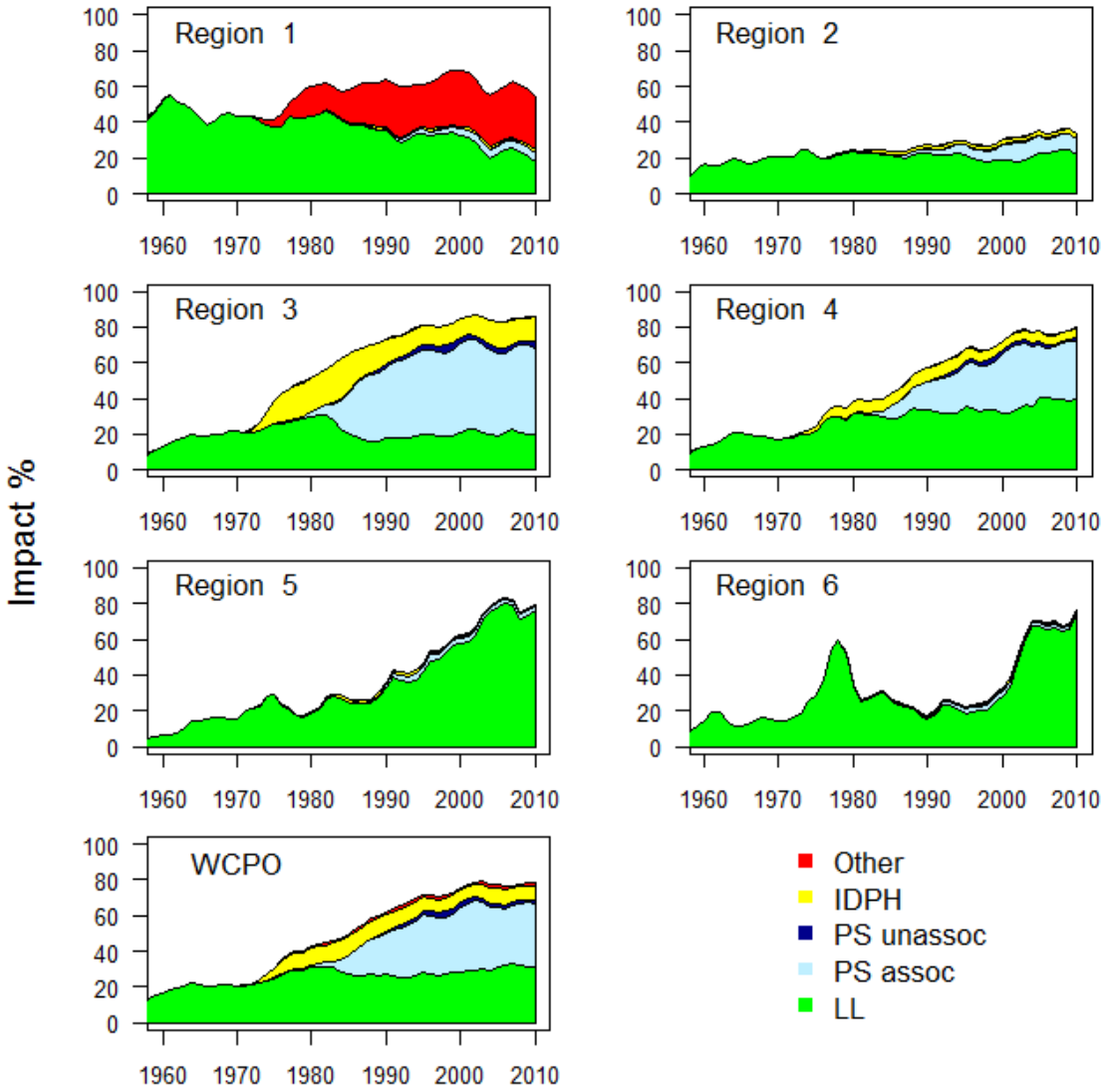

Figure BET4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) by region and for the WCPO attributed to various fishery groups (base case model). LL = all longline fisheries; IDPH = Philippines and Indonesian domestic fisheries; PS assoc = purse-seine log and FAD sets; PS unassoc = purse-seine school sets; Other = pole-and-line fisheries and coastal Japan purse-seine.

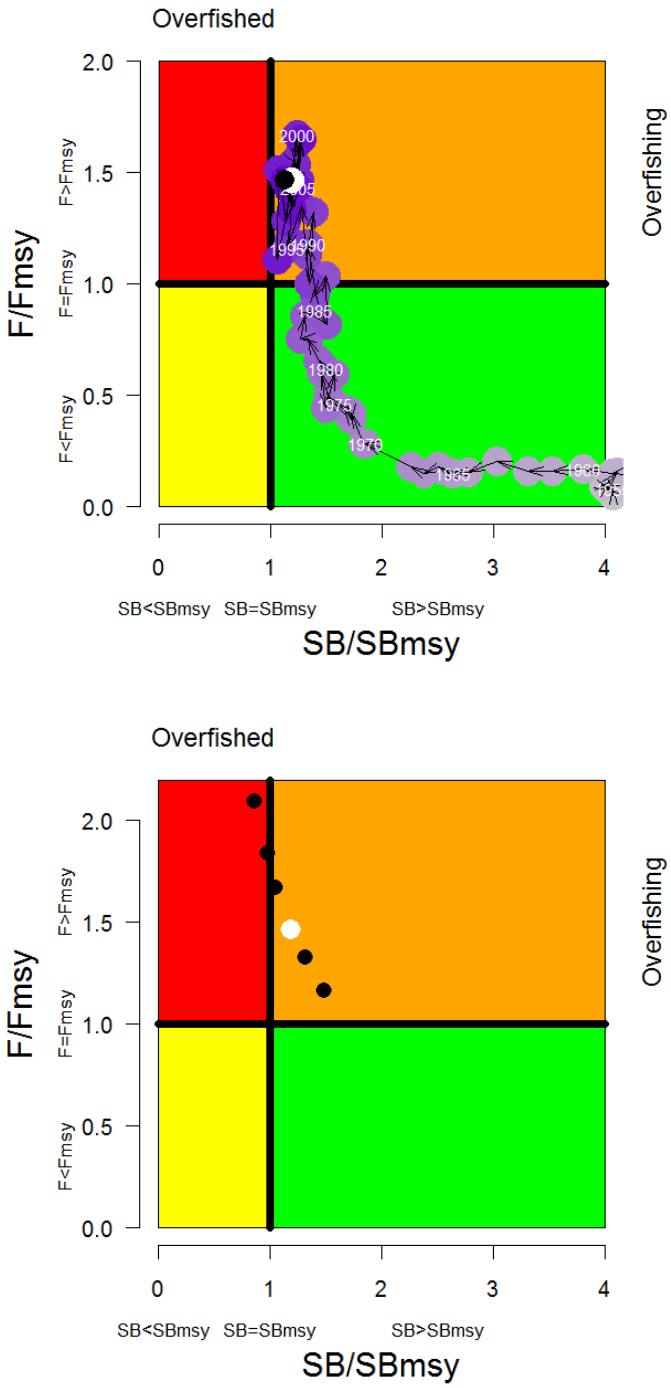

Figure BET5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the base case (top) and $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for the base case (white circle) and the five combinations of steepness and longline CPUE series. See Table BET1 to determine the individual model runs.

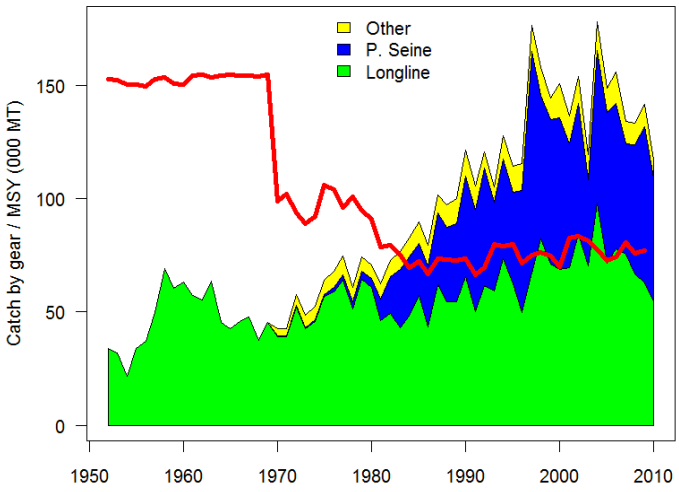

Figure BET6: History of annual estimates of MSY compared with catches of three major fisheries sectors. Declining MSY results from the change in selectivity of fishing gear and increases in catches of small bigeye.

Table BET1. Estimates of management quantities for selected stock assessment models from the 2011 base case model (run 3j – H80-op) and the five combinations of steepness and longline CPUE series. For the purpose of this assessment, "current" is the average over the period 2006–2009 and "latest" is 2010.

	H80-op (Base case)	H65-op	H95-op	H80-agg	H65-agg	H95-agg
$C_{current}$	141,160	141,365	141,029	141,561	141,805	141,356
C_{latest}	116,868	117,118	116,712	117,558	117,843	117,320
MSY	76,760	70,080	83,720	74,120	68,360	80,360
$C_{current}/MSY$	1.84	2.02	1.68	1.91	2.07	1.76
C_{latest}/MSY	1.52	1.67	1.39	1.59	1.72	1.46
F_{mult}	0.68	0.54	0.86	0.60	0.48	0.75
$F_{current}/F_{MSY}$	1.46	1.84	1.16	1.67	2.10	1.33
SB_0	739,900	810,000	698,500	688,400	762,000	644,200
SB_{MSY}/SB_0	0.29	0.33	0.24	0.29	0.33	0.24
$SB_{current}/SB_0$	0.35	0.33	0.36	0.30	0.29	0.32
SB_{latest}/SB_0	0.31	0.30	0.32	0.26	0.24	0.26
$SB_{current}/SB_{MSY}$	1.19	0.98	1.49	1.05	0.86	1.32
SB_{latest}/SB_{MSY}	1.08	0.89	1.36	0.88	0.72	1.10
$SB_{curr}/SB_{curr_{F=0}}$	0.23	0.23	0.22	0.20	0.20	0.19
$SB_{latest}/SB_{latest_{F=0}}$	0.21	0.22	0.21	0.17	0.18	0.17
Steepness (h)	0.80	0.65	0.95	0.80	0.65	0.95

Table BET2. Comparison of WCPO bigeye tuna reference points from the 2011 reference case model and the range of the six models in Table BET1; the 2010 base case model (steepness estimated as 0.98) - shown in parentheses is the alternative 2010 run (steepness assumed as 0.75); ranges of six sensitivity analyses in the 2009 assessment; and the base model and sensitivity analyses from the 2008 assessment.

Management quantity	**2011 assessment Base case (uncertainty)**	**2010 assessment Run3d (Run4b)**	**2009 Assessment**	**2008 Assessment**
Most recent catch	116,868 mt (2010)	126,769 mt (2009)	134,315 mt (2008)	143,059 mt (2007)
MSY	76,760 mt (68,360 – 83,720)	73,840 mt (65,640 mt)	Range: 52,120 ~ 67,800 mt	Base case: 64,600 mt Range: 56,800~65,520 mt
$F_{current}/F_{MSY}$	1.46 (1.16-2.10)	1.41 (1.97)	Range: 1.51 ~ 2.55	Base case: 1.44 Range: 1.33 ~ 2.09
$B_{current}/B_{MSY}$	1.25 (0.96-1.48)	1.39 (1.09)	Range: 1.11 ~ 1.55	Base case: 1.37 Range: 1.02 ~ 1.37
$SB_{current}/SB_{MSY}$	1.19 (0.86-1.49)	1.34 (0.97)	Range: 0.85 ~ 1.42	Base case: 1.19 Range: 0.76 ~ 1.20
$Y_{Fcurrent}/MSY$	0.89 (0.34-0.99)	0.94 (0.56)	Range: 0.12 ~ 0.92	Base case: 0.94 Range: 0.50 ~ 0.97
$B_{current}/B_{current,\ F=0}$	0.29 (0.25-0.30)	0.23 (0.24)	Range: 0.18 ~ 0.29	Base case: 0.26 Range: 0.20 ~ 0.28
$SB_{current}/SB_{current,\ F=0}$	0.23 (0.19-0.23)	0.17 (0.18)	Range 0.11 – 0.19	Not available

Discussion

142. The SC expressed its appreciation to the bigeye tuna assessment team for the 2011 stock assessment and then discussed several aspects of the assessment.

Input data

143. The SC noted several improvements in the inputs for the 2011 assessment, in particular the inclusion of longline indices based on operational level data from Japanese vessels, the PTTP tagging data and a revised approach for generating the longline size data represented improvements from the 2010 assessment.

144. The operational CPUE indices in particular had significant impact on the new assessment and the SC recognized the collaborative work between SPC and Japan and encouraged further analyses of these data. The SC noted that the revised indices separated the offshore and distant-water fleets, but that this separation was not possible for the early years in the series. Including additional years would allow a more full comparison between operational and aggregate data. It was also noted that there was a large spike in CPUE in the final time period for the region 2 indices which was based on very low levels of effort and was given low weight in the assessment.

145. The SC requested that future assessments provide tables of the estimated annual purse seine catches by species and estimation method - preferably separated for associated and unassociated sets.

146. SPC noted that with 100% observer coverage of the purse seine fleet that it should be possible to obtain improved estimates of purse seine discards (see ST-IP-01) which could be included in future stock assessments.

Recent patterns in fishing mortality

147. Most CCMs noted that the estimated fishing mortality for 2010, in particular that for juvenile bigeye tuna, declined in 2010 (Figure BET3). Other participants felt that these estimates were uncertain and therefore did not feel confident providing extra emphasis on them.

Biological inputs

148. There was discussion about the way in which the current assessment attempted to incorporate sex specific information from observed sex ratios in the natural mortality and maturity schedules. SPC explained that the current assumption was that trends in the sex ratio by length were driven by sex-specific differences in natural mortality related to the timing of maturity. The recent biological studies on southern albacore tuna suggested that growth can vary by sex in tunas and further investigation of sex-specific growth in tropical tunas is warranted to test this assumption. It was noted that this pattern will require further consideration of the mechanisms driving the strong patterns in sex ratios by length that are observed.

Impact of the operational CPUE indices

149. The SC noted that the new operational longline indices had a significant impact on the bigeye assessment with more optimistic stock status conclusions comparing to that derived from the index using aggregated longline data. There was considerable discussion as to the reasons for this difference.

150. SPC explained that the operational indices actually give a stronger decline in regions 3 and 4 than those estimated for the aggregate CPUE indices. Consequently, the more optimistic stock status conclusions may seem counter-intuitive. What was observed in the assessment was that the operational indices resulted in increased recruitment in the early part of the time series and the overall average recruitment level was increased. This higher recruitment resulted in a larger overall stock size and therefore lower fishing mortality (for the fixed catches).

Impact of recruitment trend on reference points

151. The SC noted that SPC had undertaken two model runs that provided different interpretations of the pattern of low recruitment from 1950-1990 and high recruitment in the past 20 years. Run 5 which excluded the pre-1975 longline CPUE, and Run 21 (the stock recruitment relationship and the related MSY reference points estimated over the period 1989-2010) which assumed that the most recent period (since 1989) better reflected the productivity of the stock.

152. There was considerable discussion of the "Run 21". The SC noted that the concept was raised at SC6 (paragraph 231 (ii)) and discussed in detail at the Pre-assessment workshop, but that it was the first time that the results from such a run had been presented to the SC. SPC explained that run 21 represents an alternative assumption about the productivity of bigeye which aims to address the inconsistency between the productivity assumptions that SC6 requested that SPC use for projections (i.e. recent average recruitment) and the productivity assumptions assumed in the assessment model – most notably the estimated MSY, B_{MSY} and $SB_{F=0}$ are much higher under this alternative assumption resulting in in lower estimates of Bcurrent/B_{MSY} and SBcurrent/SB_{MSY}

153. The SC concluded that run 21 presents an interesting concept that is worthy of future consideration in future assessments and requested that further details (for example, what the assumptions in this run mean in terms of the implied productivity of the stock) of the assumptions and implementation of this run be provided with these assessments. It was further noted that currently there was no hypothesis for potential environmental drivers that could explain the estimated pattern of recruitment for bigeye tuna.

Model runs to characterize stock status and management advice

154. The SC considered all of the model runs that had been undertaken in the assessment to determine those model run(s) which should be used to characterize the status of the stock and the management advice. The SC made a distinction that while a range might be used to characterize the uncertainty in stock status, it was preferred that only a single set of values be used for developing management advice. The SC considered that while it is possible to average results across several models to provide the management advice, it was preferred to use a single model run.

155. The SC discussed the major sources of uncertainty as included in the structural uncertainty grid to determine those model options which represent plausible alternative assumptions that should be considered. The SC recognized both the importance of steepness and the inherent uncertainty in our knowledge of the likely true values. It was considered important to account for this uncertainty. The SC also noted the difference that the operational CPUE indices had made to the stock status estimates, but recognized that this was the first year that these data were used in the reference model.

156. Following the discussion, the SC decided that for characterizing the uncertainty in stock status six model runs be used reflecting the combination of three levels of steepness (0.65, 0.80, 0.95) and two longline CPUE series (operational and aggregate indices). For the provision of management advice the SC decided to use the reference case (run 3j) which assumed steepness of 0.8 and used the operational longline CPUE indices (See table BET1)

3.1.2 Provision of scientific information

a. Stock status and trends

157. The bigeye assessment in 2011 is comparable to recent assessments (Table BET2) though there are a range of data updates and a few changed structural assumptions. The primary differences are a revised structure of the fisheries based in Indonesia and Philippines; the incorporation of recent PTTP tagging data; the use of standardized longline CPUE derived from operational-level data; and purse seine size frequency data corrected for grab sample selectivity bias using experimental spill sample data.

158. SC7 selected run 3j which had an assumed steepness of 0.8 and was based on standardized CPUE derived from operational-level longline data (hereafter referred to as the base case) to represent the stock status of bigeye. To characterize uncertainty in the assessment, SC7 chose additional models based on alternate values of steepness and standardized CPUE derived from either operational or aggregate longline data (Table BET1), as follows:

Model	CPUE	Steepness
H80-op (Base case)	Operational CPUE standardization	steepness = 0.8
H65-op	Operational CPUE standardization	steepness = 0.65
H95-op	Operational CPUE standardization	steepness = 0.95
H80-agg	Aggregate CPUE standardization	steepness = 0.8
H65-agg	Aggregate CPUE standardization	steepness = 0.65
H95-agg	Aggregate CPUE standardization	steepness = 0.95

159. Time trends in estimated recruitment, biomass, fishing mortality and depletion are shown in Figures BET 1-4.

160. F_current/F_MSY is estimated at 1.46 (base case; range 1.16 – 2.10) indicating that overfishing is occurring for the WCPO bigeye tuna stock and that in order to reduce fishing mortality to FMSY the base case indicates that a 32% reduction in fishing mortality is required from the 2006–2009 level (Figure BET5). Considering historical levels of fishing mortality, a 39% reduction in fishing mortality from 2004 levels is required and a 28% reduction from average 2001–2004 levels (consistent with the aim of CMM2008-01).

161. The base case indicates that the current total and spawning biomass are higher than the associated MSY levels ($B_{current} \big/ \widetilde{B}_{MSY}$ =1.25 and $SB_{current} \big/ \widetilde{SB}_{MSY}$ =1.19). However, two of the alternate models found that $SB_{current} \big/ \widetilde{SB}_{MSY} < 1.0$ with a range across the six models considered of 0.86 – 1.49. Therefore, there is a possibility that bigeye tuna is currently in an overfished state.

162. An analysis of historical patterns in the mix of fishing gears indicates that MSY has been reduced to less than half its levels prior to 1970 through increased harvest of juveniles (Figure BET6). Recent overfishing could result in further losses in potential yields in the future (refer to Table BET2).

b. Management advice and implications

163. The SC recommends a minimum of 32% reduction in fishing mortality from the average levels for 2006–2009 to return the fishing mortality rate to F_{MSY}. This recommended level of reduction is equivalent to a minimum 39% reduction of the 2004 level in fishing mortality, and a 28% reduction of the average 2001–2004 levels.

164. It is too early to quantitatively conclude whether CMM2008-01 has reduced fishing mortality for bigeye tuna to the levels specified in the CMM. Data for 2009 and 2010 have been incorporated into the stock assessments, but the data for these years are incomplete and estimates of fishing mortality in the final year of the model (2010) are particularly uncertain.

165. The FAD closure introduced in 2009 contributed to the reduction of bigeye catches in 2009 and preliminarily in 2010 (Agenda item 4.3a). Total purse seine effort between 20N-20S is 14% and 21% higher in 2009 and 2010, respectively, relative to 2004, and is 27% and 35% higher in 2009 and 2010, respectively, relative to the average of 2001-2004 (for flag specific references, refer to attachment B, CMM 2008-01).

166. Total purse seine effort between 20N-20S has increased by 6% from 2008 to 2010 corresponding to the implementation of CMM2008-01 and 2009 was a near record high for associated school effort in spite of the two month FAD closure. This occurred because of an increase in days fished and the provisions and exemptions within the CMM2008-01 and a range of other reasons.

167. Longline catch in 2010 appeared to have been reduced by 34% from the 2001-2004 level and by 48% from 2004 (for flag specific references, refer to attachment F, CMM 2008-01). However this may be overestimated due to incomplete data for 2009 and 2010.

168. Reported catches since 2009 from the mix of surface fisheries in Indonesia and Philippines declined by 33% in 2010, however confirmation is required when more detailed data for 2010 are available including purse seine effort data.

169. Projections to 2021 indicate that fishing mortality would be reduced to close to the F_{MSY} level, and the stock would move to a slightly overfished state. However, these conclusions should be treated with caution because projections are based on incomplete data and the assumption that catch and effort levels in 2010 will be maintained.

170. Overfishing and the increase in catch of juvenile bigeye have resulted in a considerable reduction in the potential yield of the WCPO bigeye stock. The SC concludes that *MSY* levels would increase if the mortality of juvenile bigeye was reduced.

171. The SC noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation and depletion rates were highest in equatorial regions (regions 3 and 4 in the stock assessment model), which accounts for 88% of the total bigeye tuna catch (2001-2010), and that the spawning biomass in these regions is estimated to have declined to about 17% of the level that is estimated to occur in the absence of fishing ($SB_{2010, F=0}$). The Commission may consider measures that utilise a spatial management approach.

172. Considering the incomplete submission of data, the SC highlighted the importance of improving the timely provision of all data necessary for stock assessment purposes and encourages all CCMs to provide data in accordance with the WCPFC data rules for scientific data to be provided to the Commission.

173. The SC recommends that the Commission should consider the results of updated projections at WCPFC8, and adopt additional measures to secure additional reductions in fishing mortality above those expected from the current CMM, to ensure that fishing mortality is reduced to at least the FMSY level, and remove the risk of the stock being overfished. Measures that reduce fishing mortality across a range of fish sizes (e.g. fishing gears) are likely to produce the best results.

3.2 WCPO yellowfin tuna

3.2.1 Review of research and information

Summary of SA-WP-03 (Stock assessment of yellowfin tuna in the western and central Pacific Ocean)

174. J. Hampton (SPC) presented "Stock assessment of yellowfin tuna in the WCPO". The exerts from the Executive Summary of this paper are provided below as are several figures and tables regarding stock status that reflect the model runs selected by SC for the determination of current stock status and the provision of management advice.

175. This paper presents the 2011 assessment of yellowfin tuna in the western and central Pacific Ocean. The assessment uses the stock assessment model and computer software known as MULTIFAN-CL. The yellowfin tuna model is age (28 age-classes) and spatially structured (6 regions) and the catch, effort, size composition and tagging data used in the model are classified by 24 fisheries and quarterly time periods from 1952 through 2010. The assessment included a range of model options and sensitivities that were applied to investigate key structural assumptions and sources of uncertainty in the assessment.

176. While the structure of the assessment model(s) was similar to the previous (2009) assessment, there were some substantial revisions to a number of key data sets, specifically the longline CPUE indices, catch and size data, purse-seine catch and size data, and the configuration of the Indonesian and Philippines domestic fisheries. Cumulatively, these changes resulted in a substantial change in the key results from the 2009 assessment, reducing the overall level of biomass and the estimates of *MSY*, $B_{current} / \widetilde{B}_{MSY}$ and $SB_{current} / \widetilde{SB}_{MSY}$, while increasing the estimate of $F_{current} / \widetilde{F}_{MSY}$ Overall, the current models represent a considerable improvement to the fit to the key data sets compared to 2009 indicating an improvement in the consistency among the main data sources, principally the longline CPUE indices and the associated length and weight frequency data.

177. The current assessment represents the first attempt to integrate the tagging data from the recent PTTP. The model diagnostics indicate a relatively poor fit to these data compared to the data from earlier tagging programmes, particularly for fish of the older age classes and/or longer periods at liberty. For all model options, there was a positive bias in the model's prediction of the number of tags recovered from older fish, indicating that estimated exploitation rates for recent years were higher than observed directly from the tag recoveries. This indicates a degree of conflict between the tagging data and the other key data sources, specifically the longline CPUE indices and, to a lesser extent, the longline size data. Consequently, the inclusion of PTTP data set in the model yields a rather more optimistic assessment (when contrasted with models that exclude these data).

178. The main conclusions of the current assessment are as follows:

a) For all analyses, there are strong temporal trends in the estimated recruitment series. Initial recruitment was relatively high but declined during the 1950s and 1960s. Recruitment remained relatively constant during the 1970s and 1980s, declined steadily from the early 1990s and then recovered somewhat over the last decade. Recent recruitment is estimated to be lower than the long-term average (approximately 85%).

b) Trends in biomass are generally consistent with the underlying trends in recruitment. Biomass is estimated to have declined throughout the model period. The biomass trends in the model are principally driven by the time-series of catch and GLM standardised effort from the principal longline fisheries. Over recent years, there has been considerable refinement of the longline CPUE indices, largely as a result of the utilisation of the operational level data from the longline fishery, principally from the Japanese fleet. This

data enables a number of factors to be incorporated within the analysis to account for temporal trends in the catchability of the fleet.

c) Refinement in the approach applied to process the longline size frequency data (length and weight data) has resulted in a more coherent trend in these data over the model period. As a result, there has been a substantial improvement in the fit to both the size frequency data and the CPUE indices compared to recent assessments.

d) There is considerable conflict between the tagging data (principally from the PTTP) and the other key sources of data included in the model, primarily the CPUE indices. The inclusion of the PTTP tagging data results in a the estimation of a substantially lower level of fishing mortality, particularly for the both the younger age classes vulnerable to the purse-seine associated fishery (age classes 3-4) and the older age classes (age classes > 9) vulnerable to the unassociated purse-seine fishery. The resulting assessment is more optimistic when the PTTP tags are incorporated in the model. Further auxiliary analysis of the PTTP tagging data are required to resolve the conflict between these key sources of data.

e) Fishing mortality for adult and juvenile yellowfin tuna is estimated to have increased continuously since the beginning of industrial tuna fishing. A significant component of the increase in juvenile fishing mortality is attributable to the Philippines and Indonesian surface fisheries, which have the weakest catch, effort and size data. There has been recent progress made in the acquisition of a large amount of historical length frequency data from the Philippines and these data were incorporated in the assessment. However, there is an ongoing need to improve estimates of recent and historical catch from these fisheries and maintain the current fishery monitoring programme within the Philippines. Previous analyses have shown that the current stock status is relatively insensitive to the assumed level of catch from these fisheries, although yield estimates from the fishery vary in accordance to the assumed levels of historical catch. Therefore, improved estimates of historical and current catch from these fisheries are important in the determination of the underlying productivity of the stock.

f) The ratios $B_t / B_{t,F=0}$ provide a time-series index of population depletion by the fisheries. Depletion has increased steadily over time, reaching a level of about 50-55% of unexploited biomass (a fishery impact of 45-50%) in 2006–2009. This represents a moderate level of stock-wide depletion although the stock remains considerably higher than the equivalent equilibrium-based reference point ($\widetilde{B}_{MSY} / \widetilde{B}_0$ of approximately 0.35–0.40). However, depletion is considerably higher in the equatorial region 3 where recent depletion levels are approximately 0.30 for total biomass (a 70% reduction from the unexploited level). Impacts are moderate in region 4 (37%), lower (about 15–25%) in regions 1, 5, and 6 and minimal (9%) in region 2. If stock-wide over-fishing criteria were applied at the level of our model regions, we would conclude that region 3 is fully exploited and the remaining regions are under-exploited.

g) The attribution of depletion to various fisheries or groups of fisheries indicates that the associated purse-seine fishery and Philippines/Indonesian domestic fisheries have the highest impact, particularly in region 3, while the unassociated purse seine fishery has a moderate impact. These fisheries are also contributing to the fishery impacts in all other regions. Historically, the coastal Japanese pole-and-line and purse-seine fisheries have

had a significant impact on biomass levels in their home region (1). In all regions, the longline fishery has a relatively small impact, less than 5%.

h) For the most plausible range of models, the fishing mortality based reference point $F_{current} / \widetilde{F}_{MSY}$ is estimated to be 0.56–0.90 and on that basis conclude that **overfishing is not occurring**. The corresponding biomass based reference points $B_{current} / \widetilde{B}_{MSY}$ and $SB_{current} / S\widetilde{B}_{MSY}$ are estimated to be above 1.0 (1.25–1.60 and 1.34–1.83, respectively) and, therefore, the stock is **not in an overfished state**. The stock status indicators are sensitive to the assumed value of steepness for the stock-recruitment relationship. A value of steepness greater than the default value (0.95) yields a more optimistic stock status and estimates considerably higher potential yields from the stock. Conversely, for a lower (0.65) value of steepness, the stock is estimated to be approaching the *MSY* based fishing mortality and biomass thresholds**.**

i) The western equatorial region accounts for the most of the WCPO yellowfin catch. In previous assessments, there have been concerns that the stock status in this region (region 3) might differ from the stock status estimated for the entire WCPO. A comparison between the results from the WCPO models and a model encompassing only region 3 yielded very similar results, particularly with respect to stock status. Nonetheless, there appear to be differences in the biological characteristics of yellowfin tuna in this region that warrant further investigation**.**

j) The estimates of *MSY* for the principal model options (480,000–580,000 mt) are comparable to the recent level of (estimated) catch from the fishery (550,000 mt). Further, under equilibrium conditions, the predicted yield estimates ($Y_{Fcurrent}$) are very close to the estimates of *MSY* indicating that current yields are at or above the long-term yields available from the stock. Further, while estimates of current fishing mortality are generally below F_{MSY} , any increase in fishing mortality would most likely occur within region 3 — the region that accounts for most of the catch. This would further increase the levels of depletion that is occurring within that region.

k) The current assessment investigated the impact of a range of sources of uncertainty in the current model and the interaction between these assumptions. Nonetheless, there remains a range of other assumptions in the model that should be investigated either internally or through directed research. Further studies are required to refine our estimates of growth, natural mortali*ty* and reproductive potential, incorporating consideration of spatio-temporal variation and sexual dimorphism; to examine in detail the time-series of size frequency data from the fisheries, which may lead to refinement in the structure of the fisheries included in the model; to consider size-based selectivity processes in the assessment model; to collect age frequency data from the commercial catch in order to improve current estimates of the population age structure; to continue to improve the accuracy of the catch estimates from a number of key fisheries, particularly those catching large quantities of small yellowfin; to refine the methodology and data sets used to derive CPUE abundance indices from the longline fishery; and to refine approaches to integrate the recent tag release/recapture data into the assessment model.

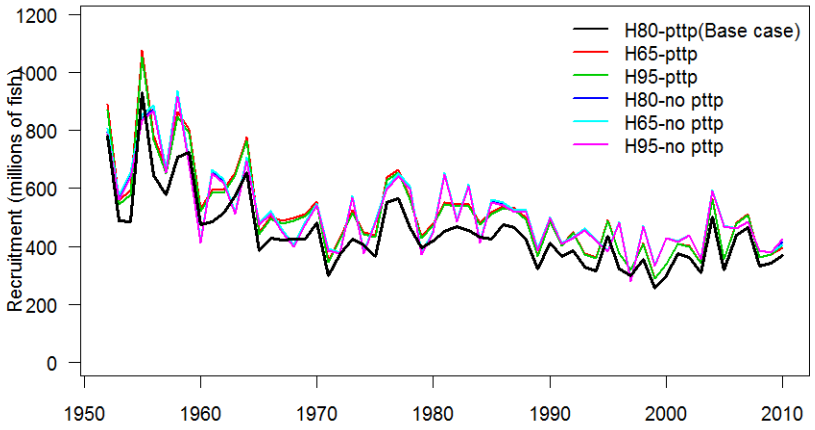

Figure YFT1: Estimated annual recruitment (millions of fish) for the WCPO obtained for the base case (LLcpueOP_TWcpueR6_PTTP – H80pttp) and the five combinations of steepness and tagging data sets included.

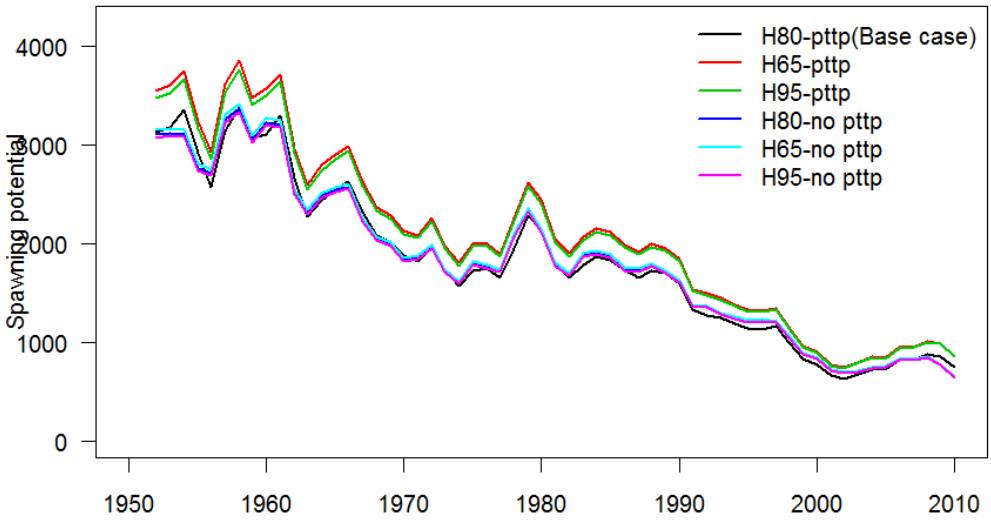

Figure YFT2: Estimated average annual spawning potential for the WCPO obtained from for the base case (LLcpueOP_TWcpueR6_PTTP – H80pttp) and the five combinations of steepness and tagging data sets included.

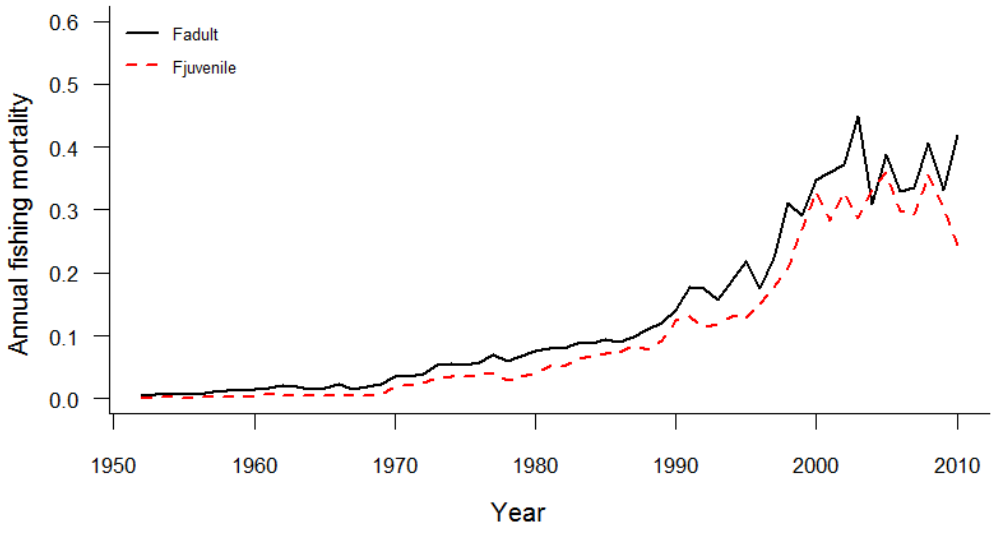

Figure YFT3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the base case model (LLcpueOP_TWcpueR6_PTTP – H80pttp).

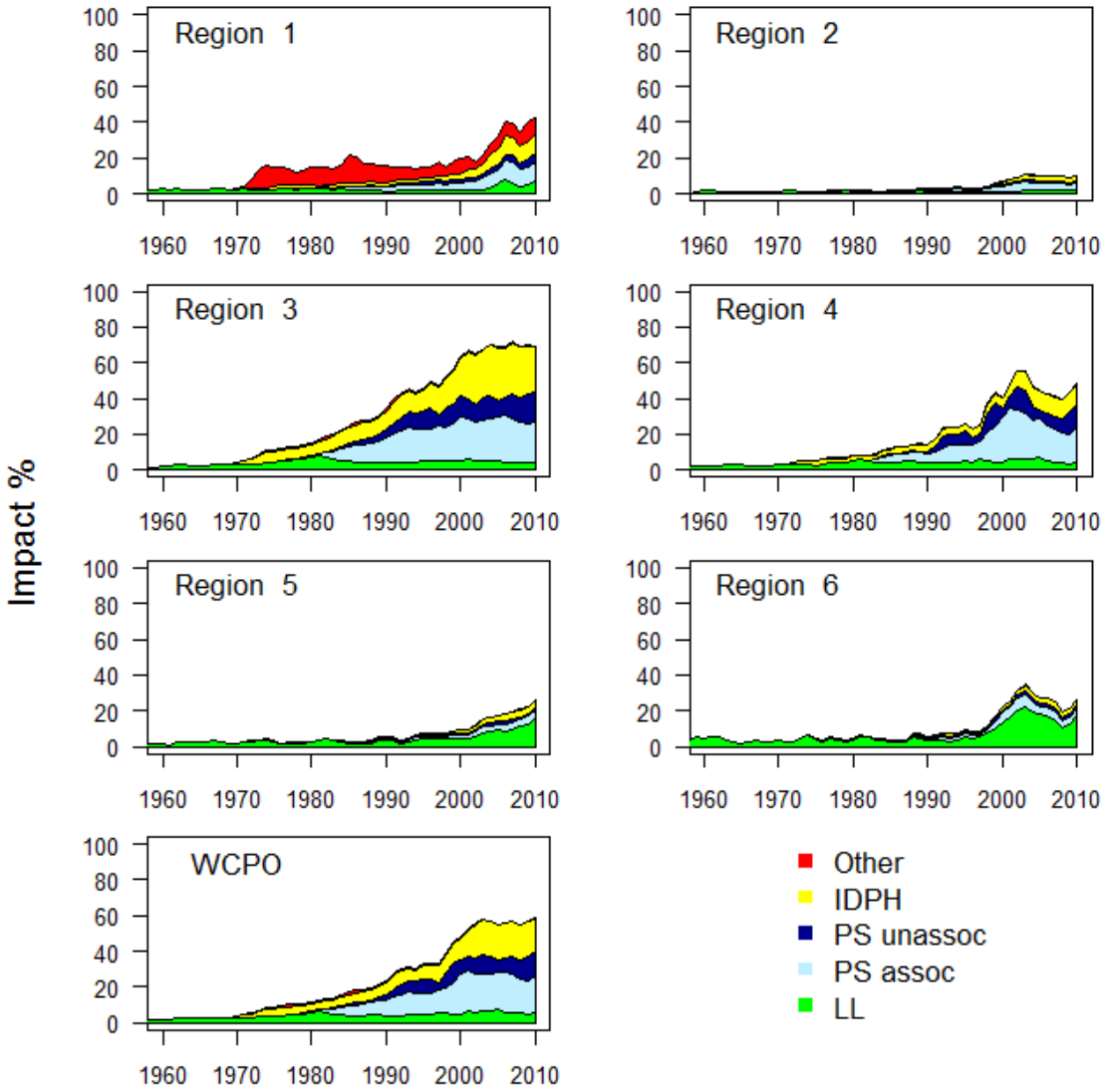

Figure YFT4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) by region and for the WCPO attributed to various fishery groups (base case model (LLcpueOP_TWcpueR6_PTTP – H80pttp)). L = all longline fisheries; IDPHIDPH = Philippines and Indonesian domestic fisheries; PS assoc = purse-seine log and FAD sets; PS unassoc = purse-seine school sets; Other = pole-and-line fisheries and coastal Japan purse-seine.

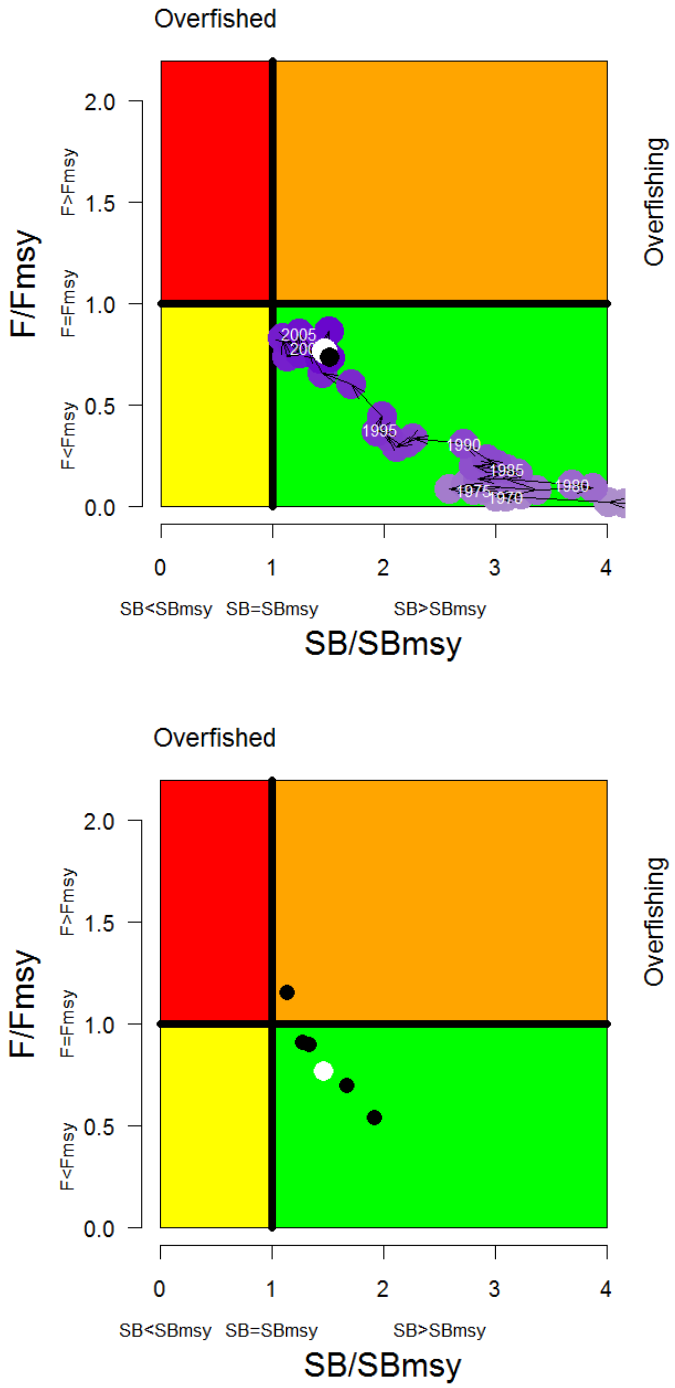

Figure YFT5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the base case model (LLcpueOP_TWcpueR6_PTTP – H80pttp, top) and $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for the base case (white circle) and the five combinations of steepness and tagging data sets included. See Table YFT1 to determine the individual model runs.

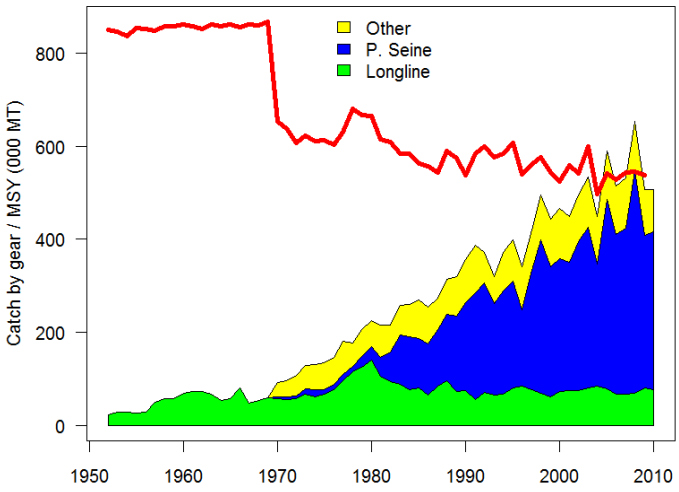

Figure YFT6: History of annual estimates of MSY compared with catches of three major fisheries sectors. Declining MSY results from the change in selectivity of fishing gear and increases in catches of small yellowfin.

Table YFT1. Estimates of management quantities for selected stock assessment models from the 2011 base case model LLcpueOP_TWcpueR6_PTTP (H80-pttp) and the five combinations of steepness and tagging data sets included. For the purpose of this assessment, "current" is the average over the period 2006–2009 and "latest" is 2010.

	H80-pttp (Base case)	H65-pttp	H95-pttp	H80-no pttp	H65- no pttp	H95- no pttp
$C_{current}$	551,120	551,300	551,283	551,488	551,508	551,480
C_{latest}	507,100	507,443	507,358	508,329	508,398	508,286
MSY	538,800	498,000	644,800	493,600	432,000	551,200
$C_{current}/MSY$	1.02	1.11	0.85	1.12	1.28	1.00
C_{latest}/MSY	0.94	1.02	0.79	1.03	1.18	0.92
F_{mult}	1.30	1.10	1.84	1.11	0.87	1.44
$F_{current}/F_{MSY}$	0.77	0.91	0.54	0.90	1.15	0.70
SB_0	2,001,000	2,272,000	2,145,000	2,035,000	2,108,000	1,984,000
SB_{MSY}/SB_0	0.29	0.34	0.24	0.30	0.34	0.25
$SB_{current}/SB_0$	0.42	0.43	0.45	0.40	0.39	0.41
SB_{latest}/SB_0	0.37	0.38	0.40	0.32	0.31	0.32
$SB_{current}/SB_{MSY}$	1.47	1.28	1.92	1.34	1.14	1.67
SB_{latest}/SB_{MSY}	1.30	1.12	1.69	1.06	0.90	1.32
$SB_{curr}/SB_{curr_{F=0}}$	0.44	0.47	0.47	0.40	0.40	0.40
$SB_{latest}/SB_{latest_{F=0}}$	0.41	0.44	0.44	0.35	0.35	0.35
Steepness (h)	0.80	0.65	0.95	0.80	0.65	0.95

Table YFT2. Comparison of WCPO yellowfin tuna reference points from the 2011 reference case model (with uncertainty based on the six models in Table YFT1); the 2009 and 2007 assessments (across a range of models).

Management quantity	2011 assessment	2009 Assessment	2007 Assessment
Most recent catch	507,100	539,481 mt (2008)	426,726 mt (2006)
MSY	538,800 (432,000-644,800)	Range: 493,600 ~ 767,200 mt	Base case: 400,000 mt Range: 344,520 ~ 549,200 mt
$F_{current}/F_{MSY}$	0.77 (0.54-1.15)	Range: 0.41 ~ 0.85	Base case: 0.95 Range: 0.56 ~ 1.0
$B_{current}/B_{MSY}$	1.33 (1.12-1.54)	Range: 1.38 ~ 1.88	Base case: 1.17 Range: 1.13 ~ 1.42
$SB_{current}/SB_{MSY}$	1.47 (1.14-1.92)	Range: 1.44 ~ 2.43	Base case: 1.25 Range: 1.12 ~ 1.74
$Y_{Fcurrent}/MSY$	0.97 (0.88-0.99)	Range: 0.76 ~ 0.98	Base case: 1.0 Range: 0.88 ~ 1.0
$B_{current}/B_{current,\ F=0}$	0.53 (0.48-0.55)	Range: 0.53 ~ 0.63	Base case: 0.51 Range: 0.51 ~ 0.58
$SB_{current}/SB_{current,\ F=0}$	0.44 (0.40-0.47)		

Discussion

179. The SC expressed its appreciation to the yellowfin assessment team for the 2011 stock assessment and then discussed several aspects of the assessment.

180. SC7 noted that the results of the assessment are broadly similar to those of the last two assessments though there have been a number of important changes and that those changes are generally improving the model fit to the key data series, which was welcomed. It was noted that the current conclusions regarding stock status suggest that current yellowfin harvest rates are sustainable. The question arose as to whether there were any indicators that suggest that management is required. In this regard, it was noted that F has been stable since 2000 and the catch has varied around the average level, with no real trend. Furthermore, in terms of reference points, a level of $SB_{current}$ / SB_0 of 25–30% would be of concern, but the current level is well above that at 42% in the reference model. It would be of concern if $SB_{current}$ got down below SB_{MSY}, but that the reference case estimate is 1.47.

Standardised CPUE

181. SC7 was informed that the standardised CPUE based on operational data for Area 6 was determined from data covering the Chinese Taipei fleet, which are available for the mid-1960s onward. While the CPUE determined from operational data covering the fleets of Chinese Taipei and Japan are comparable, the Japanese data were not used for the period prior to the mid-1960s in Area 6. It was also noted that the spatial area fished by the Japanese longline fleet in Area 3 has declined, which suggests that the standardised CPUE in Area 3 may no longer be representative.

Catchability in Areas 3 and 4

182. CCMs queried why, in relation to the "Purse-seine Associated" fishery in Areas 3 and 4, there is a steady increase in catchability through time, then a sharp decline. SC7 was informed that the increase may be due to increasing efficiency, but the reason for the decline is not clear. Interpreting catchability can be complicated as it also incorporates spatial patterns (often referred to as "availability"). Also, the "fleets" defined in the assessment are highly aggregated across flags and the effort by flags can change in time, which may affect overall catchability.

External review by the Center for Independent Experts (CIE)

183. SC7 welcomed the highly positive results of the external review of the yellowfin tuna assessment and generally agreed with the main thrusts of the reviewers' comments. It also agreed with the SPC response to the review, which suggests that the efforts of the reviewers may have been more effective if the reviewers had access to the full range of available background papers.

184. In response to a query as to what was learned from the independent review, SPC commented that it was gratifying that some of the same issues identified during the review were those previously identified by SPC. The review found that the modeling framework is sufficient, but that there is a need to improve the inputs, such as the key data. They recognised the fundamental need to know the catch, particularly for the domestic fisheries of Indonesia and the Philippines, and the purse-seine catch. They highlighted the biological uncertainties, especially growth. In this regard, yellowfin otoliths already exist that could be used.

185. The reviewers noted the same points regarding operational CPUE and size as discussed in papers SC7–SA–IP–06 and SC7–SA–IP–07. Regarding the process, the reviewers had no contact with the assessment team, which perhaps ensured the objectivity of the review, but, as a result, the reviewers were not provided with some of the fundamental documents. Also, the review was done under CIE's own Terms of Reference and not those of the Scientific Committee's. Both points should be taken into account for future external reviews.

Reproduction potential of older age classes

186. A question was raised as to why the assessment suggests a decline in the proportion mature for older age classes. SC7 was informed that the reason for the decline is because of the assumed higher mortality after sexual maturity for females (compared to males), so there are fewer females at older ages. Alternatively, growth may in fact be slower for female yellowfin at larger sizes, but the model currently does not model growth separately by gender. This may lead to underestimation of spawning potential at older sizes. It was suggested that modelling growth rates separately by gender should be examined in the future. In this regard, information currently exists on yellowfin fecundity at length, sex ratios at length, and there is limited information on different growth rates for males and females. The most useful information to be collected would be on length-at-age by sex; some otolith samples have already been collected, but not yet analysed.

Lack of fit of tagging recoveries for older fish

187. Regarding the problem of bias in the number of tag recaptures for older fish, wherein the model over-estimates the number of recoveries, it was suggested that the lack of fit may be partially due to delays in the receipt of PTTP tag recoveries. As more recoveries are received, the lack of fit should diminish.

Conflict between trends in CPUE and biomass

188. SC7 noted that there is a conflict between the declining trend in CPUE and the different trends in biomass estimates during the RTTP and the PTTP. The decline in CPUE in Area 3 may be too steep; in this regard, the targeting of bigeye by longliners in Area 3, as well as relative tag reporting rates, may need to be examined.

Recruitment and environmental factors

189. Regarding the different levels of recruitment in the first and second halves of the time series (Figure 42 in the assessment paper), it was asked whether this was due to environmental factors. SPC responded that the inclusion of work done by SPC on environmental factors in the assessment is one of many things to do. The plan is to expand the modelling framework to include changes in movement patterns driven by large-scale changes in the environment. The assessment currently assumes that movement is static, but it is known that ENSO influences movement, particularly longitudinally; until this is done, it may be that the changes in movement are affecting estimates of recruitment.

Differences in biological characteristics among areas

190. In paragraph 9 of the Executive Summary, it states that "there appear to be differences in the biological characteristics of yellowfin tuna in region 3 that warrant further investigation". One example of these differences is the difference in growth rates, as for bigeye. The maximum length of yellowfin in Area 3 is not as great as Area 2 or 4. The assessment currently estimates growth for all regions combined; however, the modal structure that is clear in the northern regions because of spawning seasonality may not be characteristic of the tropical regions. Another example is the spawning maturity schedule.

Other comments

191. It was noted that reduced availability of yellowfin in the southern region has been observed and that this should be explored in the future.

3.2.2 Provision of scientific information

a. Stock status and trends

192. The yellowfin assessment in 2011 is comparable to recent assessments (Table YFT2) though there are a range of data updates and a few changed structural assumptions. The primary differences are a revised structure of the fisheries based in Indonesia and Philippines; the incorporation of recent PTTP tagging data; the use of standardized longline CPUE derived from operational-level data; and purse seine size frequency data corrected for grab sample selectivity bias using experimental spill sample data.

193. SC7 selected the reference case (LLcpueOP_TWcpueR6_PTTP – H80) which had an assumed steepness of 0.8 and included recent PTTP tagging data (hereafter referred to as the base case) to represent the stock status of yellowfin. To characterize uncertainty in the assessment, SC7 chose additional models based on alternate values of steepness and with recent PTTP tagging data either included or excluded (Table YFT1), as follows:

Model	CPUE	Steepness
H80-pttp (Base case)	PTTP data included	steepness = 0.8
H65-pttp	PTTP data included	steepness = 0.65
H95-pttp	PTTP data included	steepness = 0.95
H80-no-pttp	PTTP data excluded	steepness = 0.8
H65-no-pttp	PTTP data excluded	steepness = 0.65
H95-no-pttp	PTTP data excluded	steepness = 0.95

194. Time trends in estimated recruitment, biomass, fishing mortality and depletion are shown in Figures YFT 1-4.

195. For the base case, $F_{current}/F_{MSY}$ is estimated at 0.77 indicating that overfishing is not occurring for the WCPO yellowfin tuna (Figure YFT5). However, one of the alternate models found that $\frac{F_{current}}{F_{MSY}} >$ 1.0, with a range across the six models considered of 0.54 -1.15. Therefore, there is a possibility that overfishing is occurring for yellowfin tuna.

196. The base case indicates that the current total and spawning biomass are higher than the associated MSY levels ($\frac{B_{current}}{B_{MSY}} = 1.33$ and $\frac{SB_{current}}{SB_{MSY}} =$1.47). None of the alternate models found that $\frac{SB_{current}}{SB_{MSY}} <$ 1.0 with a range across the six models considered of 1.14 – 1.92. Therefore, yellowfin tuna is not considered to be in an overfished state. However, while the exploitation rates differ between regions, they continue to be highest in the western equatorial region.

197. An analysis of historical patterns in the mix of fishing gears indicates that MSY has been reduced to approximately 60% of its levels prior to 1970 through increased harvest of juveniles (Figure YFT6).

b. Management advice and implications*

198. The SC determined that the WCPO yellowfin appears to be capable of producing MSY. The stock is not experiencing overfishing and is not in an overfished state. Projections to 2021 indicate that fishing mortality is projected to remain below F_{MSY} and the spawning biomass will remain above SB_{MSY}.

199. However, the SC noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation rates were highest in the western equatorial region (region 3 in the stock assessment model), which accounts for ~81% of the total yellowfin tuna catch, and that the spawning biomass in this region is estimated to have declined to about 31% of the unexploited level ($SBB_{2010,F=0}$).

200. The SC recommended that there be no increase in fishing mortality in the western equatorial region.

201. The increase in catch of juvenile yellowfin has resulted in a moderate (~40%) reduction in the potential yield of the WCPO yellowfin stock. The SC concludes that MSY levels would increase if the mortality of juvenile yellowfin was reduced.

3.3 Requests from CMM 2008-01

a. Fishing effort for bigeye and yellowfin tuna from other commercial tuna fisheries*

202. No new information was submitted.

3.4 WCPO skipjack tuna

3.4.1 Review of research and information

Summary of SA-WP-03 (Stock assessment of yellowfin tuna in the western and central Pacific Ocean)

203. S. Hoyle (SPC) presented "Stock assessment of skipjack tuna in the WCPO". The excerpts from the Executive Summary of this paper are provided below as are several figures and tables regarding stock status that reflect the model runs selected by SC for the determination of current stock status and the provision of management advice.

204. This paper presents the 2011 assessment of skipjack tuna in the western and central Pacific Ocean. The assessment uses the stock assessment model and computer software known as MULTIFAN-CL. The skipjack tuna model is age (16 quarterly age-classes) and spatially structured. The catch, effort, size composition, and tagging data used in the model are grouped into 18 fisheries (a change from the 17 fisheries used in the 2010 assessment) and quarterly time periods from 1972 through 2010.

205. The current assessment incorporates a number of changes from the 2010 assessment, including:

a) Updated catch, effort, and size data;
b) A revised standardised effort series for each region based on a new GLM analysis of catch and effort data from the Japanese distant-water pole-and-line fishery.
c) Adjustment of size frequency data based on observer sampling of skipjack, bigeye, and yellowfin size and species compositions, and adjustment for grab-sampling bias.
d) Changes to the modelling of the Philippines and Indonesia purse seine fisheries. These fisheries are separated into fishing activity in archipelagic waters, and fishing outside archipelagic waters to the east of longitude 125°E. Purse seine effort to the east of 125°E is included in the main associated purse seine fishery, apart from domestically-based vessels which are included in a new PI-ID domestic purse seine fishery.
e) Inclusion of tag releases and recoveries from the recent SPC-PTTP tagging programmes, which increases tagging data in the assessment by 50%.
f) Steepness, a parameter defining the shape of the stock recruitment relationship, was changed from 0.75 to 0.8 in the reference case, with alternative values of 0.65 and 0.95 included in sensitivity analyses.
g) Growth parameters were fixed at their values estimated in 2010.

206. In addition to these changes, a large suite of additional models were run to aid the development of the final "reference case" model. This reference case model is used as an example for presenting model diagnostics, but the most appropriate model run(s) upon which to base management advice will be determined by the Scientific Committee. The sensitivity of the reference model to key assumptions (i.e. regarding the stock recruitment relationship, the catch per unit effort time series, the purse seine catch and size data, the growth model, and the PTTP tagging data) were explored via sensitivity analyses. The results of these analyses should also be considered when developing management advice.

207. A number of trends in key data inputs were noted as particularly influential for the assessment results. The large tagging data set, and associated information on tag reporting rates, is relatively informative regarding stock size. The relative sizes of fish caught in different regions are also indicative of trends in total mortality, mediated though growth, catch, and movement rates. The assessment is therefore very dependent on the growth model.

208. For the northern region, there was little contrast in the Japanese pole and line CPUE time-series. However, both the southern region Japanese pole and line CPUE time series showed increases early in the time series and declines at the end, with greater decline in region 2.

209. Overall, the main assessment results and conclusions are as follows:

a) Estimates of natural mortality are strongly age-specific, with higher rates estimated for younger skipjack.

b) The model estimates significant seasonal movements between the western and eastern equatorial regions. The performance of the fishery in the eastern region has been shown to be strongly influenced by the prevailing environmental conditions with higher stock abundance and/or availability associated with El Niño conditions (Lehodey *et al*. 1997). This is likely to be at least partly attributable to an eastward displacement of the skipjack biomass due to the prevailing oceanographic conditions, although this dynamic cannot be captured by the parameterisation of movement in the current model.

c) Recruitment showed an upward shift in the mid-1980s and is estimated to have remained at a higher level since that time. This change in estimated recruitment is driven in the model by the CPUE data, and also by the tagging data, given the relative tag return rates from the SSAP and the RTTP tagging programmes. Recruitment in the eastern equatorial region is more variable with recent peaks in recruitment occurring in 1998 and 2004–2005 following strong *El Niño* events around those times. Conversely, the lower recruitment in 2001–2003 followed a period of sustained *La Nina* conditions. Recent recruitment is estimated to be at a high level, but is poorly determined due to limited observations from the fishery.

d) The biomass trends are driven largely by recruitment and fishing mortality. The highest biomass estimates for the model period occurred in 1998–2001 and in 2005–2007, immediately following periods of sustained high recruitment within the eastern equatorial region (region 3).

e) The biomass trajectory is influenced by the underlying assumptions regarding the treatment of the various fishery-specific catch and effort data sets within the model. The Japanese pole-and-line fisheries are all assumed to have constant catchability, with any temporal trend in efficiency assumed to have been accounted for by the standardization of the effort series. The CPUE trends are influential regarding the general trend in both recruitment and total biomass over the model period. In all regions there is a relatively good fit to the observed CPUE data, with some deterioration when PTTP tagging data are introduced.

f) The model also incorporates a considerable amount of tagging data that provides information concerning absolute stock size during the main tag recovery periods. Including the PTTP tagging data in the model resulted in higher estimates of recent biomass and MSY. Initial analyses of the data suggest some conflict with inferences from

the CPUE time series about trends in abundance. Further work on both data sources is recommended.

g) Within the equatorial region, fishing mortality increased throughout the model period and is estimated to be highest in the western region in the most recent years. The impact of fishing is predicted to have reduced recent biomass by about 47% in the western equatorial region and 21% in the eastern region. For the entire stock, the depletion is estimated to be approximately 35%.

h) The principal conclusions are that skipjack is currently exploited at a moderate level relative to its biological potential. Furthermore, the estimates of $F_{current} / \widetilde{F}_{MSY}$ and $B_{current} / \widetilde{B}_{MSY}$ indicate that overfishing of skipjack is not occurring in the WCPO, nor is the stock in an overfished state. These conclusions appear relatively robust, at least within the statistical uncertainty of the current assessment. Fishing pressure and recruitment variability, influenced by environmental conditions, will continue to be the primary influences on stock size and fishery performance.

i) For the model assumptions investigated, there was only moderate variation in the estimates of stock status. The most influential assumptions involved steepness and growth. There are insufficient data to estimate steepness reliably within the assessment model and many of the key management quantities are strongly influenced by the values assumed. Growth and its variation in space, through time, and among individuals is not well understood. However, only a limited range of assumptions was investigated in this assessment, and as a result the true level of uncertainty is likely to be under-estimated. A range of other assumptions in the model should be investigated either internally or through directed research. Further studies are required to refine our estimates of growth and reproductive potential, including spatio-temporal variation; to examine in detail the time-series of size frequency data from the fisheries, which may lead to refinement in the structure of the fisheries included in the model; to consider size-based selectivity processes in the assessment model; to continue to improve the accuracy of the catch estimates from a number of key fisheries; to refine the methods used to adjust catch and size data in the purse seine fisheries; to refine the methodology and data sets used to derive CPUE abundance indices from the pole and line fishery; to refine approaches to integrate the recent tag release/recapture data into the assessment model; and to develop more formal and rigorous methods for prioritizing the many available research options.

j) ***Based on estimates of*** $F_{current} / \widetilde{F}_{MSY}$ ***and*** $B_{current} / \widetilde{B}_{MSY}$ ***from the reference model and associated sensitivity grid, it is concluded that overfishing of skipjack is not occurring in the WCPO, nor is the stock in an overfished state.*** These conclusions appear relatively robust, at least within the statistical uncertainty of the current assessment. Although the current (2006-2009) level of exploitation is below that which would provide the maximum sustainable yield, recent catches have increased strongly and the mean catch for 2006-2009 of 1.5 million tonnes is equivalent to the estimated MSY at an assumed steepness of 0.8, but below the grid median estimate of 1.9 million tonnes. Maintenance of this level of catch would be expected to decrease the spawning stock size towards MSY levels if recruitment remains near its long-term average level. Fishing mortality and recruitment variability, influenced by environmental conditions, will both continue to affect stock size and fishery performance.

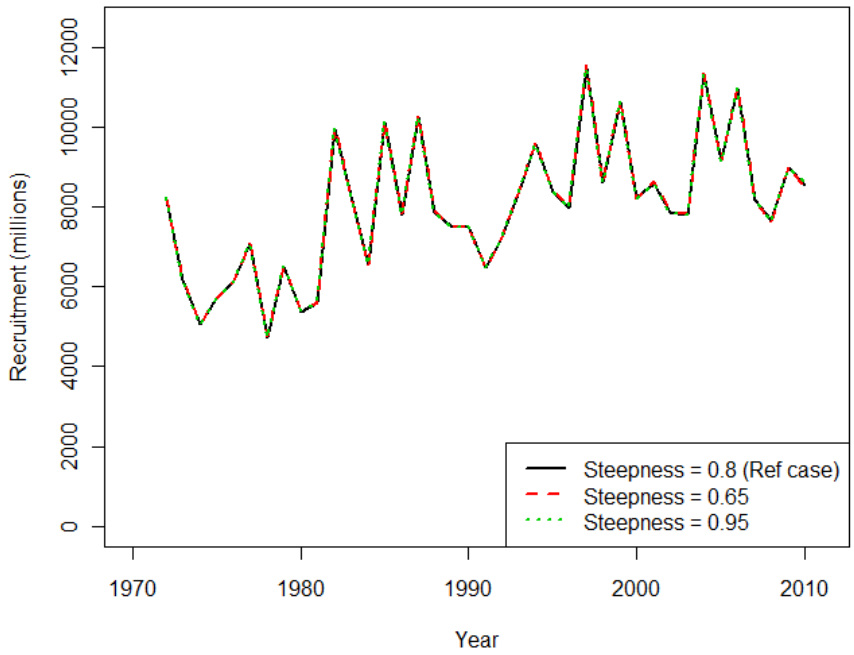

Figure SKJ1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the reference model (steepness = 0.8 - black line) and the two alternative steepness values.

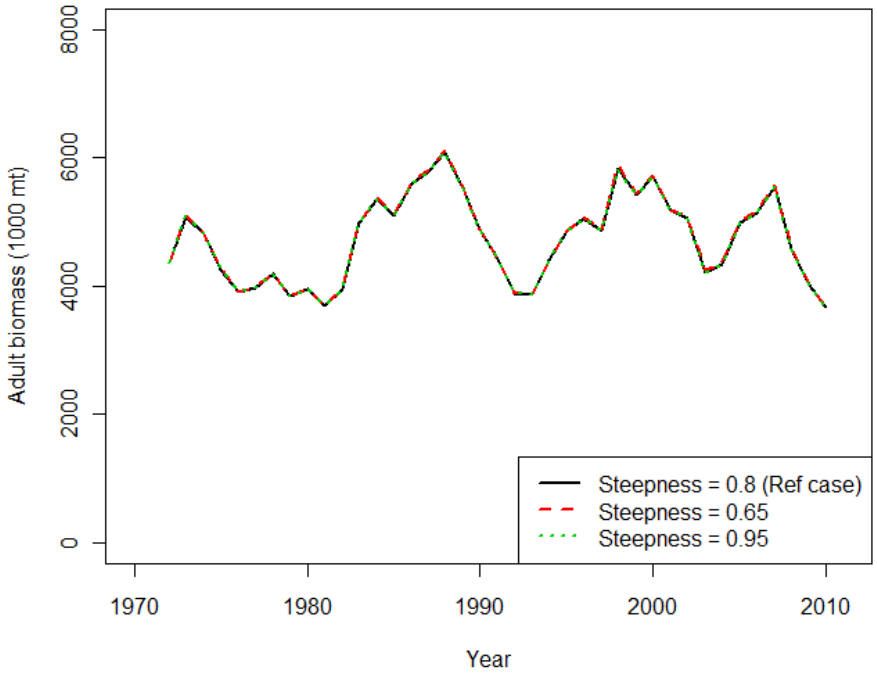

Figure SKJ2: Estimated average annual average spawning biomass for the WCPO obtained from the reference model and the two alternative steepness values.

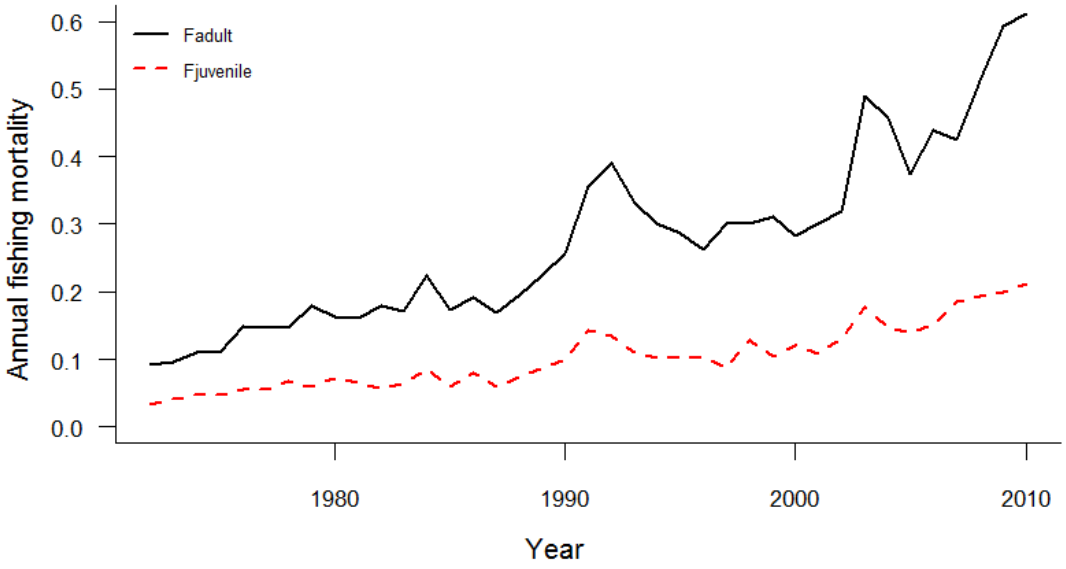

Figure SKJ3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the reference case model.

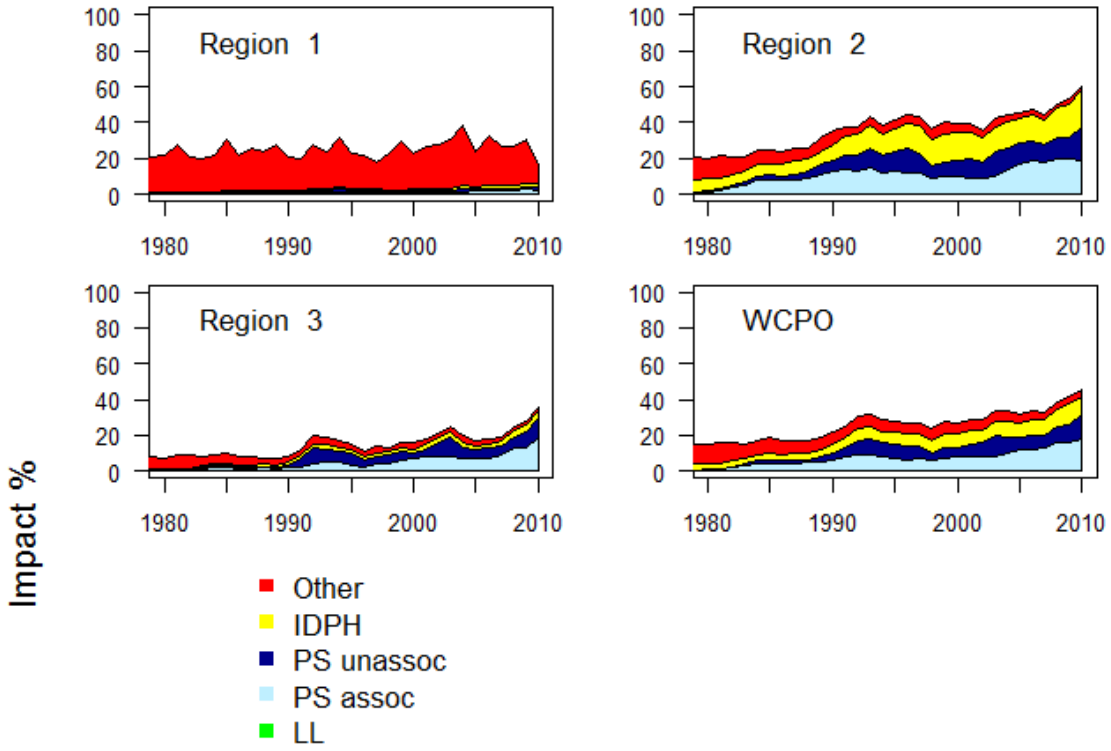

Figure SKJ4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) by region and for the WCPO attributed to various fishery groups (reference case model). L = all longline fisheries; IDPH = Philippines and Indonesian domestic fisheries; PS assoc = purse-seine log and FAD sets; PS unassoc = purse-seine school sets; Other = pole-and-line fisheries and coastal Japan purse-seine.

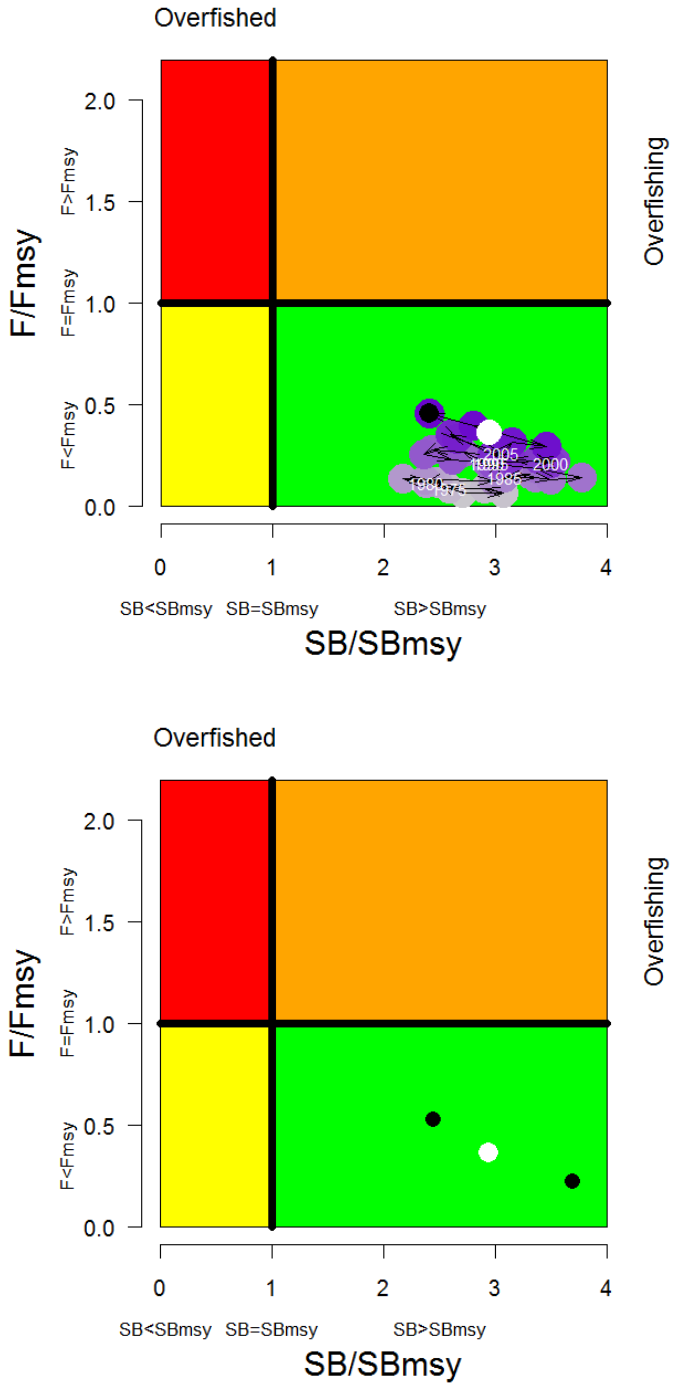

Figure SKJ5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the reference case model (top) and $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for the reference case (white circle) and the two alternative steepness values. See Table SKJ1 to determine the individual model runs.

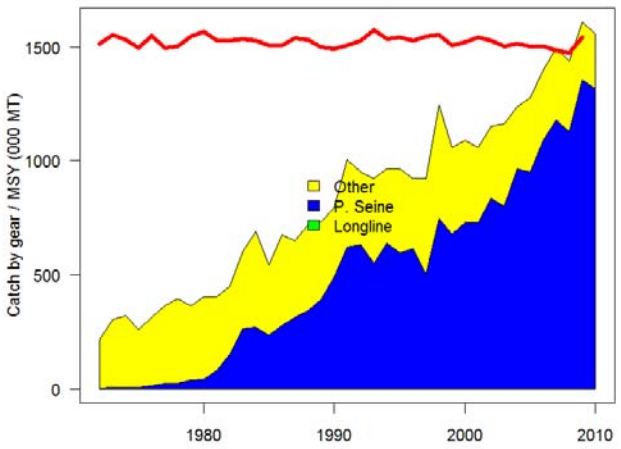

Figure SKJ6: History of annual estimates of MSY compared with catches of three major fisheries sectors.

Table SKJ1. Estimates of management quantities for selected stock assessment models from the 2011 reference case model and the two alternative steepness values. For the purpose of this assessment, "current" is the average over the period 2006–2009 and "latest" is 2010.

	H80 (Base case)	H65	H95
$C_{current}$	1,484,702	1,484,729	1,484,894
C_{latest}	1,556,643	1,556,596	1,556,924
MSY	1,503,600	1,274,000	1,818,000
$C_{current}/MSY$	0.99	1.17	0.82
C_{latest}/MSY	1.04	1.22	0.86
F_{mult}	2.71	1.9	4.46
$F_{current}/F_{MSY}$	0.37	0.53	0.22
SB_0	5,787,000	5,940,000	5,888,000
SB_{MSY}/SB_0	0.27	0.32	0.22
$SB_{current}/SB_0$	0.79	0.77	0.82
SB_{latest}/SB_0	0.60	0.58	0.62
$SB_{current}/SB_{MSY}$	2.94	2.45	3.69
SB_{latest}/SB_{MSY}	2.21	1.84	2.80
$SB_{curr}/SB_{curr_{F=0}}$	0.63	0.63	0.65
$SB_{latest}/SB_{latest_{F=0}}$	0.54	0.54	0.56
Steepness (h)	0.80	0.65	0.95

Table SKJ2. Estimates of reference points from the 2011 (with uncertainty based on the range of models in Table SKJ1), 2010, and 2008 skipjack tuna stock assessments. The spatial domain of the 2008 assessment was limited to the equatorial region of the WCPO.

Management quantity	2011 Assessment (uncertainty)	2010 Assessment	2008 Assessment
Most recent catch	1,556,643	1,575,287 mt (catch based on spill sampling)[a]	1,546,436 mt (2007[b]) 1,726,702 mt (2007[c]) 1,410,389 (WCPO catch based on spill sampling)
MSY	1,503,600 (1274000 – 1818000)	1,375,600 mt	1,280,000 mt
$Y_{Fcurrent}/MSY$	0.76 (0.65-0.86)	0.80	0.70
$B_{current}/B_{current, F=0}$	0.65 (0.65-0.67)	0.63	0.66
$F_{current}/F_{MSY}$	0.37 (0.22-0.53)	0.34	0.26
$B_{current}/B_{MSY}$	2.68 (2.32-3.17)	2.24	2.99
$SB_{current}/SB_{MSY}$	2.94 (2.45-3.69)	2.67	3.82

Discussion

210. The SC thanked the science provider for the skipjack assessment, which had similar conclusions to past assessments, noting that there have been changes to model structure and underlying assumptions. The SC noted that the revisions and additions to the input data used in the 2011 assessment have influenced the assessment. The SC supported the principal conclusions that skipjack is moderately exploited and that the stock is neither subject to overfishing nor is it overfished and that these conclusions appear relatively robust, at least within the statistical uncertainty of the current assessment.

211. The SC also recognized that fishing pressure and recruitment variability, influenced by environmental conditions, will continue to be the primary influences on stock size and fishery performance. The SC endorsed that the reference case of the stock assessment should be the basis for the Committee‘s advice on skipjack. The advice provided should also include stock status advice with the stock recruitment steepness parameter fixed at 0.65 and 0.95 to describe the uncertainty in the assessment. The SC would like to see work to improve the skipjack model continued as a priority so that CCMs can clearly understand changes in the status of this stock.

212. The SC noted that at the pre-assessment workshop there was general agreement that the reference case for 2011 would use a steepness of 0.8. A comparison of this reference case with 2010 assessment results where the steepness of the base case was 0.75 suggests that the choice of steepness values of 0.8 or 0.75 has little influence on the skipjack assessment and there is no strong reason to choose one over the other. The SC invited comment from the science provider on whether, for consistency between assessments, it was advisable that 0.75 be selected as the base case in 2011. The SC was advised that run5 of the structural sensitivity analyses includes the reference case dynamics with steepness changed to 0.75. However, this is the only model structure in the suite of model runs with a steepness of 0.75. All models in the structural sensitivity grid have steepness at either 0.65, 0.8 or 0.95

213. The SC noted concerns about the decline of skipjack catches in the northern coastal area around Japan (see SA-IP-12). Furthermore, although in 2010 skipjack catches by the middle-sized Japanese pole and line recovered from 2009 (lowest), the second lowest catch was recorded in 2010. It is suggested that the statement from the SC6 report (reducing skipjack availability to high latitude due to high catches in the equatorial area) should be repeated in the SC7 report. This statement reads "There is concern, yet to be substantiated, that high catches in the equatorial region could result in range contractions of the stock, thus reducing skipjack availability to higher latitudes (e.g. Japan, Australia, and New Zealand) fisheries".

Index of abundance

214. The SC noted that the catch rate index that was used in the assessment was generated from fisheries that only represented 4% of the catch in recent years and that the spatial coverage of these fisheries has changed over time. The SC noted that there was wide spatial coverage by pole and line fleets until the 1980s when the purse seine fleet expanded. However there is little spatial overlap between the pole and line and purse-seine fisheries, with the pole and line fisheries largely restricted to the boundaries between regions 1, 2 and 3. The SC noted that this was potentially a concern for the structure of the assessment model as it is likely that there are different trends and variability in the response of the stock to harvest at the periphery as opposed to the core of skipjack distributions.

215. One of the major changes in the 2011 skipjack stock assessment was the estimated change in the biomass trend around 1984. The use of a revised standardised CPUE is a feature of the new assessment and is estimated from operational pole and line data and takes vessel effects into account. There has not yet been sufficient opportunity to fully evaluate and understand the factors which influence the CPUE and this is ongoing work. However it was noted that the change in biomass coincides with changes in the Japanese distant water pole and line fleet (see SC7-SA-IP-13). In response to low catches in this period the size of the pole and line fleet decreased and extended further into equatorial area.

Length Frequency data

216. The SC noted that the use of information obtained from spill and grab sampling to adjust the size distribution used in the assessment could have resulted in obscuring of the length frequency modes. This was not a factor in the 2010 assessment of skipjack as this assessment used unadjusted size composition data. The SC noted that SC7-ST-IP-02 provides further explanation on the size composition data.

217. In the 2011 yellowfin assessment it was noted that the growth curve estimated for region 3 was different to previous years and it is suspected that this is due to the change in size composition data. However this explanation is preliminary as no formal evaluation of the yellowfin model has been undertaken to explain this observation.

New fisheries data

218. Clarification was requested on whether the current definition for Indonesia/Philippines fisheries used in the model included the new data recently provided under the WPEA-OFM project. The SC noted that information paper SC7-SA-IP-03 explains how this new data has been used. It was noted that for Indonesia the catch data is provided as an annual catch estimate and disaggregation of this data is based on best knowledge and expert opinion. Future logbook data is expected to improve the disaggregation of this data. On the issue of fishery definition the SC requested that in future it would be preferable if the science provider standardised the abbreviations of the various fisheries across the assessments for each species.

Model structure and parameterisation

219. The SC also noted that there was some conflict between the new CPUE data and the PTTP data particularly at the end of the time series where the CPUE data estimates a steeper decline in biomass without the PTTP data and this is an issue that needs to be resolved. In the structural sensitivity analyses, alternate CPUEs were included however there were no models that explicitly tested the inclusion or exclusion of the PTTP data, however such a model was included in the overall suite of model runs.

220. The SC commented that the fishing mortality estimate for region 1 in the stock assessment model had increased by two times in comparison to that estimated for region 1 in the 2010 assessment The changes made to the CPUE index are likely to have been responsible for this change.

221. It was noted that the north/south movement and recruitment distribution estimated by the model may be unrealistic given the known distribution of suitable spawning habitat (inferred from sea surface temperature and other factors), however this is mitigated by the fact that recruitment in MFCL is driven by observations in the fisheries. In this case, fish at the age of recruitment are too small to be observed and may then move into non-spawning areas in the period between hatching and having grown to a size vulnerable to the fishery. There is potential in the future to use alternatives models such as SEAPODYM, which models fish distribution in association with habitats at a high resolution, to estimate mixing rates that could then be used in MFCL to better assign the biomass of fish aged less than 6 months (2 quarters of age).

3.4.2 Provision of scientific information

a. Stock status and trends

222. SC7 selected the reference case as the base model to represent the stock status and Committee's advice on skipjack tuna. A value of 0.8 was chosen as the mid-point of the range of steepness values considered in the 2011 assessment. Similar to other tuna species, the actual value of steepness for the WCPO skipjack currently remains unknown.

223. Fishing mortality rates tended to be higher during the last decade than for the preceding period, and fishing mortality and biomass indicators relative to MSY started to move towards 1.0, although they remained substantially below the F_{MSY} level ($F_{current}/F_{MSY}$= 0.37). The stock is not in an overfished state as biomass is above the B_{MSY} ($B_{current}/B_{MSY}$= 2.68).

b. Management advice and implications

224. Catches in 2010 were roughly 1.556 million mt, the second highest recorded and below the record high catch of 1.608 million mt in 2009. Equilibrium yield at the current F is about 1.14 million mt. This is about 76% of the MSY level. The assessment continues to show that the stock is currently only moderately exploited (F_{CUR}/F_{MSY} = 0.37) and fishing mortality levels are sustainable. However, there is concern that high catches in the equatorial region could result in range contractions of the stock, thus reducing skipjack availability to higher latitude (e.g. Japan, Australia, New Zealand, and Hawaii) fisheries.

225. If recent fishing patterns continue, catch rate levels are likely to decline and catch should decrease as stock levels are fished down to MSY levels. Due to the rapid change of the fishing mortality and biomass indicators relative to MSY in recent years, increases of fishing effort should be monitored. The Commission should consider developing limits on fishing for skipjack to limit the declines in catch rate associated with further declines in biomass.

226. Fishing is having a significant impact on stock size, especially in the western equatorial region and can be expected to affect catch rates. The stock distribution is also influenced by changes in oceanographic conditions associated with El Nino and La Nina events, which impact upon catch rates and stock size. Additional purse-seine effort will yield only modest gains in long-term skipjack catches and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas. The management of total effort in the WCPO should recognize this.

227. Noting the uncertainty in purse-seine species composition, SC7 urged the Commission to continue improving estimates of purse-seine composition data. SC7 requested CCMs, port states, flag states and vessel operators to support efforts for paired spill and grab sampling together with the effort to collect landings and cannery data.

3.5 South Pacific albacore

228. Two Working Papers were presented which addressed the review of Project 39 (SC7-SA-WP-05), and the albacore tuna stock assessment (SC7-SA-WP-06)

3.5.1 Review of research and information

a. Review of Project 39

Summary of SC7-SA-WP-05 (Regional study of South Pacific albacore population biology: Year 3 – Biological sampling and analysis)

229. Simon Nicol presented Project 39, Regional study of South Pacific albacore population biology and described the third year of the project (SC7-SA-WP-05). The objectives for the third year were to complete biological sampling of albacore in the southwest Pacific region (otoliths and gonads), continue laboratory analysis of the material collected, and estimate preliminary biological parameters (age, growth and reproduction).

230. The biological sampling component of the project is complete with material being collected from 3,384 albacore caught across the southwest region from Australia to south of the Pitcairn Islands (i.e. from 130°E to 130°W). Very good industry cooperation was integral to the success of the sampling program. All material sampled has been received and archived for current and future use.

231. Preliminary length-weight relationships have been calculated for albacore sampled in Australia and New Zealand based on 1,756 measurements. Validated (direct and indirect) otolith-based ageing protocols have been developed for albacore. Otoliths from 2,152 fish have subsequently been selected for annual age estimation based on sampling location, fork length and sex. All otoliths have been prepared (sectioned) and approximately half have been read. Daily ageing of small fish is also being undertaken to further validate the annual ageing protocols and to examine growth in the first year of life.

232. Histological sections of ovaries have been prepared for all females >70 cm fork length sampled (n=1,162). This size range encompasses immature and mature fish which is important for examining reproductive characteristics such as size/age-at-maturity, spawning time/area, and spawning fraction. All sections have been read and the reproductive status determined. The priority for the next 5 months is to complete the laboratory work and analyses. Biological parameters will be delivered to stock assessment and harvest strategy scientists by the end of 2011.

Discussion

233. The SC commended the project participants on the project and noted that it has generated significant new and important information on albacore population biology. Some CCMs expressed their gratitude to the many people who have taken part in this project and look forward to the results and outcomes of the study and their incorporation in the next stock assessment. One CCM expressed concern about whether the methods used to read otoliths have been peer-reviewed and generally accepted by scientific community, and encouraged the project investigators to seek publication of the methods and results in scientific journals.

b. Review of 2011 stock assessment

Summary of SC7-SA-WP-06 (Stock assessment of South Pacific albacore tuna)

234. S. Hoyle (SPC) presented "Stock assessment of albacore tuna in the South Pacific Ocean". The exerts from the Executive Summary of this paper are provided below as are several figures and tables regarding stock status that reflect the model run selected by SC for the determination of current stock status and the provision of management advice.

235. This assessment uses the same underlying structural assumptions as the 2009 assessment. Due to improved understanding of the data inputs, the model structure of the 2009 alternate case was applied in the 2011 reference case. The main conclusions of the assessment are:

a) Estimated stock status is similar to 2009 estimates (Figures ALB1-ALB3).
b) Biological research indicates that male and female albacore have quite different growth curves, which are not included in the model. Growth curve errors can bias estimates of biomass and fishing mortality. Estimated management parameters should therefore be viewed with caution.
c) There is considerable uncertainty about the early biomass trend, but this has negligible effect on the management parameters, or advice to managers regarding the status of the stock.
d) Estimates of F2007-2009/FMSY (0.26), SB2009 / SBMSY (2.25) do not indicate overfishing above FMSY, nor an overfished state below SBMSY (Figure ALB3).
e) Results from the 2009 assessment suggest that much variation in management parameters is attributable to steepness, which we have no information about. This variation makes management advice based on MSY relatively uninformative. Alternative metrics such as the expected CPUE, relative to a target CPUE, may be less affected by uncertainty. They may also be more relevant to the management needs of the fishery.
f) There is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries.
g) Longline catch rates appear to be declining, and catches over the last 10 years have been at historically high levels. This CPUE trend may be significant for management.

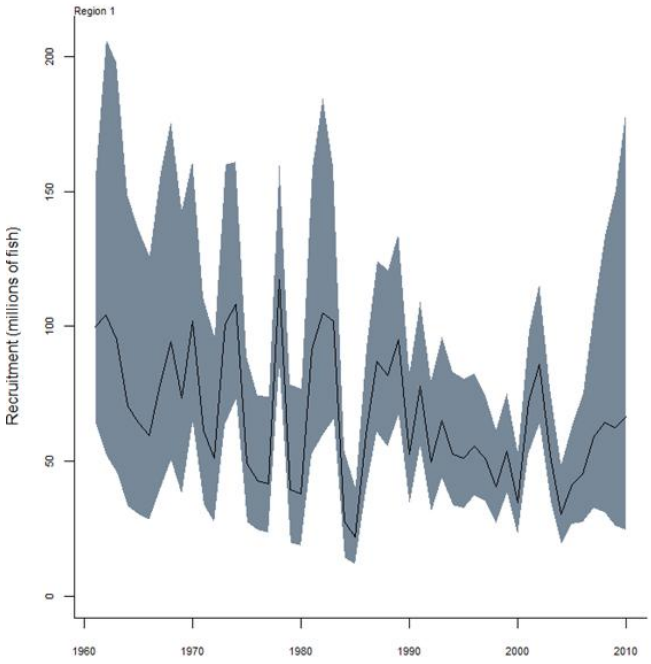

Figure ALB1: Annual recruitment (number of fish) estimates. The grey area represents parameter uncertainty estimated from the Hessian matrix.

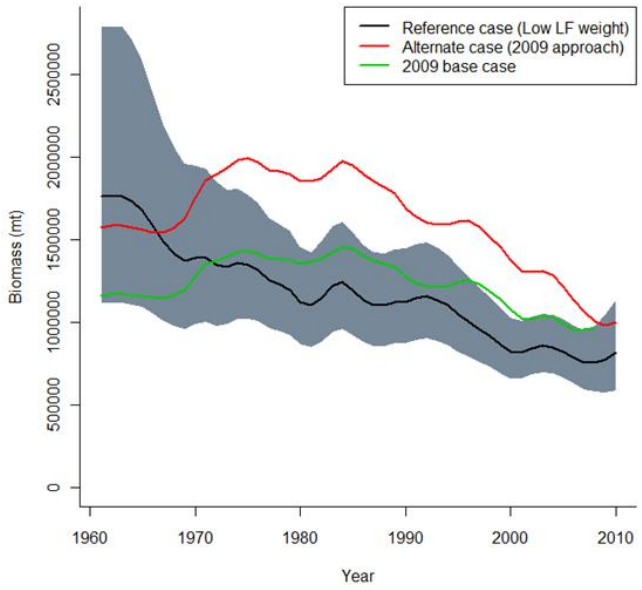

Figure ALB2: Annual estimates of total biomass (thousands of metric tonnes). Several scenarios are shown to illustrate the change between this year's reference case, the alternate case that used the same approach as in 2009, and the biomass trend estimated in the 2009 base case. The comparisons illustrate some effects of conflict between the CPUE and the length frequency data. The grey area represents parameter uncertainty estimated from the Hessian matrix.

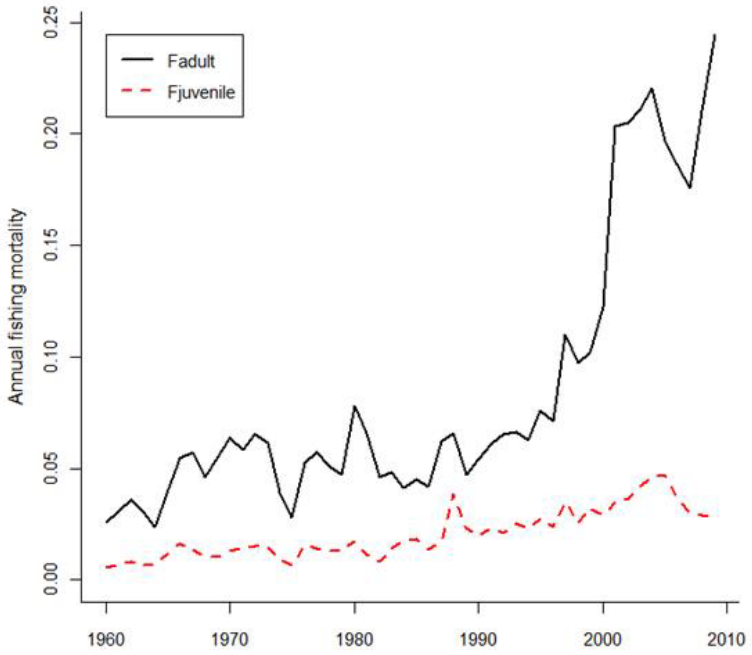

Figure ALB3: Annual estimates of fishing mortality for juvenile and adult South Pacific albacore.

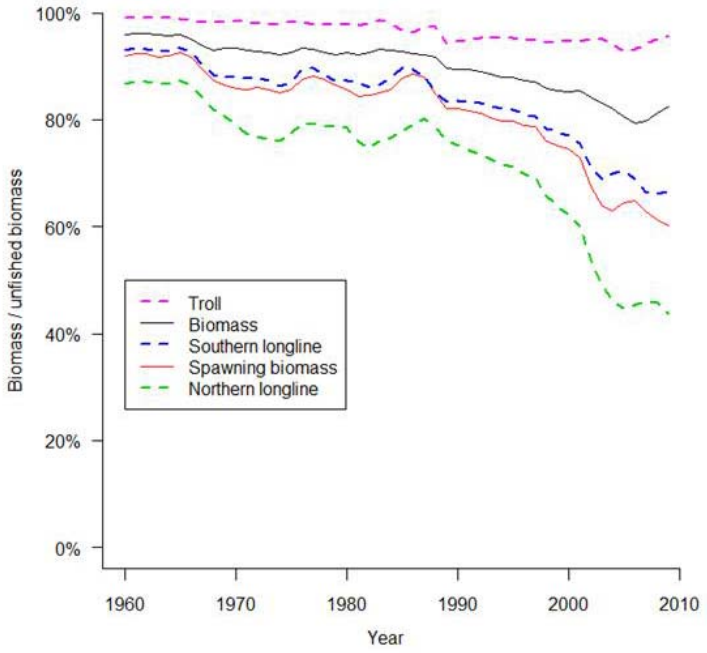

Figure ALB4: Decline in biomass due to the impact of fishing mortality, for exploitable biomass in the troll, southern longline, and northern longline fisheries, for total biomass and for spawning biomass.

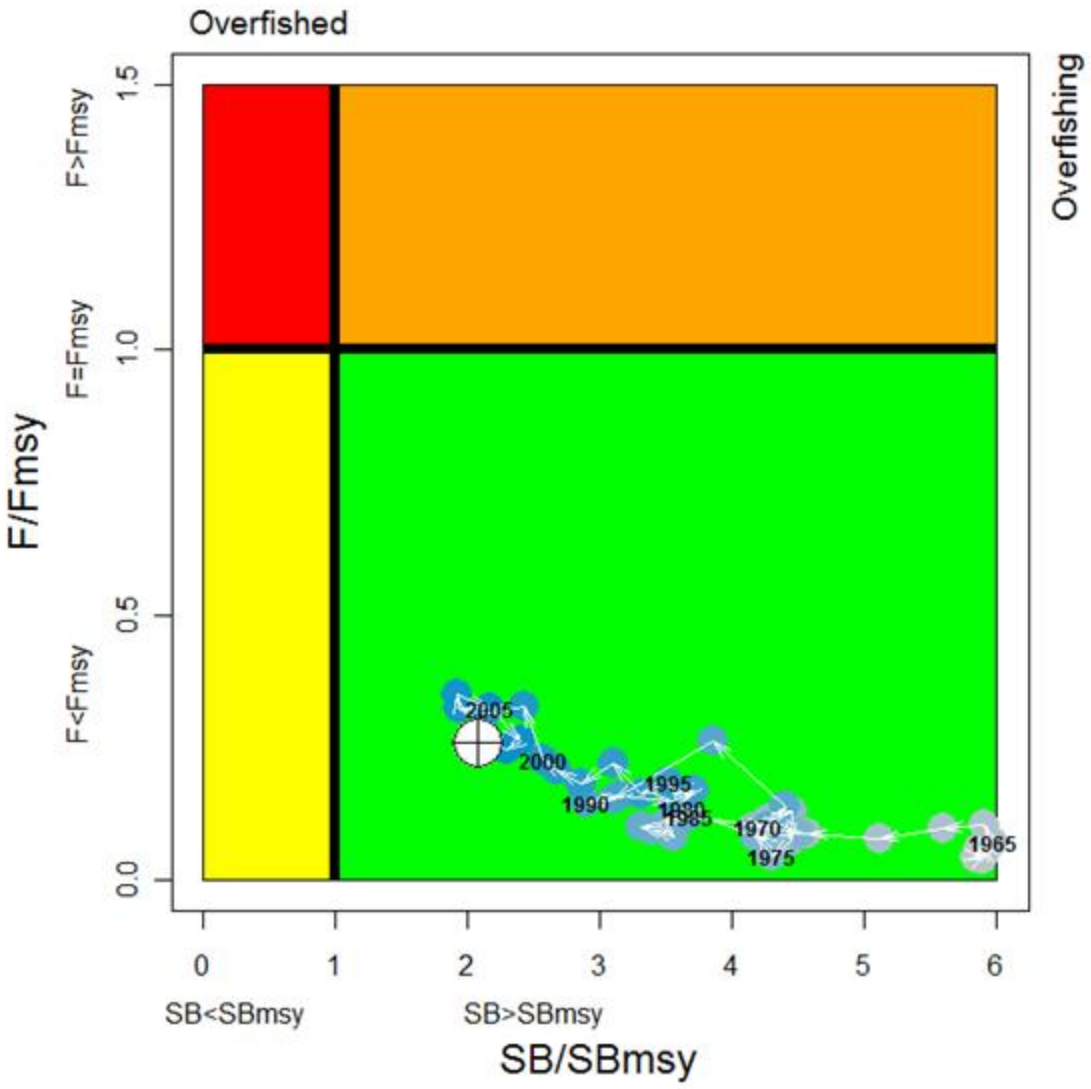

Figure ALB5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points, for the model period (starting in 1960). The colour of the points is graduated from pale blue (1960) to blue (2009), and points are labelled at five-year intervals. The last year of the model (2010) is excluded because it is highly uncertain.

Table ALB1: Management parameters estimated from the 2011 Reference case model, and estimates from the 2009 assessment, for comparison.

Management quantity	Reference case		2009 Base	2009 Median
$C_{2007\text{-}2009}$	54,520	$C_{2005\text{-}2007}$	66,869	65,801
$YF_{2007\text{-}2009}$	57,130	$YF_{2005\text{-}2007}$	64,490	58,955
MSY	85,200	MSY	97,610	81,580
$YF_{2007\text{-}2009} / MSY$	0.67	$YF_{2005\text{-}2007} / MSY$	0.66	0.72
$C_{2007\text{-}2009} / MSY$	0.64	$C_{2005\text{-}2007} / MSY$	0.69	0.80
F_{MSY}	0.14	F_{MSY}	0.14	0.16
$F_{2007\text{-}2009} / F_{MSY}$	0.26	$F_{2005\text{-}2007} / F_{MSY}$	0.25	0.29
B_0	1,141,000	B_0	1,309,000	1,098,500
B_{MSY}	605,900	B_{MSY}	692,100	553,200
B_{MSY} / B_0	0.53	B_{MSY} / B_0	0.53	0.49
$B_{2007\text{-}2009}$	762,240	$B_{2005\text{-}2007}$	965,860	863,665
$BF_{2007\text{-}2009}$	903,500	$BF_{2005\text{-}2007}$	1,041,000	836,300
$B_{2007\text{-}2009}F_0$	950,947	$B_{2005\text{-}2007}F_0$	1,159,433	1,084,933
SB_0	400,700	SB_0	460,400	406,600
SB_{MSY}	104,200	SB_{MSY}	120,000	101,700
SB_{MSY} / SB_0	0.26	SB_{MSY} / SB_0	0.26	0.24
SB_{2009}	234,537	SB_{2007}	273,557	236,793
SBF_{2009}	251,500	SBF_{2007}	292,500	235,250
$SB_{2009}F_0$	372,043	$SB_{2007}F_0$	402,873	390,193
$B_{2007\text{-}2009} / B_0$	0.67	$B_{2005\text{-}2007} / B_0$	0.74	0.76
$BF_{2007\text{-}2009} / B_0$	0.79	$BF_{2005\text{-}2007} / B_0$	0.80	0.74
$B_{2007\text{-}2009} / B_{MSY}$	1.26	$B_{2005\text{-}2007} / B_{MSY}$	1.40	1.53
$BF_{2007\text{-}2009} / B_{MSY}$	1.49	$BF_{2005\text{-}2007} / B_{MSY}$	1.50	1.49
$B_{2007\text{-}2009} / B_{2007\text{-}2009}F_0$	0.80	$B_{2005\text{-}2007} / B_{2005\text{-}2007}F_0$	0.83	0.80
SB_{2009} / SB_0	0.59	SB_{2007} / SB_0	0.59	0.60
SBF_{2009} / SB_0	0.63	SBF_{2007} / SB_0	0.64	0.59
SB_{2009} / SB_{MSY}	2.25	SB_{2007} / SB_{MSY}	2.28	2.44
SBF_{2009} / SB_{MSY}	2.41	SBF_{2007} / SB_{MSY}	2.44	2.36
$SB_{2009} / SB_{2009}F_0$	0.63	$SB_{2007} / SB_{2007}F_0$	0.68	0.64

Discussion

236. The SC thanked the science provider for their stock assessment of South Pacific albacore tuna and noted that its conclusion were consistent with previous assessments. The SC recognized that a key distinguishing feature of the South Pacific albacore tuna assessment was that most of the exploitation is on the adult stock and not juveniles. This partly helps to explain the resilience of the south Pacific albacore stock. The members agreed that the reference case for South Pacific albacore tuna stock status and trends is reasonable and the sensitivity tests undertaken were appropriate.

237. However, some CCMs noted that key conclusions are now somewhat more pessimistic than previous assessments (i.e. B/B_{MSY} closer to 1). Some uncertainty remains relating to current levels of fishing mortality, and support was expressed by some CCMs for further research to improve the model, culminating in an updated assessment in 2012

238. The SC asked SPC to explain why the trajectory estimated in the Kobe plot of South Pacific albacore tuna looks so different from other species, with $B_{current}$ approaching B_{MSY} while $F_{current}$ remains well below F_{MSY}. The SC was advised that because fishing effort is not high enough to explain the decline in CPUE (i.e. fishing effort is low relative to FMSY), the model may be compensating by estimating declining recruitment (and subsequently declining biomass). This might also result in an overestimation of the overall level of biomass, however, there are other possible explanations for the observed trends and further analyses are needed.

239. One CCM suggested that the next assessment should perhaps provide more focus on the longline fisheries north of 25S which appear to be depleting biomass considerably, with potential implications for its management. There was concern expressed by members about the transfer of longline effort from the Indian Ocean which is occurring despite the CMM that exists to regulate this. One member requested analyses by the SPC to determine if a shift of effort to south of 20 S has occurred for longline fisheries.

Input Data

240. The SC expressed concern about the differences in catches shown in General WP 01 and those shown in the stock assessment paper, however. SPC clarified that those differences in data were related to the different availability of data at the time when the two papers were prepared.

241. Concern was also expressed regarding processes that can bias tuna data collection and the extent to which that can be understood or accounted for in future albacore assessments (for example, port sampling of longline caught fish, where small albacore are binned on aggregate but big fish are weighed individually, a process that may create bias. High grading for size at sea was another example). SPC agreed that better metadata is needed to understand how data collection processes have changed through time and the SC was referred to the information paper on data gaps (ST-IP-01) that highlights the need for more information on how data is collected.

Catch per unit effort (CPUE)

242. The SC discussed some recent changes in the fishery such as a recent decline in the CPUE of China's longline fishery. It was noted that the large regional scales of the current assessment model (where fisheries data is aggregated across large areas and sometimes fisheries) limit its ability to identify the reasons for such declines.

243. The SC briefly discussed the standardization process for longline CPUEs and noted that while significant analyses have been devoted to this in the past (for example, a cluster analysis of operational-

level data was used to separate targeted versus non-targeted effort), there is still potential to improve this standardisation with additional fine-scale operational data.

Model Structure and parameterization

244. Some CCMs noted that there may be merit in sharing biological and selectivity information between NP and SP albacore assessments. It was noted that natural mortality and biomass were influenced by steepness, which is poorly informed by assessment data. The SC emphasized the importance of gaining a better understanding of the impacts of variability in climate and oceanography upon stock dynamics and suggested these effects need consideration in future assessments.

245. There was discussion on the potential to structure future assessment models by explicitly modeling the dynamics of each sex. The limited availability of historical sex ratio data for future assessment models was raised and it was noted that the lack of sex-specific length frequency data should not be a problem. If future assessment models explicitly account for sex then observer data on sexing will be an important data source for the model.

Status and trends

246. The 2011 assessment results are similar to those of the 2009 assessment (Tables ALB1).

247. Time trends in estimated recruitment, biomass, fishing mortality and depletion are shown in Figures ALB1−4, and Table ALB1 compares reference points between the 2011 and 2009 assessments.

248. The key conclusion of the reference case is that overfishing is not occurring and the stock is not in an overfished state (Fig. ALB5). Reference point levels estimated in the 2011 assessment were similar to those estimated in the 2009 assessment and depletion levels ($SB_{2009}/SB_{2009,F=0}$) of albacore was moderate at ~37%. However SC7 noted that the depletion levels of albacore available to the longline fisheries north of 25S was above 50%.

Management advice and implications

249. The South Pacific albacore stock is currently not overfished nor is overfishing occurring, and current biomass levels are sufficient to support current levels of catch. Any increases in catch or effort are likely to result in catch rate declines, especially relating to longline catches of adult albacore, with associated impacts upon vessel profitability. SC7 further notes that vessel activity must be managed, as per the requirements of CMM 2010-05.

250. The SC7 noted that the impact of oceanographic and climate variability is a key area of uncertainty and supported continued integration in future stock assessments. SC7 recognised the economic difficulties faced by the domestic albacore fisheries of Pacific Island countries and territories.

3.6 South Pacific swordfish

3.6.1 Review of research and information

251. There was no presentation of a formal working paper under this agenda item, however the SC noted the relevance of paper ST-IP-04 (South Pacific Swordfish Data Available for Stock Assessments)

Discussion

252. The SC highlighted the need for a new South Pacific swordfish stock assessment, but recognised that this would not be possible without operational data for the Spanish longline fleet that operates in the South Pacific, an issue which was highlighted in ST-IP-04. Some CCMs recommended that the paper ST-IP-01 (Estimates of Annual Catches in the WCPFC Statistical Area) be forwarded to TCC7, and that the data be provided by WCPFC8.

253. The SC was advised that the delay in provision of Spanish data was due to the need for an explanatory document to be drafted to accompany the data, which will soon be forthcoming. SPC described discussions with the EU which indicated that a commitment had been given to provide operational level catch and effort data (including that prior to 2010) and 1cm binned size data.

254. Some CCMs recommended that initially the SC should direct SPC to work with the EU and provide an assessment of the data set and that the SC include in the work plan for next year, an analysis of the fishery indicators for this stock.

255. The Cook Islands briefly described satellite tagging research being conducted on swordfish in its waters and recommended that information from this and other Pacific swordfish tagging programmes should be included in the fishery indicator paper for SC in 2012.

256. It was noted that Australia currently holds a substantial amount of electronic tag data for swordfish and the SC asked if this was available to help distinguish Southwest Pacific swordfish from and South Central Pacific swordfish. Australia referred to ST-IP-04 and that a report on this data was available on the AFMA website (http://www.afma.gov.au/wp-content/uploads/2010/06/RR2006-809-Investigation-of-local-movement-and-regional-migration-behaviour-of-broadbill-swordfish-targeted-by-the-Eastern-Tuna-and-Billfish-Fishery.pdf).

3.6.2 Provision of scientific information

a. Status and trends*

257. SC7 noted that no stock assessment was conducted for South Pacific swordfish in 2011; therefore, the stock status description and management recommendations from SC5 are still current.

258. The SC noted that current WCPFC data holdings are insufficient to undertake an assessment in 2012, as indicated in ST-IP-04. The EU advised that the provision of their operational longline data will be provided to the WCPFC shortly. The SC recommends that SPC work with the EU with regards to their data, and provide an assessment as to whether the data set will be useful in expanding the spatial scope of previous assessments to include the south-central Pacific, or if possible the entire south Pacific Ocean. The SC further recommends that an analysis of the fishery indicators of this stock be prepared for presentation at SC8.

b. Management advice and implications*

259. The advice from SC5 should be maintained, pending a new assessment or other new information. SC7 recommended that Statistics Paper IP-04 be forwarded to the TCC for consideration.

3.7 Southwest Pacific striped marlin

3.7.1 Review of research and information

260. S. Brouwer (New Zealand) provided the progress of Project 64 (Collation of SP striped marlin data) as follows:

> This work comes out of SC 6 where it was decided to begin work for a striped marlin assessment. It was noted that some time would be required to collate the data that sit outside of the WCPFC data holdings that would be informative for this assessment. $30K was allocated for this work. NZ and Aus are collaborating to get these data together. We will be presenting this work to pre-assessment workshop and SC7 next year. This project collates and analyses data from the commercial data for striped marlin caught in New Zealand waters and the commercial and recreational data from both New Zealand and Australia.
>
> In New Zealand two commercial datasets are available for investigation; commercial tuna longline logbooks, and observer logbooks. The total number of striped marlin reported is small, a total of 3597 striped marlin have been reported by commercial tuna longliners since 2000, and just 421 striped marlins have been observed since 1990. The overwhelming majority of sets are unsuccessful.
>
> The commercial logbooks are compromised by the failure of many vessels to report their catch of striped marlin, which they are required to release, but the standardised series of positive catches shows some promise as an index of relative abundance.
>
> Two signals of relative abundance are potentially available from each dataset; the probability of capture (presence-absence) and the catch rate in positive sets. These can be combined, but in this study they are considered separately, because the binomial part is either unreliable (as in the case of the commercial logbook data) and/or it dominates the combined index because of the very high proportion of unsuccessful sets (both datasets). The binomial and combined series are presented for completeness without detailed diagnostics.
>
> Positive catches usually comprise a single fish and rarely more than two fish per set. There is thus little contrast in catch rate in positive sets, but the standardised series suggests an overall decline in abundance. The fit of positive catches to the lognormal assumption is poor and is improved slightly by assuming an inverse Gaussian error distribution. The effect of the alternative error distribution on the annual indices is to steepen the decline slightly in recent years. The series is based on observed catches has large error bars around each point due to the small number of records.
>
> Nominal CPUE reflects the encounter rate, which is very low and highly variable from year to year. Constraining the commercial logbook dataset to effective effort (with respect to striped marlin) did not markedly alter this pattern and although it is possible that it reflects real changes in the availability of the stock to New Zealand waters the observed encounter rate provided no corroboration of the pattern seen in the commercial logbook series.
>
> These CPUE analyses are done on the data that were groomed and submitted to WCPFC. In respect of some potential explanatory variables these datasets are not complete, and there is some potential to improve the analyses in future with dedicated data extracts. The shortened time series of commercial data used reflects the period for which we have confidence that striped marlin were being reported, however there is some potential to extend that series back a little further in time for the positive catches only.

The New Zealand Sport Fishing Council (NZSFC, formerly NZ Big Game Fishing Council) compiles annual sport fish tallies for the main species from 60 gamefishing clubs around New Zealand. These records contain a reasonably complete record of striped marlin catch and were used to provide an estimate of the national landed recreational catch. The tagging database was used to provide the number of striped marlin by species recorded as tagged and released. There has been a significant increase in total recreational catch of striped marlin since the 1987 billfish moratorium and subsequent regulation were introduced.

The individual weights of recreationally caught marlin are recorded by game-fish clubs, with some records back to the start of the fishery in the 1920s. Prior to 1988 a high proportion of the recreational catch was landed and accurately weighed. Since the early 1990s 60% of all striped marlin caught by recreational anglers were tagged and released. Fish weight is estimated for fish alongside the boat and the accuracy of these estimates cannot be assured. The average annual striped marlin weights for four of the oldest deep sea angling clubs has declined since the late 1950s with higher inter annual variability.

Northland charter boat CPUE has been collected in a relatively course form (average catch per vessel day for the season) since 1977. A subset of the detailed daily logbook data has been used to extend this data series since 2007. There are few informative variables available to use in standardising charter CPUE. Vessel technology, equipment, and fishing techniques have changed significantly over this time series. Current CPUE is about equivalent to the best years in the late 1970s and early 1980s

Discussion

261. The Convener asked New Zealand to summarize the situation for the prospects for a new South Pacific striped marlin assessment. It was noted that at SC6, there were unutilised sources of data available from New Zealand, notably from the New Zealand long line vessels that were required to discard striped marlin and from New Zealand and Australian recreational fishing vessels. Work was on going to explore the New Zealand observer data on striped marlin discards. There were problems with the data quality in that positive records of striped marlin catches were frequently for only a single fish.

262. The recreational data in New Zealand was of higher quality as recreational fishermen had been keeping records over a relatively long time period, extending back in some cases to the 1920s. Fishermen recorded estimated weights on tag and release and this was being validated by analyzing recreational striped marlin tag and recaptures of less than one month. New Zealand was also looking at a charter vessel catch per unit effort time series which extends back to 1977. These data will be made available for the SPC pre-assessment workshop in 2012 and for incorporation into a 2012 stock assessment. The SC noted that a 2009 study on striped marlin biology will provide improved life-history parameters for the 2012 stock assessment and that the new assessment would benefit from the inclusion of Chinese Taipei and Japanese longline data.

3.7.2 Provision of scientific information

a. Status and trends*

263. SC7 noted that no stock assessment was conducted for southwest Pacific striped marlin in 2011; therefore, the stock status description and management recommendations from SC2 are still current.

264. SC7 further noted the current work progress of Project 64, the compilation of striped marlin data by New Zealand and Australia that will be completed in March 2012. The results of this work will be presented to the pre-assessment workshop for incorporation into the stock assessment in 2012. It was

noted that given the last stock assessment was carried out in 2006, and an updated assessment is required. It was proposed that SPC be tasked with carrying out a revised stock assessment for presentation at SC8.

b. Management advice and implications*

265. The stock status description and management advice from SC2 should be maintained, pending a new assessment or other new information..

3.8 North Pacific striped marlin

3.8.1 Review of research and information

266. The SA convener presented information on north Pacific striped marlin on behalf of the ISC chair with information arising from ISC 11. There was no stock assessment completed for north Pacific striped marlin in 2011.

Discussion

267. Some CCMs expressed both their concern over the status of the northern striped marlin stock and their disappointment that the planned ISC stock assessment for north Pacific striped marlin had not been completed to date, which was largely due to delays in data submission by ISC members. They further called into question the ability of the ISC process to deliver on this issue. They subsequently recommended that the SPC-OFP as science providers to the Commission be tasked with undertaking a new stock assessment in 2012 as part of the work programme of the SC. Concern was also expressed regarding the lack of an SC working paper to support the presentation on striped marlin. In response, the presenter indicated that papers describing this research were available on the ISC website.

268. SC7 noted that North Pacific striped marlin is not a "northern stock" according to the Convention and rules of procedure and therefore should be considered by the SC and not by the ISC. It was clarified that there would be no formal presentation on north Pacific striped marlin.

269. The SC also requested advice from CCMs or SPC about the appropriateness of catch limits in CMM 2010-01.

3.8.2 Provision of scientific information

a. Status and trends*

270. SC7 noted that no stock assessment was conducted for North Pacific striped marlin in 2011; therefore, the stock status description and management recommendations from SC6 are still current.

b. Management advice and implications*

271. SC7 recommends an immediate reduction in fishing mortality for this stock. SC7 noted that CMM 2010-01 was agreed by WCPFC7 to achieve this goal, but that the catch limits in that CMM need to be reviewed to ensure that they are sufficient.

272. SC7 recommended that SPC should work with ISC on the data related work required for the next assessment. If the ISC fails to provide stock assessment results by SC8, future stock assessments for this stock should be undertaken by the science service provider as part of the work programme of the SC.

3.9 Northern stocks

3.9.1 North Pacific albacore (CMM 2005-03)

273. S. Teo presented the recently completed north Pacific albacore stock assessment, which was conducted by the ISC ALBWG. The assessment was completed in June 2011 using fishery data through 2009. The assessment was conducted using a seasonal, length-based, age-structured, forward simulation population model developed within the Stock Synthesis modeling platform (Version 3.11b) and was based on the assumption that there is a single well-mixed stock of albacore in the north Pacific Ocean (base-case model). The model used quarterly catch-at-length data; 16 age-aggregated fisheries defined by gear, location, season, and catch units (weight or number); a new growth curve estimated within the model; and use of conditional age-at-length (otoliths) data not previously available.

274. Analyses were carried out to assess the sensitivity of the results to assumptions including data weighting (both between data types and relative weightings of different sources within a data type), biology (stock-recruitment relationship, natural mortality, growth), and fishery selectivity patterns. Stochastic future projections of the stock were conducted to estimate the probability that future spawning stock biomass (SSB) will fall below the average of the ten historically lowest estimated SSBs (SSB-ATHL) in at least one year of a 25-yr (2010-2035) projection period. The base-case scenario for projections assumed average recruitment and constant F (at the current F level, F2006-2008), but sensitivity of the results to alternative harvest scenarios (constant catch and constant F2002-2004), two recruitment scenarios (high and low levels), and alternative structural assumptions (down-weighting of the length composition data, stock recruitment relationship, growth) was investigated. Retrospective analyses were conducted to assess the level of bias and uncertainty in terminal year estimates of biomass, recruitment, and fishing mortality. A reference run of the VPA model configured as in the 2006 assessment, but with updated catch-at-age and age-aggregated CPUE indices, was conducted to compare important estimated quantities for model-related changes.

275. The base-case model estimated that SSB likely fluctuated between 300,000 and 500,000 mt between 1966 and 2009 and that recruitment averaged 48 million fish annually during this period. The pattern of F-at-age showed fishing mortality increasing to its highest level on 3-yr old fish and then declining to a much lower and stable level in mature fish.

276. Current F (geometric mean of 2006 to 2008, F2006-2008) is lower than F2002-2004 (current F in the 2006 assessment). Future SSB is expected to fluctuate around the historical median SSB (~400,000 t) assuming F remains constant at F2006-2008 and average historical recruitment levels persist. F2006-2008 is approximately 30% below FSSB-ATHL 50% and there is about a 1 % risk that future SSB will fall below the SSB-ATHL threshold in at least one year in the projection period assuming average historical recruitment and constant F2006-2008, i.e., current F is well below the 50% probability level. However, if recruitment is about 25% lower than the historical average and F remains constant at F2006-2008, then the risk of future SSB falling below the threshold by the end of the projection period increases to as high as 54%.

277. Sensitivity and retrospective analyses evaluated the impact of alternative assumptions on the assessment results. These analyses revealed scaling differences in estimated biomass (total and SSB) and, to a lesser extent, recruitment, but few differences in overall trends. Relative F-at-age patterns were not affected by different assumptions, except when the growth curve parameters from the 2006 assessment

were used, and F2006-2008 was consistently lower than F2002-2004. Although there was considerable uncertainty in absolute estimates of biomass and fishing mortality, the estimated trends in both quantities were robust and advice based on FSSB was not affected by this uncertainty. Terminal year estimates of biomass and recruitment show no bias, but there was a high level of uncertainty in the most recent recruitment estimates. Given these findings, the WG believes that the current parameterization of the base-case model is appropriate.

278. Both the SS3 base-case model and the VPA reference run estimated similar historical trends in SSB and recruitment, but with different scaling for biomass. The scaling difference was largely attributable to the different growth curves used in SS3 base-case model and the VPA reference run. A sensitivity run of the base-case model in which growth parameters were fixed to those used in the VPA, reduced the scaling of biomass to the level of the VPA reference run. Sensitivity analyses of future projections showed that stock status and conservation advice is relatively insensitive to these scaling differences. The WG concluded that the growth curve used in the 2006 assessment was not representative of growth in North Pacific albacore. The WG also concluded the SS3 model will replace the VPA as the principal model in future North Pacific albacore assessments.

Discussion

279. The SC thanked the ISC for this stock assessment and for providing such a comprehensive working paper and presentation. It was noted that this is the first time that this level of detail has been made available to the SC and this is a positive step. The SC sought clarification on the spatial characteristics of albacore catches, especially in relation to fisheries F6 and F8 in the assessment and how data standardization had been accommodated. The SC was advised that information on the spatial distribution of the fishery had not been included in the stock assessment but that the information is available in information papers of the ISC11. The SC was advised that CPUE indices were standardized using operational level data provided by ISC members and that the model is very sensitive to the CPUE indices, and particularly those for fishery S7.

280. SPC noted that longline targeting in the area north of Region 3 had shifted toward albacore from about 1994, as reported in WCPFC-SC6-WP-02. This shift in targeting may have increased the CPUE in the S7 index at this time, and exaggerated the increase in model derived abundance indices. SPC indicated that including hooks per basket information in the standardization would be unlikely to fully remove targeting switch effects. The SC was advised that these issues would be taken back to the ISC working group for consideration for further analyses.

281. SC members posed a series of questions in relation to: 1) the temporal extent of the model run that begins in 1966; 2) whether data from Chinese longline had been included in the analysis; 3) how the incorporation of otolith data from Wells et al. (2011) may influence model results; and 4) questioned whether tagging data from the 1970s where included in the assessment.

282. In response, the SC was advised that: 1) data on length frequency and other parameters were less reliable prior to 1966 and so were excluded from this analyses; 2) catch data from Chinese longline had been included in the analysis; 3) the sensitivity of including Wells et al. (2011) growth data had not been conducted; and 4) noted that the 1970s tagging data is not currently included in the analysis but that the ISC is currently examining how tagging data may be incorporated in future assessments.

283. SPC noted the assessment indicates a high variability in catch and biomass that might suggest that biomass is being affected by catch, but that the assessment suggests that abundance is driven by recruitment. SPC suggested that the biomass is too high for the catch to drive the modeled biomass down, and may be over-estimated. SPC further noted that if the S7 CPUE series was removed, a much lower biomass results, meaning that the high biomass estimate is being driven by S7, an index that may be affected by target change. The presenter added that current data shows no clear trends but will be investigated further.

284. SPC noted the ISC had catch data dating back to 1952 that could be easily incorporated into the assessment. The presenter indicated that future assessments would attempt to make better use of historical data.

285. Some CCMs indicated that they did not consider that maintaining Spawning Stock Biomass at the average of the ten historically lowest estimated levels is a suitable target reference point or management objective as referred to in the paper. This could be regarded as a limit reference point. They recommended that the ISC should evaluate the interim reference point for this species against other, more common reference points so there is an understanding of its implications.

286. Some CCMs also observed that this latest assessment is inconsistent to previous advice from the Albacore Working Group, with the current assessment much more optimistic than the past two assessments. Its reliance on the level of recruitment remaining at historical levels to maintain present levels of F suggests a more precautionary approach needs to be taken with regards to present management measures. Those CCMs recommended that the current measure be reviewed to ensure that it is capable of restraining fishing mortality, noting that a lack of data has made this difficult in the past. The SC welcomed the ISC advice that this assessment would be independently reviewed.

a. Status and trends*

287. SC7 noted that the ISC ALBWG provided the following conclusions on the stock status of North Pacific albacore:

"Although there is uncertainty in the absolute estimates of biomass (total and SSB) and fishing mortality, the stock status and conservation advice based on the FSSB-ATHL reference point are relatively insensitive to these uncertainties as trends in SSB and recruitment are robust to the different plausible assumptions tested by the WG. Estimates of F2006-2008 (current F) expressed as a ratio relative to several potential F-based reference points (FMAX, F0.1, FMED, F20-50%) are less than 1.0 (Table X) and SSB is currently around the long-term median of the stock and is expected to fluctuate around the historical median SSB in the future assuming constant F2006-2008 and average historical recruitment. The ratio F2006-2008/FSSB-ATHL is 0.71, which means current F is well below the fishing mortality that would lead SSB to fall below the SSBATHL threshold.

Table NPALB1. Potential reference points and estimated F-ratio using Fcurrent ($F_{2006\text{-}2008}$), associated spawning biomass and equilibrium yield. $F_{SSB\text{-}ATHL}$ is not equilibrium concept so SSB and yield are given as median levels.(ref**)

Reference Point	$F_{2006\text{-}2008}/F_{RP}$	SSB (t)	Equilibrium Yield (t)
$F_{SSB\text{-}ATHL}$	0.71	346,382	101,426
F_{MAX}	0.14	11,186	185,913
$F_{0.1}$	0.29	107,130	170,334
F_{MED}	0.99	452,897	94,080
$F_{20\%}$	0.38	171,427	156,922
$F_{30\%}$	0.52	257,140	138,248
$F_{40\%}$	0.68	342,854	119,094
$F_{50\%}$	0.91	428,567	99,643

288. The WG concludes that overfishing is not occurring and that the stock likely is not in an overfished condition, (e.g., F20-50% < 1.0), although biomass-based reference points have not been established for this stock."

289. The SC7 considers FSSB-ATHL reference point to be a limit reference point.

b. Management advice and implications

290. SC7 noted the following conservation advice from the ISC:

"The ISC noted that F2006-2008 is significantly below F2002-2004 and provided the following recommendations on conservation advice:

a) The stock is considered to be healthy at average historical recruitment levels and fishing mortality (F2006-2008).
b) Sustainability is not threatened by overfishing as the F2006-2008 level (current F) is about 71% of FSSB-ATHL and the stock is expected to fluctuate around the long-term median SSB (~400,000 t) in the short- and long-term future.
c) If future recruitment declines by about 25% below average historical recruitment levels, then the risk of SSB falling below the SSB-ATHL threshold with 2006-2008 F levels increases to 54% indicating that the impact on the stock is unlikely to be sustainable.
d) Increasing F beyond F2006-2008 levels (current F) will not result in proportional increases in yield as a result of the population dynamics of this stock.
e) The current assessment results confirm that F has declined relative to the 2006 assessment, which is consistent with the intent of the previous (2006) WG recommendation."

3.9.2 Pacific Bluefin tuna (CMM 2010-04)

291. J. Broziak very briefly presented some information on Pacific Bluefin tuna from ISC 11 on behalf of the ISC chair. There was no discussion relating to this agenda item.

a. Status and trends*

292. SC7 noted that no stock assessment was conducted for Pacific bluefin tuna in 2011; therefore, the stock status description and management recommendations from SC6 are still current.

b. Management advice and implications*

293. SC7 recalled previous SC advice that it is important to reduce fishing mortality on Pacific Bluefin to 2002-2004 levels or below, particularly on juveniles in the 0-3 age classes and requested that the Northern Committee continue to monitor fishing mortality on age 0-3 fish.

3.9.3 North Pacific swordfish

294. J. Broziak very briefly presented some information on north Pacific Swordfish from ISC 11 on behalf of the ISC chair. There was no discussion relating to this agenda item.

a. Status and trends*

295. SC7 noted that no stock assessment was conducted for North Pacific swordfish in 2011; therefore, the stock status description and management recommendations from SC6 are still current. The SC notes that the last ISC assessment concluded that this stock is not overfished and overfishing is not occurring, and that the current level of catches is sustainable. Continued monitoring of exploitation rates in the area north of 20° north is required to ensure the stock remains well above B_{MSY}. The SC noted that the Northern Committee has scheduled an assessment for this stock for 2013

b. Management advice and implications*

296. SC7 noted that at SC6, ISC concluded that both swordfish stocks in the North Pacific are healthy and above the level required to sustain recent catches. No management advice was provided. Therefore the advice from SC6 should be maintained, pending a new assessment or other new information.

297. SC7 recommends that the Commission task the Northern Committee with provision of the 2013 assessment to SC9 at its completion, for review.

AGENDA ITEM 4 MANAGEMENT ISSUES THEME

298. The Convenor for the Management Issues theme, R. Campbell (Australia) opened this session and outlined the agenda.

299. G. Pilling (SPC), I. Freeman (FFA), S. Auld (Australia) and M. Kamatie (FFA) were selected as rapporteurs.

300. The Convener informed the meeting that five Working Papers would be presented during this session and that a further three Information Papers had been prepared. He also noted that a presentation on Information Paper MI-IP-01 (TUMAS: A tool to allow analysis of management options using WCPFC stock assessments) had been made by Simon Hoyle (SPC) during a session held on Wednesday evening.

4.1 Terms of Reference

301. The Convener informed the meeting that as this Theme had only met for first time at SC6 there were currently no terms of reference (TOR) for this Theme, and based on a recommendation from SC6 that he had drafted some TOR for consideration. The Convenor then presented these draft TOR (contained in Information Paper MI-IP-02) to the meeting for discussion. After some discussion, the

TOR, as drafted by the Convenor and with the above change, were then adopted. The final adopted TOR are located in Attachment G.

Discussion

302. There was a suggestion that the last TOR be changed from "Make recommendations to the Commission..." to "Provide advice to the Commission…" but after some discussion and clarification on the difference between the words "advice" and "recommendations", and when the meeting was informed that the SC chair only reports recommendations to the Commission, it was agreed to change this TOR to "Provide advice and make recommendations to the Commission…".

Recommendations

303. SC7 recommends that the Commission adopt the Terms of Reference for the Management Issues Theme as outlined in Attachment G

4.2 Limit reference points for the WCPFC

304. The Convener opened this agenda item by reminding the meeting of the recommendations made at SC6 that Project 57 on Reference Points be completed intersessionally and that the results be reported to SC7. After reviewing the results SC7 was then to make a recommendation to the Commission on candidate reference points (both type and value) for each of the key target species in the WCPFC.

305. The Convener listed the intercessional work programme identified as Project 57 on the Scientific Research Plan.

a. Identify candidate indicators (e.g. $B_{current}/B_o$, $SB_{current}/SB_{MSY}$) and related limit reference points (LRPs) (e.g. $B_{current}/B_o=X$, $SB_{current}/SB_{MSY}=Y$), the specific information needs they meet, the data and information required to estimate them, the associated uncertainty of these estimates, and the relative strengths and weaknesses of using each type within a management framework.
b. Using past assessments, evaluate the probabilities that related performance indictors exceed the values associated with candidate RPs.
c. Evaluate the consequences of adopting particular LRPs based on stochastic projections using the stock assessment models.
d. Undertake a literature review or meta-analyses to provide insights into levels of depletion that may serve as appropriate limit reference points and other uncertain assessment parameters (e.g. steepness).

306. He further explained that of the four tasks included in Project 57, tasks 2 and 3 had been undertaken by OFP-SPC whist tasks 1 and 4 had been put out to tender with CSIRO (Australia) having been selected to undertake these tasks.

307. The discussion for the following papers MI-WP-03 and MI-WP-04 are combined and summarised following the two paper abstracts

Summary of MI-WP-03 (Identification of candidate limit reference points for the key target species in the WCPFC)

308. R. Campbell presented a summary of MI-WP-03 (Identification of candidate limit reference points for the key target species in the WCPFC) working paper on the behalf of the authors who were unable to attend.

309. The paper provides the results of the commissioned project to provide the Western and Central Pacific Fisheries Commission (WCPFC) and Scientific Committee with a set of candidate limit reference points for the key target species in the WCPFC, and to review steepness and depletion levels used across the tuna Regional Fisheries Management Organisations (RFMOs).

310. The project defined limit reference points as the level of 'F' fishing mortality or level of SSB or total biomass to be avoided. It was noted that additional limit reference points may be needed when management objectives are defined for by-catch species, ecosystem considerations, other conservation objectives, economic and social objectives.

311. Three categories of limit reference points, with varying data requirements and strengths and weaknesses, were examined: Maximum Sustainable Yield (MSY), spawning potential-per-recruit (SPR) and depletion based limit reference points.

312. Some reference points are sensitive to the value for "steepness", which is a key parameter in fisheries stock assessments that measures productivity of the stock at low stock size. A review of the stock assessments of tunas and tuna like species across the tuna RFMOs highlights the difficulty in estimating or assuming a value for steepness for the majority of tuna stocks. There is commonly insufficient data on recruitment at low stock size and recovery from depletion to enable steepness to be reliably estimated in the tuna stock assessments. Providing stock status and management advice that is robust to the uncertainty in steepness is essential for effective management, and is often understated.

313. The authors recommended a three-level hierarchical approach to selecting and setting limit reference points for fishing mortality (F) and Spawning Stock Biomass (SSB) based on decreasing levels of available information. The first level uses FMSY and SSBMSY but only in the case where a reliable and precise estimate of steepness is available. The second level uses FSPR and 20% of SSB0 for cases in which uncertainty in steepness is high, but the key biological (natural mortality, maturity) and fishery (selectivity) variables are reasonably well estimated. The third level does not include an F-based limit reference point if the key biological and fishery variables are not well estimated, but simply uses a SSB limit of 20% of SSB0.

314. A simulation model of tuna-like species was developed to evaluate the consistency and robustness of limit reference points for specific target species of tuna in the Western and Central Pacific Ocean (WCPO). It was parameterised to represent yellowfin/bigeye and skipjack tuna type populations. From this work default values for the candidate limit reference points were recommended. Specific values for reference points for each species should be evaluated with decision rules (that define action to be taken), to ensure performance to protect the stock.

315. For yellowfin and bigeye the second level of the hierarchy of reference points was recommended. For skipjack the third level of the hierarchy was recommended because of the sensitivity of the estimates of FSPR to the maturity-at-age relationship required for level 2. For Albacore and the billfish species the third level of the hierarchy was recommended because of uncertainties in some of the key life-history and fishery variables required for level 1 or level 2.

Summary of MI-WP-04 (Evaluation of stock status of bigeye, skipjack and yellowfin tunas against potential Limit Reference Points)

316. S. Harley presented WCPFC-SC7-2011/MI-WP-04 (Evaluation of stock status of bigeye, skipjack, and yellowfin tunas against potential limit reference points)

317. This paper describes analyses of the limit reference points proposed in Preece et al. (2011; WCPFC-SC7-2011/MI-WP-03). The analyses address: 1) the probabilities that related performance indictors exceed the values associated with candidate reference points; and 2) evaluation of the consequences of adopting particular LRPs based on stochastic projections using the stock assessment models. Two approaches were considered for evaluating uncertainty in stock status against the reference points: 1) structural uncertainty based on the grid used in each assessment; and 2) stochastic projections (for BET and YFT only due to time constraints).

318. With respect to the reference points proposed by Preece et al. (2011) we found that:

a) Bigeye tuna: the fishing mortality limit reference point (FSPR40%) has been exceeded with high probability for the past 20 years and will continue to be exceeded with high probability into the future under current levels of fishing. The spawning biomass limit reference point (20%SB0) will only be exceeded with very low probability in the future unless recruitment declines to the mean level predicted by the SRR; then that limit reference point will be exceeded with relatively high probability (0.48 in 2021). It is important to note that under the assumption of recent average recruitment, the estimate of SB0 based on historical recruitment will underestimate the average unfished biomass in the projection period;
b) Skipjack tuna: historical and projected future biomass far exceed the spawning biomass limit reference point;
c) Yellowfin tuna: the fishing mortality limit reference point has been exceeded with high probability for the past 10 years and the probability that it will be exceeded in the future was very sensitive to future recruitment assumptions. While yellowfin is much closer to the spawning biomass limit reference point than skipjack tuna, none of the historical estimates or future projections of spawning biomass declined below this level.
d) These results suggest that adoption of limit reference points is important for bigeye and yellowfin tuna as these stocks are at the levels (biomass and/or fishing mortality) where limit reference points are likely to impact on future fishing management strategies. For skipjack tuna, we are likely to be at a much higher level so instead the focus must be on determining management objectives and setting target reference points to maximize fishery performance.
e) Finally, it is suggested that if biomass-based limit reference points be adopted that consideration be given to adopting variants that are robust to non-equilibrium conditions.

Discussion

319. In response to a question regarding how accurate an estimate of the age-at-maturity needed to be for skipjack, if one were to use a SPR reference point for this species, it was explained that whilst this still needed to be determined, the choice of reference points for this or any other species can be adjusted as better information is gained on key parameters, allowing one to move up the hierarchy of reference points. SPC informed the meeting that characterization of the spawning biomass of bigeye and yellowfin is still improving, but could indeed change as more information on reproductive biology is gained through projects currently underway.

320. A further question was asked as to whether the SPR values used in the paper were based on female life history parameters or composite sex life history parameters as this could make a difference on the results. The Convenor undertook to investigate this.

321. Some CCMs asked that the SC recommend to the Commission that the limit reference points recommended be adopted, but on a provisional basis, but noting there are further issues that need to be considered before these or any other limit reference points could be formally adopted by the Commission. These include:

a) SPR is a suitable indicator but further consideration is required of whether 40% SPR is an appropriate limit reference point.
b) Further work is required to make decisions about the acceptable levels of risk associated with the use of SB20 and the harvest control rules that the Commission needs to adopt to make sure that it avoids the limit.
c) Potential conflict between having one reference point (SPR40) that is similar to MSY and another (SB20) that is similar to half of MSY.
d) Need for a comparison of the newly proposed reference points to estimates of the (MSY based) reference points according to the previous stock assessments of each species, for all stocks considered under the Commissions mandate.
e) Any reference point should be implemented in a way that is compatible with the provisions about the Convention on principles for the management of stocks and also on ensuring the optimum utilisation of those stocks. This last concept is crucial given the multispecies nature of the fisheries we are dealing with. These trade-offs need to be considered actively when the Commission sets reference points and designs harvest rules around them, as losses in target species catch may result from actions required to avoid a limit reference point for a bycatch species. In particular, the harvest strategy for all stocks needs to account for this in a way that allows for the optimum utilisation of stocks, which may result in a situation where there are different reference points and associated risk levels for different stocks, rather than the current approach of consistent reference points for all stocks.
f) Further consideration of whether the SB reference point should be $20\%SB_0$ or $20\%SB_{F=0}$

322. A further view was expressed that the 20%SBo and 40%SPR reference points could be seen as defaults but if the percentage values needed to vary between species then how could the best values for each species best be identified. The Convenor explained that the technique outlined in MI-WP-03 might be used to examine the relationship between the ratio Fx%SPR/FMSY over a range of plausible values of steepness and attempt to find the value of "x" where this ratio most closely approximated the value of 1 over this range. However, it was agreed that projections which use a stock-recruitment relation are still based on an assumed value of steepness unless one adopts, for example, average recent recruitment.

323. Some CCMs indicated that setting the level of the limit reference point is the first step. The next step will be to determine the allowable risk of breaching the reference point when designing harvest control rules.

324. A further comment noted that the first two tiers of the approach outlined in MI-WP-03 were a positive move and that the use of SPR is common among other fisheries management agencies and provides a meaningful proxy for MSY. For these reasons the use of SPR was advocated. The use of a percentage SPR is very useful and has been evaluated in numerous simulations but it needs to match up with the stock assessment outcomes and should be derived from the female biology. However, the need for the third tier was questioned because of the uncertainty in the estimation of SB0 when life-history parameters are not known.

325. A further comment was made that it would be necessary to consider regime shifts and oceanography in the analysis of reference points as there was a need to ensure the maintenance of stocks in times when productivity was below average. Whilst it was acknowledged that such analyses are difficult, it was suggested that one could compare recruitment anomalies with changes in the southern oscillation index (SOI).

326. The need to define what is meant by a limit reference point was also raised and support was expressed for the definition used in MI-WP-03 or that used in the UN Fish Stocks Agreement.

327. The Convenor provided the following summary of the discussion. The utility of the hierarchical approach appeared to have general support, although a concern had been expressed on the need to go down to level 3. There was also support for the use of SPR as a limit reference point, though the need for further analyses to identify the most appropriate percentage values also was supported. The comment on the need to consider regime shifts was also noted, and whether current depletion under an F=0 scenario is better than the use of SBo.

328. The meeting was informed of the work undertaken by the late Dr Myers on reproductive potential and it was commented whether the estimates provided on the steepness for tuna and billfish by this work could provide some prior understanding. It was also noted that a Myers legacy database was being developed and some reanalysis is planned. An alternative approach by Mangel and Brodziak was described, called the "direct approach" that is based on life-history parameters, to estimate a prior distribution for steepness. SPC commented that some work that supplants Dr Myers work had already been undertaken (SA-IP-08) and that further work was planned.

329. Some CCMs noted that it would still be necessary to consider other reference points for the key target stocks, including empirical reference points as well as those derived from stock assessment models. They expressed interest in standardised CPUE based reference points as part of the management package for those fisheries where high levels of profitability are sought such as skipjack and albacore.

330. Some CCMs indicated that setting target reference points for skipjack is a key for determining purse-seine effort limits. A request was made for SPC to provide a paper for WCPFC8 on candidate targets reference points, based on the use of empirical CPUE as well as stock assessment models.

331. Following a question about whether the approach proposed in paper MI-WP-03 would be recommended to the Commission the Convener noted that while there had been support expressed for this proposal there had also been some concerns expressed about the value associated with the SPR reference point.

332. A proposal was made to include in the recommendations the comment in MI-WP-03 that additional reference points will be needed as management objectives are identified and defined for other management related issues such as the impact of fishing on bycatch species and the ecosystem, as well as economic and social objectives.

333. In response to a question about the choice between using reference points based on Bo versus current depletion under an F=0 assumption it was noted that under equilibrium recruitment then the two approaches should give similar results but where there is a strong pattern in recruitment trends estimating biomass in the absence of fishing is more robust. Furthermore, the use of that type of metric as reference point would also take into account potential regime shifts and other more general changes and the large degree of non-stationarity seen in stock assessments suggests the latter approach better.

334. A view was expressed and supported to provisionally adopt the reference points outlined in MI-WP-03 but that further work was required to clarify the appropriate value of x in the x%SPR reference point.

Recommendations

335. SC7 provided the following recommendations:

a) SC7 recommends that the Commission note the working papers on the identification and evaluation of candidate limit reference points (LRP) presented to SC7.

b) SC7 recommends that the Commission adopt a working definition for LRPs based on the following principles:
   i) they define a state of the fishery which is considered to be undesirable and which management action should avoid,
   ii) the probability of breaching a LRP should be very low,
   iii) management actions should be taken before the fishery falls below or is at risk of falling below a LRP.

c) SC7 recommends that the Commission adopt the hierarchical approach (as outlined in MI-WP-03) to identifying the key limit reference points for the key target species in the WCPFC as follows:

Level	Condition	LRPs
Level 1	A reliable estimate of steepness is available	F_{MSY} and B_{MSY}
Level 2	Steepness is not known well, if at all, but the key biological (natural mortality, maturity) and fishery (selectivity) variables are reasonably well estimated.	$F_{X\%SPRo}$ and either $20\%SB_o$ or $20\%SB_{current,F=0}$
Level 3	The key biological and fishery variables are not well estimated or understood.	$20\%SB_o$ or $20\%SB_{current,F=0}$

d) SC7 recommends that due to a high degree of uncertainty in the steepness parameter for yellowfin tuna and bigeye tuna the Commission adopt a fishing mortality based LRP based on a spawner-per-recruit level of $F_{X\%SPRo}$ and a biomass based LRP based on a depletion level of either $x\%SB_o$ or $x\%SB_{current,F=0}$ for these species in the WCPFC.

e) SC7 recommends that due to a high degree of uncertainty in the steepness parameter and uncertainties in some life-history and fishery parameters for the other key target species in the WCPFC that the Commission adopt either a $x\%SB_o$ or a $x\%SB_{current,F=0}$ reference level as a biomass based LRP for these species.

f) SC7 recommends that SPC-OFP, using the most recent stock assessment models for south Pacific albacore, bigeye tuna, skipjack tuna, and yellowfin tuna undertake further analyses to evaluate the consequences of:
   i) different levels of spawning-potential-per-recruit, $x\%SPR_o$ (where x is in the range 20-50% in 10% increments) to be associated with the adopted fishing mortality-based LRP,
   ii) using either a $x\%SB_o$ or a $x\%SB_{current,F=0}$ biomass-based LRP (range of x of 10-40%),
   iii) also adopting a spawning-potential-per-recruit-based LRP for the key target species other than yellowfin and bigeye tuna, and

g) Noting the progress made by ISC in developing reference points the SC recommends to the Commission that the Northern Committee consider similar analyses for the three stocks that they assess including for north Pacific albacore a comparison of these to the $F_{SSB-ATHL}$ reference point identified by the Northern Committee.

h) SC7 recommends that the results of these further analyses be presented to, and reviewed by, the Workshop of Management Objectives to be held in early 2012 and the workshop conclusions be reported to SC8 for comment before consideration by the Commission.

i) SC7 noted that once adopted, these reference points will need to be implemented along with harvest control rules. SC7 recommended that development of these harvest control rules should be included in the SC work plan and budget. Such harvest control rules must give adequate recognition to the fact that these are multi-species fisheries as well as the provisions of the Convention.

j) SC7 recommends that the Commission hold open the consideration of other reference points (both target and limit) to reflect management objectives as they are identified and defined for other management related issues such as the impact of fishing on by-catch species and the ecosystem, as well as economic and social objectives. These could include empirical as well as model based reference points.

k) SC7 requested that SPC-OFP prepare a paper for the management objectives workshop to identify and evaluate candidate target reference points for skipjack, including empirical reference points such as those based on CPUE as well possible target reference points derived from stock assessment models.

4.3 Review of CMM 2008-01*

336. The Convenor opened this agenda item by noting that the Review of CMM-2008-01 had originally been listed as agenda item 3.3b under the Stock Assessment Theme but had been moved to the Management Issues Theme.

337. John Hampton (OFP-SPC) made a combined presentation of working paper MI-WP-01 and an updated version of the paper WCPFC7-2010/15 which had been provided to WCPFC7(http://www.wcpfc.int/doc/wcpfc7-2010-15/review-implementation-and-effectiveness-cmm-2008). The following contains the abstract from MI-WP-01 and a combined summary of the discussion for both papers.

Summary of MI-WP-01 (Analysis of purse seine set type behavior in 2009 and 2010)

338. This paper describes the purse seine fishery in 2009 and 2010, with particular reference to the FAD closures that occurred in both years. Both raised logsheet and observer data were used in the analysis. The main findings of the paper are:

a) The incidence of reported activity related to use of drifting FADs was considerably lower in 2010 (5.1%) compared to 2009 (13.5%);

b) The use of fish aggregation lights was observed on some vessels with a similar incidence in 2009 (2.2%) and 2010 (2.9%);

c) Total catch was below average during the 2009 closure and in September of the 2010 closure, although effort remained at around normal levels throughout both closures;

d) The catches of bigeye tuna were strongly reduced during both closure periods compared to the other months of those years;
e) The impacts of the closures on skipjack and yellowfin catches are more moderate;
f) The proportions of associated sets conducted during the 2010 closure were close to zero, and compliance with the measure appears to have improved somewhat;
g) In 2010, the proportions of catch and effort associated with FAD usage outside the closure period, particularly the months immediately before and after the closure, had lower FAD usage than is typically the case. This may be associated with the retrieval and re-deployment of FADs, although this needs to be verified by other data;
h) While catches were reduced during the closures, the average size of the catch was higher for all species, particularly yellowfin, during the closures because of the larger average size of fish caught in unassociated sets. These larger average sizes may offset to some extent the loss of catch that occurs as a result of the closures.

Discussion

339. It was noted that the data presented was for the area between 20°N and 20°S only, so did not include purse seine catches outside this area, nor did it include catches from the Indonesia and Philippines fleets. In turn, levels of purse seine effort in 2010 were significantly higher than in previous years.

340. It was noted that overall, the results of the stock assessment presented a similar picture of stock status of previous years. It was again noted that purse seine effort remains high, contributed to by exemptions agreed in the CMM. Uncertainty remains over the longline catch decrease, particularly given that longline vessels were relocating to the Pacific from the Indian Ocean, while it was noted that a reduction in longline catch of 30% doesn't necessarily result in a significant reduction of F, if catch were declining due to declines in stock size.

341. It was also noted that a better understanding of how fishing mortality on bigeye tuna has changed in recent years in response to CMM 2008-01 actions must await reliable estimates for 2010 juvenile and adult fishing mortality from the stock assessments. Fishing mortality estimates in the terminal year are not reliable and so will need a further year or two to get a better estimate.

342. With reference to the slide on the size composition of skipjack tuna in 2009 and 2010, it was queried why no size data were presented for the closed period in 2010, whereas data were presented for other species. The SC was advised that this was due to the reduction in FAD sets and the resulting low catches of skipjack on FAD sets (making the size data not apparent on the figure), while the catches of other species in other areas could be from archipelagic waters, where there may be a higher composition of YFT and BET in those regions.

343. It was noted that the exclusion of catches from those longline fleets exempted under CMM 2008-01 from the plot of overall longline bigeye tuna catches by year might result in a very different pattern in recent years.

344. Some CCMs noted that while evaluation of the impact of the CMM as a whole is in its early days, the trends demonstrated in the preliminary analysis were pleasing. Most notably that: i) incidence of reported activity related to use of drifting FADs was considerably lower in 2010 compared to 2009; ii) total catch was below average during the 2009 closure and in September of the 2010 closure; iii) catches of bigeye tuna were strongly reduced during both closure periods compared to the other months of those years; and iv) 2010 proportions of catch and effort associated with FAD usage outside the closure period had lower FAD usage than is typically the case;

345. Some CCMs also noted that the average size of the catch was higher for all species, particularly yellowfin, during the closures because of the larger average size of fish caught in unassociated sets. These larger average sizes may offset to some extent any loss of catch that occurs as a result of the closures

Summary MI-WP-02 (Projections based on 2011 stock assessments)

346. S. Harley (OFP-SPC) made a presentation of working paper MI-WP-02

347. This paper provides a brief overview of the generic forward projections that were undertaken using the reference case models for the 2011 assessments for bigeye, skipjack, and yellowfin tunas. Similar methods were used as in previous years and the results are provided in the form of an excel spreadsheet with a separate worksheet for each species. Projections were run using two recruitment assumptions – spawner recruitment relationship-based estimates, and the ten year recent average. The former may be more appropriate for yellowfin and skipjack tuna.

348. There are many important data issues that, while likely having minimal impact on the stock status conclusions of the assessments, will have a critical bearing on the interpretation of the projections results summarized here. These issues arise partly because this is the first year that projections have been undertaken with the current assessment so early in the year (i.e. for the SC).

349. Depending on the outcomes of SC7 with respect to choosing those assessment model run(s) to be used for the provision of management advice, these projection results may be updated after the SC and, if necessary, a different (e.g. finer) grid could be used.

Discussion

350. It was noted that the data used in the projections was incomplete, and this may bias the projected outcomes, and there was a need to perform an updated set of projections incorporating the most recent data received by the Commission. Discussion of the projection paper focused on the methodological approach to perform the projections, and the scenarios that might be examined.

351. It was also noted that the deterministic projection approach reduced the ability to evaluate the probability that reference points might be exceeded. Stochastic projections, particularly with the inclusion of a stock-recruitment relationship and sampling from recent recruitment per spawner residuals was suggested as an option for the future.

352. Given the uncertainty in the 2010 longline catch, the suggestion was made that it may be useful to consider 2009 as a starting point for projections, given that catches are better represented in that year. It was noted that this would require plausible assumptions on the performance of the initial 10% reduction from that level from 2009 to 2010. Related to this, the terminal year fishing mortality has been identified as uncertain based upon retrospective analyses, which interacts with the catchabilities estimated for 2010, used in the forward projection. It was noted that gaps in the catch data in the last year may correlate with underestimates of fishing mortality, which also has implications for projections. It was noted that the timescale for improving the catch information is uncertain, given the pattern of fishing and frequency of return to port for provision of logbooks, although the potential for vessels to radio information in was noted. The annual catch estimates may be updated more rapidly.

353. Some CCMs had independently undertaken analysis of several of the key runs in the Excel file, and based on the results of those suggested that: i) further moderate reductions in fishing mortality are necessary to be more confident of removing bigeye overfishing: ii) further reductions in purse seine effort

are projected to produce relatively smaller gains in stock status than previously because of the low level of FAD use in 2010 as the base year for the projections which remains to be confirmed as a sustained response to the FAD closure, and iii) however, a package of further moderate reductions in fishing mortality from both longlining and purse seining are likely to be necessary

354. Some CCMs believed that there are indications from the 2010 data and the projections that the current package of measures in CMM 2008-01 could be largely achieving the objectives of the CMM and that current effort levels would maintain the skipjack stock well within MSY-based reference points. However, the Commission's Science Service Provider informed the meeting that it is likely to take information from two or three years to assess the effectiveness of the current measures and as such the SC should therefore be rather cautious in providing advice based largely on only partial information from 2010.

355. The scenarios to be run within the projections were discussed. The option to include scalars implemented in a stepped basis was discussed and the option for an increment of 0.1 was noted. It was also noted that the number of scenarios to be run should be constrained to a reasonable level, given the time required to perform the work, and some prioritization of the runs was needed. Scoping of the robustness of the projection results to lower priority runs, such as the phasing-in of management measures was suggested during less pressurized time periods.

356. Based on this discussion, and the opinions expressed, the Convenor requested that SPC draft a set of options for running the updated projections and that these would be considered further when adopting recommendations.

357. PNA members advised the SC7 that they are introducing an extra 1 month closure to the 3 month FAD closure for foreign vessels that is already in place in 2011 and this should have a further positive impact in reducing the catch of bigeye tuna, and further suggested that the planned projections should include analysis of this option. There was a request for the projections to include options for the reduction of overall purse seine effort.

Summary of MI-WP-05 (Prospects for effective conservation of bigeye tuna stocks in the Western Central Pacific Ocean)

358. Patrick Lehodey (CLS, France) made a presentation of working paper MI-WP-02. The main issues highlighted by the paper were as follows:

359. The Western and Central Pacific Fisheries Commission (WCPFC) agreed to close certain high-seas areas in the Western and Central Pacific Ocean to purse seine tuna fishing starting in 2010. These measures have potential economic benefits to the countries surrounding the closed areas and may also have potential stock conservation benefits for tunas. We used a spatially explicit ecosystem model of tuna population dynamics, SEAPODYM, to simulate the effects of closures on stock biomass and catch of bigeye tuna (*Thunnus obesus*) 1980 through 2003. The fate of the fishing effort displaced by these closures was not considered in the WCPFC conservation measures.

360. Therefore we examine two different effort displacement scenarios: (1) complete loss of the displaced fishing effort; and (2) redistribution of effort proportional to the historical (average) distribution of catch per unit effort (CPUE). When fishing effort is redeployed, the benefits to the stock are not detectable. The beneficial effect on stock biomass is greatest when the displaced fishing effort was completely lost. However, even in this latter case, the effects of the closures on stock size are quite small (less than 4 % averaged over the simulation period). In view of the limited stock conservation benefits of the closures, we also considered other potential bigeye conservation measures. If spatial closures are

extended to longline fisheries, the biomass increase becomes greater (approximately 7%). Prohibition of the use of fish aggregating devices by the purse seine fleet produces a similar biomass increase. We conclude that:

a) Closing areas to purse seine fishing without consideration of the fate of displaced fishing effort will not be effective for bigeye conservation.
b) Conservation measures that combine closing areas to purse seine fishing and proportional reduction of fishing effort may yield a small bigeye conservation benefit.
c) Restricting longline fishing in known bigeye spawning areas in combination with purse seine area closures and effort reduction offers the best option for achieving effective bigeye conservation.
d) Limitation of FADs use would have a strong positive impact on bigeye stock conservation.
e) Benefits from any bigeye conservation measure will only be detectable after 10 years and be fully realized after two decades, i.e. in the 2030s assuming timely implementation. Recovery will be modulated by both natural and anthropogenic climate-related ecosystem variability. Environmental changes induced by anthropogenic release of greenhouse gases should be clearly visible by the end of the 2030's (Lehodey et al 2010b). The status of bigeye stock at that time will depend on today's conservation and management measures.
f) The bigeye population encompasses both the WCPFC and IATTC convention areas. Though spatial measures have a strong local effect, they also have a spillover effect at the whole range of the species. Thus, the management of this stock would benefit from collaborative and coordinated actions of both international Commissions.

Discussion

361. The Western and Central Pacific Fisheries Commission (WCPFC) agreed to close certain high-seas. Clarification was sought on the phrase 'PNA high seas areas' referred to in the presentation and an explanation was provided that these areas represented those high seas areas already closed by the PNA.

362. Discussions noted that the scenario examining the movement of longline effort out of the closed high seas areas assumed the effort was removed from the fishery. It was noted that in reality this effort might be displaced, and hence would have an impact on other tuna species, such as south Pacific albacore. It was noted that these fisheries are important to island states, and if catch rates in the albacore fisheries drop, they might become uneconomical. Consideration of multispecies issues is therefore important. It was noted that the work focused on bigeye tuna by design, but further work should include multispecies and multifishery issues.

363. Some CCMs encouraged more work of this kind from relatively independent sources bringing new scientific perspectives to the management issues. The SC hoped that this work can be further reported on next year.

Recommendations

364. SC7 recommends that the TCC and the Commission note the following conclusions based on the analyses presented in working papers MI-WP-01 and MI-WP-05 and an updated version of WCPFC-2010/15 when reviewing the implementation of CMM-2008-01:

a) that the number of days reported with any activity related to a drifting FAD was 13.5% in 2009 and 5.1 % in 2010 during the FAD closure periods. Trends in FAD usage and associated catch information indicate that the FAD closure has been effective in reducing FAD use in the purse seine fishery,

b) the limits placed on purse-seine operations have not adequately constrained total purse-seine effort, with total effort in 2009 and 2010 estimated to be 25% and 32%, respectively higher than the 2001-2004 level and the total purse-seine catch of bigeye during 2010 the third highest on record,

c) Purse seine catches of bigeye tuna (in 20°N-20°S) declined in 2010 by 21% from 2009 and by 7.3% from the 2001-2004 average,

d) closing areas to purse seine fishing without consideration of the fate of displaced fishing effort will not be effective for bigeye conservation,

e) the provisional longline catch in 2010 is 30% lower than the 2001-2004 level. However, this estimate is based on incomplete data and is despite an increase in fleet size. Furthermore reductions in catch may not necessarily correspond to reductions in fishing mortality.

365. SC7 recommends that the OFP-SPC update the projection results presented in working paper MI-WP-02 and the results be presented to TCC and WCPFC8. These projections are to be based on the procedures outlined in the table and subsidiary notes below:

Factor	Options	Dimensions
Model runs	Base case model	1
Species	BET, SKJ, YFT	3
Recruitment	Recent average and SRR	2
Longline catch	1.2, 1.1, 1.0, 0.9, 0.8 times 2010 catches	5
Purse seine total effort (excl. ID/PH ex-APW)	2009 (low); 2010 (high)	2
FAD/UNA set effort split (outside FAD closure)	2009 (high FAD use); 2010 (low FAD use)	2
Purse seine FAD effort (including ID/PH ex-APW)	1.2, 1.1, 1.0, 0.9, 0.8, times total effort (with redistribution)	5
ID/PH APW fisheries	2010 catch and effort	2
Other fisheries (e.g. Pole and line and JP coastal PS)	1.2, 1.1, 1.0, 0.9, 0.8 times 2010 effort	5
Closures of PS fishery	2 month closure, 3 month closure	2
CMM 2008-01 exemptions	With exemptions, without exemptions	2
	TOTAL RUNS	24,000

366. SC7 requests the following specific outputs in addition to those typically provided:

i) Projected stock status in relation to $20\%SB_o$ and $20\%SB_{2021,F=0}$.

ii) Projected fishing mortality in relation to $F_{30\%SPRo}$ and $F_{40\%SPRo}$.

367. In addition, for a small subset of model runs, it is recommended that stochastic projections be undertaken and the probability of exceeding the above reference points be calculated.

4.4 Management Objectives Workshop

368. The Convener informed the meeting that the Commission had directed the Secretariat to prepare Terms of Reference (TOR) for the Management Objectives Workshop which is proposed to be held in

early 2012 and that SC7 had been invited to provide elements to be noted in the TOR. He further informed that meeting that following a request from the Secretariat he had drafted some TOR for consideration by SC7 and these were outlined in Information Paper MI-IP-03. These draft TOR had been updated based on comments provided by attendees at the Informal Small Group which had met during the Thursday lunch break to discuss these TOR.

369. The Convenor talked to this Information Paper explaining that the original SC recommendation to the Commission to hold a Workshop on Management Objectives had been made at the Special Workshop on Reference Points which had been held in conjunction with SC5 in 2009.

Discussion

370. Some CCMs noted that while scientific input would be required for the management objectives workshop, it would also require deep and difficult policy and political discussions. There will therefore be a need for further development of the TOR after the SC. They referred to key issues from WCPFC7 for consideration:

i) that management objectives are firmly based on and reflect the full range of consideration related to stock management provided for in the Convention - this includes various principles in Articles 5 and 30; and
ii) that full consideration is given to multispecies issues.

371. In response to this statement the Convener noted that there will likely be a need to establish a coordinating committee to provide guidance on the organisation of the workshop. He also noted that, as identified by SC6, there would be a need for the preparation of working papers that would be presented at the workshop.

372. Noting that there were no further comments on the draft TOR, the Convenor informed the meeting that these TOR would be forwarded to the Secretariat and could serve as a basis upon which the Secretariat would then draft a final set of TOR for consideration at WCPFC8.

373. At the end of this agenda item, the Convenor informed the meeting that he would prepare a set of draft recommendations for each of the agenda items discussed by this theme and that these recommendations would then be presented to and discussed by the SC at a later time

Recommendations

374. SC7 recommends that the WCPFC Secretariat, when drafting Terms of Reference for the Commission for the Workshop on Management Objectives, take into consideration the Terms of Reference cleared by SC7 (see Attachment H).

375. SC7 recommends that the Commission take into consideration the previous recommendations made at SC6 relating to the Workshop on Management Objectives, in particular i) that an independent international expert(s) be invited to the workshop to provide expert guidance on the use of reference points and other issues of relevance to identifying fisheries management objectives, and ii) that in order to assist with the success of the workshop, some preparatory scientific work (for example, as identified in paragraph 335, f) and k), under agenda item 4.2) would need to be undertaken.

376. The convener thanked all presenters, the authors of all working papers and information papers, and the SC for its input to this Theme session.

AGENDA ITEM 5 ECOSYSTEM AND BYCATCH MITIGATION THEME

5.1 Ecosystem effects of fishing

a. Progress of SEAPODYM applications

377. Patrick Lehodey presented SEAPODYM applications in WCPO – progress report (EB-WP-06). The development of SEAPODYM to Pacific tuna and billfish species has been included in the WCPFC SC's programme of work as an affiliated, independently funded project. Progress in the model development and its application to Pacific skipjack tuna were presented. Key new developments included the implementation of robust normal likelihood for the parameter optimization approach and code upgrade allowing optimization experiments at any temporal and spatial resolution. Research studies funded by the Oceanic Fisheries Programme of SPC and the NRIFSF of the Fisheries Research Agency of Japan allowed development of a new skipjack model configuration using realistic high resolution environmental forcing, increased resolution of fishing data, and robust normal likelihood approaches. This led to improvements in the optimization of parameters for skipjack tuna with a better fit to fishing data and a lower total biomass estimates. It remains important to investigate if such a tendency continues while running optimization experiments with increased resolution and corresponding resolution of fishing data sets.

378. Skipjack adult biomass was predicted to be in its lower range in 2008 and 2009, but higher recruitment occurred in 2010 following the 2009-10 El-Niño event. The powerful La Niña event developing in 2010-11 resulted in lower skipjack recruitment in the 1st quarter of 2011. Based on this relationship between skipjack recruitment and ENSO, it is possible to forecast the future trend of the stock. Since ENSO-neutral conditions have developed in the 2nd quarter of 2011 and are expected to continue until the end of the year, skipjack biomass would reach a low trough at the end of 2011. Unless an El Niño event develops in 2012, the skipjack biomass forecast for 2012-13 should remain in the low range of its long term productivity.

379. After scaling the new parameterization to a pre-operational model at resolution 0.25° x week, analyses can be conducted to investigate fine scale changes in the skipjack population dynamics and fisheries. Examples are provided at regional levels with the Japanese domestic fleets and at EEZ scale in Papua New Guinea. It also becomes possible to envisage near real time monitoring of the stock. The interest of such products for the monitoring of fisheries needs to be discussed and evaluated.

380. The model was also used to investigate the impact of climate change under the UN IPCC A2 scenario for the next century. After correction of a temperature bias in the climate model outputs, a new projection of skipjack dynamics was achieved with parameter estimates close to the values obtained using more realistic re-analyses of the historical fishing period. Results showed a more clear extension of habitat towards higher latitude and stabilization of skipjack total biomass in the WCPO until 2060 (without considering fishing). The result was insensitive to a "no change" scenario for oxygen concentration.

Discussion

381. Discussion focused on inputs for primary productivity, appropriate spatial scales for modeling and the ability for SEAPODYM to test for range contraction in stocks. SEAPODYM uses satellite data as inputs for primary productivity, and the presenter stated that research has shown this to well represent seasonality in primary productivity though he noted that work is ongoing to evaluate the model and its inputs. To optimize the spatial scale used in the model, good agreement was needed in the resolution of

the fishing data and the realism of the environment. One method might be to increase the resolution until decreases in biomass stabilize and the presenter suggested this could be tested by using 0.5 degree data.

382. The presenter believed SEAPODYM could be used to examine range contraction in a fishery by modulating the biomass of the predators and examining whether the biomass of adults contracts into a favourable zone due to fewer predators. Skipjack recruitment in the North Pacific could be set to zero and impacts on fisheries in the tropics could be examined. One of the co-authors highlighted the result of SEAPODYM simulation to examine range contraction, which suggested that when fishing mortality is removed from the equatorial region there is an impact upon biomass of skipjack in the sub-tropical area, where there is a possible reproductive area for fish migrating to the temperate waters. The presenter also postulated that range contraction might have occurred as a result of the recent contraction of the Kuroshio current creating less favourable conditions in the north and resulting movement of skipjack into its core habitat.

383. Moreover, there was recognition that skipjack may be a keystone species in the WCPO and some CCMs recommended further ecological studies on this topic and for the results to be presented to the SC.

384. Some CCMs voiced support for the SEAPODYM research programme. They noted the importance of SEAPODYM applications to better understand oceanographic effects on fishing and oceanography in national waters of their countries. There was also support for collaboration with research institutions to pursuing this research and to conduct in-country Productivity Susceptibility Analyses (PSAs) and Ecological Risk Assessments (ERAs).

5.2 Sharks

a. Process for the nomination of key shark species.

385. Shelley Clarke presented a Proposal for a process for designating WCPFC key shark species for data provision and assessment (EB-WP-05). This work was conducted in response to SC6's request for SPC to develop a process for the nomination of key shark species and to identify a subset of these for assessment. It provides a framework for evaluating proposals for new key shark species by describing the range of issues to be considered including i) potential impact by fisheries; ii) designations by other conservation and management systems; iii) the degree of ecological concern; and iv) adequacy of available data and the potential to collect more. A proposed process flowchart and worksheet are provided to assist in evaluating whether the species should be designated as a WCPFC key shark species for data provision, for assessment, or both.

Discussion

386. SC7 thanked SPC for their work in developing the proposal. As shark species were added in previous years to the key shark species listed in an ad hoc manner, several CCMs expressed enthusiasm for a process by which species could be considered for inclusion as a key shark species based on several factors including the availability of data and importance of a species catches to the fishery. There was consensus that the step considering designation for conservation and management under other systems be removed from the process since there are varying levels of scientific rigor involved in designations conducted by other organizations and the SC has the expertise to determine if the science supports any additions to the key shark species list.

387. SC7 was reminded that the proposed process for designating key shark species is largely concerned with data collection and assessment, and that the Commission may adopt CMMs for any or all

shark species on the basis of whatever information is available to it. SC7 agreed to recommend the proposed process to the Commission as amended in the preceding paragraph.

b. Stock status of key shark species included in the WCPFC Shark Research Plan

Summary of EB-WP-03 (Analyses of Catch Data for Oceanic Whitetip and Silky Sharks reported by Fishery Observers in the Hawaii-based Longline Fishery in 1995-2010)

388. Keith Bigelow presented analyses of catch data for oceanic whitetip and silky sharks reported by fishery observers in the Hawaii-based longline fishery in 1995-2010 (EB-WP-03). This report presented descriptive statistical summaries and generalized linear model (GLM) analyses of catch data for oceanic whitetip shark *Carcharhinus longimanus* and silky shark *C. falciformis* in the Hawaii-based pelagic longline fishery. This paper is a collaborative effort begun at the Secretariat of the Pacific Community (SPC) in New Caledonia and completed at the NOAA Fisheries Pacific Islands Fisheries Science Center (PIFSC) in Hawaii. The data were collected by fishery observers aboard commercial vessels in 1995–2010. Oceanic whitetip shark mean annual nominal CPUE decreased significantly from 0.428/1,000 hooks in 1995 to 0.036/1,000 hooks in 2010. This reflected a significant decrease in nominal CPUE on longline sets with positive catch from 1.690/1,000 hooks to 0.773/1,000 hooks, and a significant increase in longline sets with zero catches from 74.7% in 1995 to 95.3% in 2010. Oceanic whitetip shark CPUE was standardized by delta-lognormal and zero-inflated Poisson GLM methods. The latter method was employed because 90.1% of the longline sets caught zero oceanic whitetip sharks.

389. Four factors (16 haul years; calendar quarters; deep- and shallow-set fishery sectors; eight fishing regions) were significant explanatory variables in these analyses. Sea surface temperature was a significant continuous explanatory variable in a binomial GLM of the presence or absence of oceanic whitetip shark catches. The haul year effect coefficients from these models were used to compute indices of relative abundance. These time series were highly correlated, and each was also highly correlated with the time series of nominal CPUE. The silky shark catch data differed from the oceanic whitetip shark data in four major respects. The first was that nearly all silky sharks are caught on deep sets. The second was that most (62.5%) of the silky shark catch was taken from 0-10^{0}N, although only 3.4% of the observed fishing occurred in those latitudes. The third difference was that sample sizes were very small before 2000.

390. Finally, although 46.3% of the longline sets from 0-10^{0}N caught zero silky sharks, 54.5% of the silky shark catch in these waters was taken on 11.5% of the longline sets, which caught ≥5 silky sharks. These differences led to use of the data from 0-10^{0}N in the deep sector from 2000–2010 in the GLM analyses, which were fitted by delta-lognormal and quasi-Poisson (i.e., over-dispersed) methods. These GLM analyses had low explanatory power. Silky shark CPUE has ranged from 0.034/1,000 hooks to 1.840/1,000 hooks, but with no significant trend. Therefore, it is concluded that the relative abundance of silky shark in tropical waters exploited by this fishery, particularly near the Line Islands, has remained fairly stable since 2000. This was not the case with oceanic whitetip shark, which has apparently undergone a highly significant decline in relative abundance in this fishery since 1995.

Discussion

391. Some CCMs asked if any seasonal patterns in catch were seen for the two species in the Hawaii observer dataset and if there was any effect on catch by set depth. The presenter replied that no seasonal pattern for CPUE was seen for either species. The presenter also noted that oceanic whitetip sharks are epipelagic and similar catches were observed in both shallow and deep sets. For silky sharks, however, catches have only been observed in the deep sets in more tropical waters. As the Hawaii shallow set

fishery does not operate in that area, no conclusions can be made as to whether catches for silky sharks might vary by set type.

Summary of EB-WP-03 (Analysis of North Pacific shark data from Japanese commercial longline and research/training vessel records)

392. Shelley Clarke presented an analysis of North Pacific shark data from Japanese commercial longline and research/training vessel records (EB-WP-02). These analyses included North Pacific longline operational data from research and training vessel surveys (1992-2008) and commercial longline logbook records (1993-2008) provided by Japan for onsite analysis in Shimizu during January-March 2011. Both data sets required filtering to remove records believed to under-report actual shark catches. The analysis was based on 7,974 sets representing 10 vessels in the research and training vessel surveys and 88,129 sets representing 112 vessels in the commercial longline fleet. Application of different filtering methods could result in larger sample sizes, but this benefit would need to be weighed against the probability of increasing the presence of under-reported catches in the filtered database. When considering the selection and application of data filters it is important to recall that if vessels began releasing/discarding (and not reporting) sharks in recent years, filtering may not fully correct for this effect, and declining catch rate trends would thus potentially be exaggerated. On the other hand, if reporting practices do not change but shark stock abundance actually does diminish over time, declining catch rates would be expected. The challenge was to apply a filter which removes those catch records which are under-reported, but retains those which are low but accurate.

393. Filtered data were examined in terms of five potential indicators of fishing pressure: distribution, catch composition, catch rate, targeting and size. Blue sharks, which dominate the shark catch in the North Pacific, showed declining catch rates in research and training vessel surveys but a strong trend of increase in commercial records until 2005 and declines thereafter. Evidence of blue shark targeting was found in the increasing concentration of effort in areas of high catch rates. Mako sharks comprise a small proportion of the catch (<10%) but "effective" targeting may be increasing as a result of targeting of co-occurring blue sharks. Mako catch rates showed an increasing trend in both data sets until 2006 for the main commercial fishing grounds in the western North Pacific. Decreasing catch rate trends were shown for makos in both the central North Pacific and western North Pacific since 2006. Oceanic whitetip and silky shark catch rates showed declines in the research and training vessel data and were rarely recorded after 2005. There was also some evidence for a trend of decreasing size of both males and females of these species in recent years. Thresher sharks were analysed as a group and results are expected to mainly reflect the status of bigeye thresher. An increasing trend was found in the research and training vessel data and an inconclusive pattern in the commercial data.

Discussion

394. There was discussion on the concentration index, filtering, differing trends in blue shark CPUE in the commercial versus research/training data, factors considered in the standardization process, and whether changes observed were due to differences in the presence or absence of sharks, or to the number of sharks caught when catches are made. It was noted that the Japanese training vessel trips are conducted for the purposes of training students to become fishermen. For safety reasons, there is general uniformity in their set and operational styles onboard training vessels. Additionally, most training vessels operate in different seasons or areas from commercial vessels in order to avoid interfering with commercial operations.

Summary of EB-WP-01 (An indicator-based analysis of key shark species based on data held by SPC-OFP)

395. S. Clarke then presented an indicator-based analysis of key shark species based on data held by SPC-OFP (EB-WP-01). Both longline and purse seine log-sheet datasets suffer from missing shark catch records and a lack of species-specific recording, therefore the indicator analysis was based on observer data only. Shark data from the observer data sets are, however, also constrained by a lack of representativeness, particularly for the North Pacific, and for the purse seine fishery by the physical practicalities of onboard sampling.

396. Shark status indicators in four main classes were assessed: range based on fishery interactions, catch composition, catch rates and biological indicators of fishing pressure (e.g. median size, sex ratio). For blue sharks, which dominate longline catches in most regions, declines in catch rates were observed in nominal and standardized analyses for the northern hemisphere. In the southern hemisphere catch rates declined in the nominal analysis but increased in the standardized analysis in recent years. Both significant increases and decreases in blue shark size were identified. Data for makos in the northern hemisphere were comparatively sparse, although this species is known to be commonly found there. Catch rate analysis showed different trends in different regions and no significant size trends. Oceanic whitetip sharks were once commonly caught in both longline and purse seine fisheries in tropical waters but their presence in observer samples has become increasingly rare over time. Catch rate analyses of data from both longline and purse seine fisheries showed clear, steep declines in abundance. Declining median size trends for oceanic whitetip sharks were observed in all regions and sexes in both fisheries until samples became too scarce for analysis; these trends were significant in the core habitat areas in tropical waters. Silky sharks comprise the largest proportion of the shark catch in both longline and purse seine fisheries in the western tropical WCPO. Silky shark catch rates follow an upward then downward trajectory for both longline and purse seine fisheries. Most catches in both fisheries were juveniles and within the core habitat of the western tropical WCPO significant declines in median sizes were identified for both sexes in both fisheries. The three thresher species have divergent, but not necessarily distinct distributions which, in combination with low sample sizes, produced no clear catch trends for the group. A significant decrease in median size was identified for threshers in tropical areas, most of which are expected to be bigeye threshers

Discussion

397. It was noted that the observer data held by SPC is an amalgamation of data across all fleets that have provided data. There have been changes in some fleet practices over time, and while some of those factors have been considered in this analysis, other factors were not able to be considered due to limited data. Most observer data was concentrated within EEZs, but some occurred on the high seas. It was unknown what amount of observer data was available within archipelagic waters. CCMs interested in examining differences in shark catches by fishing method were advised to ask SPC for assistance since many country reports produced by SPC contain a section on sharks.

398. An industry representative expressed concern that many conservation measures for sharks and other bycatch species have been developed and adopted without the consultation of the industry. Costs to comply with such measures can be quite high, and the industry would like to have input in order to develop practical approaches that would minimize impacts to domestic fleets.

399. There was some discussion on the size of sharks caught by the longline and purse seine fisheries and SC7 was directed to Annexes 7 and 8 in working paper EB-WP-01 for additional information. In general smaller sharks were caught in purse seine fisheries than longline fisheries.

400. Noting declines of blue sharks in the North Pacific, the United States mentioned that some analysis has been done on blue sharks using the Hawaii longline observer data and suggested that this information could be presented next year at SC8.

c. Information relevant to the Shark CMM

401. Shelley Clarke presented a status snapshot of key shark species in the Western and Central Pacific and potential mitigation options (EB-WP-04). This document synthesized all of the shark assessment work completed to date under the Western and Central Pacific Fisheries Commission's Shark Research Plan and discusses existing and potential conservation and management measures for sharks. The current state of eight of the WCPFC's key shark species (blue; shortfin and longfin mako; oceanic whitetip; silky; and bigeye, common and pelagic thresher sharks) in the Western and Central Pacific Ocean is summarized. Various measures implemented to reduce shark mortality due to fishing are examined including the existing WCPFC shark measure and alternative measures applied by WCPFC members in national waters. Measures currently applied by other regional fisheries management organizations are evaluated using WCPO observer data. Conclusions regarding the status of the stocks and the effectiveness of current management measures are presented.

Discussion

402. SC7 thanked SPC for their work on compiling and analyzing information on key shark species in the WCPO. Japan noted that the earthquake and tsunami in March resulted in losses of 30-40% of their fishing vessels and destruction of one of their major fishing ports and associated processing plants. Some Japanese surface longliners continue to operate, but their coastal gillnet fishery has completely stopped its operations. Japanese industry believes it will take at least three years to be able to recover to the point at which they can begin processing shark meat again. Japan further noted that shark meat is an important historical industry and is committed to encouraging full utilization of retained sharks.

403. A CCM expressed support for inclusion of the shark research plan into the strategic plan as well as support for the use of risk based assessments if traditional stock assessments are unable to be carried out due to data limitations. In this case they support further, more detailed analysis planned for 2012 and look forward to a well-considered and constructive approach to revising the shark CMM in 2012. The same CCM expressed support for a 'no retention' and 'prompt release unharmed' for oceanic white tip for longline fisheries that have not already banned wire traces, or implemented compatible measures with equivalent effect, and the replacement of a 'fin to carcass ratio' with a requirement that sharks are landed with fins attached. They also noted that the development of training materials on how to best release sharks would be useful, as bringing sharks on board can be dangerous for fishing crew. SC7 was reminded that there is a paragraph in the existing shark CMM encouraging research on developing methods to avoid or reduce shark bycatch. CCMs were also urged to provide data on key shark species to comply with the data provision requirements of the Commission. Some CCMs felt that a revision of the shark CMM is necessary in order to reduce fishing mortality on blue sharks and oceanic whitetips and to more closely monitor the status of other key shark species. Another CCM noted that it currently has a no retention ban for striped marlin for commercial vessels, and that this has not seemed to impact the fishing, and believed a no retention policy could help to reduce fishing mortality of oceanic whitetip sharks.

404. Some CCMs encouraged collaboration in the timely provision and analysis of data on shark species for scientific purposes. They thanked SPC for progress on development of a shark database and urged all CCMs and stakeholders to provide shark data in compliance with relevant data provision rules of the Commission in the duration of the research Plan's implementation. The importance for reporting of key shark species was re-emphasized as this was a compulsory requirement under the shark measure and also under the Commission binding rules on data provision. Some CCMs continued to support the Plan's aim to explore, compile and better coordinate existing shark research and data, and to improve shark catch data.

405. Some CCMs further stated that SC7 was tasked to review CMM 2010-07 specific to paragraphs on: data provision, fin to carcass ratio, need for revised or new CMMs and update advice on stock status of key shark species. SC7 has been asked to review progress of the Shark Research Plan including plans for shark stock assessments. SC members had a number of proposals which they wished to be reflected in the SC7 advice as follows:

a. support and encourage shark data collection and provision for assessment purposes by all CCMs;
b. support ban on target or incidental purse seine setting and catch of whale sharks in the WCPO
c. support reduction in fishing mortality on oceanic whitetip sharks and blue sharks in the North Pacific and close monitoring on fishing mortality of other key shark species.

406. There were comments made by CCMs during this session expressing concern for whale sharks. A CCM pointed out that under Agenda 5.2, that discussion should be focussed on eight key species. The CCM suggested that whale sharks be discussed under Agenda 5.5.

Recommendations

407. SC7 is concerned about the steep declining standardized catch rates and size trends of oceanic whitetip shark caught by longline and purse seine fisheries in the Western and Central Pacific. This species should be prioritized for further investigation in the second year of the Commission's Shark Research Plan to provide a better understanding of fishery impacts to this species.

408. SC7 recommended that the WCPFC8 consider mitigation measures for oceanic whitetip sharks in the Convention Area and blue sharks in the north Pacific on the basis of existing information both presented to SC7 and available from other studies.

409. Current shark research plan is scheduled to conduct a stock assessment on oceanic whitetip sharks and silky sharks for SC8 and on blue sharks for SC9.

410. Recognizing the considerable body of work on shark catch mitigation including non-retention and live-release, deeper hook deployment on longlines (for epipelagic species), use of circle hooks, and prohibition on targeting, finning and wire leaders, SC7 further recommends SC8 consider investigations into the effectiveness of mitigation measures for sharks.

411. SC7 recommended that WCPFC adopt the process for designating WCPFC key shark species for data provision and assessment.

5.3 Seabirds

Summary of EB-WP-07 (Distribution of seabird bycatch at WCPFC and the neighboring area of the Southern Hemisphere)

412. Yukiko Inoue presented distribution of seabird bycatch at WCPFC and the neighboring area of the Southern Hemisphere (EB-WP-07). This paper described distribution of the bycatch CPUEs of those species in the ocean of the Southern Hemisphere, and examined their spatial and seasonal patterns. Data from scientific observer programs, data from fishing boats for high school training and data from chartered research boats were used for the analyses. Bycatch CPUE (number of seabirds/1000 hooks) was calculated by species or species groups, and its spatial distribution was presented by 5 x 5 degree blocks.

By-catch CPUEs of seabirds were the highest in the Tasman Sea in the WCPFC convention area but the value was smaller than that in high interaction areas beyond the WCPFC convention area.

413. In the southern WCPFC area, bycatch CPUE of albatrosses was observed to be greater than that of petrels. Albatross species, mostly wandering albatrosses, black-browed albatrosses, Buller's albatrosses and shy albatrosses were caught in the Tasman Sea. On the other hand, white-chinned petrels and flesh-footed shearwaters, which are thought to dive deeper than albatrosses and frequently by-caught in the Atlantic and Indian Oceans, were not caught in the Tasman Sea. Albatrosses at a higher conservation risk are exclusively caught in the area south of 25 degree S. With the data from the WCPFC convention area, capture of white-chinned petrels did not statistically account for simultaneous capture of albatrosses and giant petrels.

414. Previous studies showed that the interaction of white-chinned petrels with baited hooks exceeded the bycatch of albatrosses in pelagic longline off South African waters, and relatively lower CPUEs of total albatrosses in the WCPFC area than the others could be at least partially attributed to this fact. However, in the case in the Tasman Sea, albatrosses with higher conservation risks such as wandering albatrosses were by-caught without diving seabirds. It is likely that the bycatch mechanism in the Tasman Sea differs from that off South Africa. To clarify the mechanism, more data and research are needed in the Tasman Sea.

Discussion

415. The SC thanked Japan for the valuable presentation of these data, and noted that the data highlight some previously little known areas for seabird bycatch. Clarification was sought on the species caught most frequently by the Japanese fleet: black-browed albatross were caught in the highest numbers in the WCPFC Area, but wandering albatross were the species caught in highest numbers in the Tasman Sea. The authors did clarify that it was indeed, the CPUE of wandering albatross that was higher. The SC noted that the differentiation between systems with and without white-chinned petrels, as described in the paper, could be useful in relation to refining effective mitigation measures. Some CCMs noted that the paper proposes that the Tasman Sea differs from other areas in not having a white-chinned petrel dominated system. However, other species of diving petrel occur in the area, and the SC supported Japan's conclusion that further research in the Tasman Sea would be valuable.

416. The presenter was also queried on whether there was any consistency in mitigation measures applied in all three oceans. The presenter indicated that the data they have obtained shows there is consistency in the mitigation measures applied in each ocean, but that they have only been used in recent years since CCSBT required seabird mitigation.

417. SC noted that the GLM undertaken in the paper was preliminary and there may be other appropriate methods with which to analyse the data. Clarification was sought on whether the observer data were representative of the commercial fleet as a whole, and whether the analysis had been able to take into account spatial variations in the use of bycatch mitigation measures. The majority of the data are from the CCSBT fishery, representative of the spatial distribution of the fleet, though not covering all seasons. The presenter noted that the CCSBT vessels would have used tori lines, but agreed that the data could be affected by historical changes in use of mitigation measures and noted that Japan plans further analyses on the dataset in the future.

418. The SC noted that the paper identifies seabird bycatch as occurring south of 25°S, confirming the results of the recent WCPFC ERA for seabirds (presented to SC6). The SC also noted a recent publication by Chinese Taipei which documents seabird bycatch occurring in the South Pacific from 25°S. The SC noted that these data should be considered in relation to a future update of the existing seabird CMM, and

that data from other fleets are needed as important data gaps remain. The SC also noted that the currently-available analyses aggregate data to a 5x5 degree grid, and that it would be valuable to examine these further at a finer spatial scale. CCMs supported the recommendation in the paper that an integrated approach between the Pacific, Atlantic and Indian Oceans in relation to seabird bycatch mitigation would be useful.

Summary of EB-WP-09 (A comparison of two blue-dyed bait types for reducing incidental catch of seabirds in the experimental operations of the Japanese southern bluefin tuna longline)

419. Daisuke Ochi presented a comparison of two blue-dyed bait types for reducing incidental catch of seabirds in the experimental operations of the Japanese southern bluefin tuna longline (EB-WP-09). This document reported an experiment to evaluate the effects of blue-dyed squid and fish baits for reducing incidental catch of seabirds in the Japanese longline fishery survey cruises. The surveys were conducted by Matsuei-maru No.3 in 2001, Fukuseki-maru No.33 in 2002 and Fukuryu-maru No.21 in 2003 off South Africa in the Southern Ocean. Squid and fish (sardine, striped mullet and mackerel) were used as bait during the surveys. Results showed that the incidental catch of seabirds was lower for both blue-dyed squid and fish baits than that for non-dyed baits. A marked difference was recorded in the catch rate of seabirds by the Fukuseki-maru No.33, and no seabirds were taken by the Matsuei-maru No.3 and Fukuryu-maru No.21 when blue-dyed baits were used. Both blue-dyed squid and fish baits were effective for reducing the incidental catch of seabirds as compared with both non-dyed squid and fish baits. The results also indicate that deploying a combination of blue-dyed bait and tori-line is quite effective in avoiding seabird bycatch in tuna longline fishery.

Discussion

420. The SC thanked Japan for this analysis. Clarification was sought on whether the dataset also included data on the effectiveness of blue dyed bait in reducing seabird bycatch during gear retrieval. The presenter noted that in the case of the Japanese longline fishery, few birds are caught on the haul. This is considered to be related to the fact that hooks are retrieved rapidly from depth to deck. For future experiments on the effectiveness of blue-dyed bait, it was noted that an effective experimental design may be to alternate dyed and un-dyed baits, to reduce potentially confounding variables. If the experimental design is not reviewed it may cause SC to reach the wrong conclusions, hence incorrect advice. The segmentation to be used for collecting the data should be revised to (blue dyed bait, normal coloured bait, blue dyed bait, normal coloured bait) so that the data is independent and not biased.

Summary of EB-WP-10 (Seabird interaction rates estimated from observer data (2004-2011) in the Hawaii-based shallow and deep-set longline fisheries)

421. Keith Bigelow presented an analysis of seabird interaction rates estimated from observer data (2004-2011) in the Hawaii-based shallow and deep-set longline fisheries (EB-WP-10). Seabird interactions have occurred in both the shallow (swordfish targeting) and deep-set (tuna targeting) U.S longline fisheries that are based in Hawaii. Part 1 of the U.S. Annual Report of the WCPFC (2010) contains estimates of observations for all U.S. longline fisheries and this report characterizes observed seabird interactions and operational attributes of Hawaii-based longline fleet disaggregated by the shallow-set (n=10.297 sets), deep-set at or north of 23ºN (n=10,263) and south of 23ºN (n=15,675). The report analyses observer data from 2004 to May 2011, a period after substantial mitigation methods were mandated in the fisheries. The annual observed interaction rate in the shallow-set fishery which does not use a line shooter averaged 0.044 seabirds per 1,000 hooks (2004–2010 range=0.009–0.066). The annual observed interaction rate in the deep-set fishery which use a line shooter at or north of 23ºN averaged 0.009 (range=0.002–0.014) and 0.002 (range=0.001–0.005) to the south of 23ºN. The ratio of seabird

interaction rate between the shallow fishery and deep-set fishery is 4.73 and 22.91 for deep sets at or north of 23ºN and south of 23ºN, respectively.

Discussion

422. The SC welcomed the detailed description of fishery operations presented in this paper. However, some CCMs commented that the two fisheries described in the paper differ in several respects, including time of set, and that it is therefore not possible to conclude from this paper whether line shooter is, or is not, an effective bycatch mitigation measure for seabirds. The results may have been more informative if data could have been collected for analysis from deep setting vessels that have and those that fish without line shooters. The presenter suggested that currently there are no fishermen deploying deep sets when not using line shooters, because attaining a deep longline set (deepest hook ~ 250m) with a monofilament longline is impossible. The industry transitioned from rope to monofilament gear 20 years ago.

423. The SC noted that controlled experiments provide the most reliable source of information on the effectiveness of bycatch mitigation measures. At the same time, the SC acknowledged that seabird bycatch mitigation research is costly, and that the desire to establish a robust experimental design is often constrained by logistical limitations in the fishery.

424. The SC noted that the paper identified that most birds were caught in the shallow set fishery during gear retrieval, which takes place after sunrise, and that most birds were released alive but injured. Clarification was sought on whether there was a reason that fishermen choose to haul after sunrise, and whether there are data available on degree of seabird injury or post-release survival. Time of haul is believed to relate to the time needed for fishermen to rest between operations. The US has considered refining its categorization for injured birds, but concluded that this introduces problems of subjectivity between observers.

425. Some CCMs stated that the current CMM measure continued to provide the basis for adequate protection to seabirds in areas where interactions have historically occurred. However, some CCMs welcomed current recent research and trials on weighted branch lines, use of dead baits and live baits, use of blue-dyed bait, location of latitudinal boundary and deep setting line shooter. The main outstanding issue was the lack of information on implementation of key elements including the technical specifications for mitigation measures. Some CCMs reiterated that the current technical specifications for the mitigation measures in CMM 2007-04 should remain in place, until further information or proposals to modify the technical specifications were further discussed through SC process.

426. In addition, some CCMs noted that spatial risk indicators with longline fisheries in the WCPO require gathering of further information to enable areas where high levels of interaction occur to be identified. Some CCMs also noted low interactions in the subtropical and tropical regions, and the suggestion to shift the latitudinal line northwards to 25 South. They look forward to considering further information on this issue at the SC to assess whether such a shift is required.

427. The SC reaffirmed its recommendation from SC6 that the TCC may want to consider treating the North and South Pacific separately in future revisions of the CMM 2007-04, as long as such a revision is based on advice accepted by the SC, and does not weaken the existing measure. It was noted that the consideration of seasonal patterns, such as those presented in EB-WP-07, was useful, and that this should be considered in working towards a revision of the current seabird measure, which could perhaps be considered at SC8.

428. The SC welcomed the data submitted by members at this meeting. Several members noted that a key issue was lack of data, including lack of data on the implementation of the existing seabird bycatch

mitigation measure. It was also noted that the WCPFC Ecological Risk Assessment for seabirds has identified areas where more data need to be collected, and that consideration of further information is needed in order to consider whether a shift of latitudinal boundary is required. Some CCMs welcomed further analysis, but expressed the view that current data do not suggest the need to extend CMM 2007-04 into equatorial waters.

429. Finally, it was noted by SC7 that in relation to improving the existing seabird CMM, the key issue is the current limitations of the data. Moreover there is an onus on flag states to demonstrate that they do not have a problem in relation to seabird bycatch. CMMs were encouraged to consider how improvements may be made to the observation and recording of seabird interactions for inclusion in the national country reports.

Recommendations

430. SC7 noted no management recommendations were formulated so the management recommendations from SC6 are still current.

431. SC7 encourages further research and the exchange of information inter-sessionally with the view towards evaluating the effectiveness of CMM 2007-04 at SC8

5.4 Sea turtles

No issues were discussed on sea turtles.

5.5 Other species and issues

a. Guidelines for the release of encircled animals

432. Following an introduction to the project by V. Restrepo (ISSF), D. Itano (PFRP) presented the status of the purse seine bycatch mitigation project and research cruises funded by the International Seafood Sustainability Foundation with notes on the development of best practices for the live release of encircled animals (EB-WP-11). The status and future plans of the ISSF funded project were described that will support research cruises on purse seine vessels in all oceans to conduct FAD associated bycatch reduction research. A steering committee consisting of scientists from all tuna RFMO regions agreed to prioritize research on the reduction of fishing mortality of bigeye tuna and tunas of undesirable size and pelagic sharks that are taken in associated sets while research on other bycatch species (marine turtles, other finfish) will also be addressed. The steering committee agreed the project should be conducted in all ocean basins exploited by large-scale tropical purse seine fisheries to test the influence of local oceanographic conditions on potential solutions to bycatch reduction.

433. A list of potential research activities was developed to investigate potential mitigation measures that could be implemented: (a) before arriving at a FAD, (b) immediately before the set, (c) after the set during net retrieval, and (d) from the vessel after catch loading has commenced. The planning of research priorities and cruises has been assisted by a series of Skippers Workshops in Europe, Africa, Latin America and the WCPO to benefit from the knowledge of purse seine captains and crew who are highly experienced with FAD fishing in their respective regions. Research cruises have been completed in the western Indian and the Eastern Pacific Oceans and are being planned for implementation in the eastern Atlantic and the WCPO for early 2012. The project will also assist in the development of best practices for the live release of encircled animals (whale sharks, manta rays and mobula rays) as well as procedures for the safe handling and live release of oceanic sharks. In a related development the government of Papua New Guinea has provided funding to the WCPFC to be applied toward FAD bycatch mitigation

research. The ISSF project steering committee will meet again in San Diego, California on 21-23 August 2011 to review progress to date and refine research priorities and plan the Atlantic and WCPO cruises.

Discussion

434. Japan outlined a draft guideline of best practice for dealing with whale shark in purse seine nets with an emphasis on releasing the whale shark as quickly as possible without endangering the crew. Japan provided these draft guidelines (Attachment I).

435. CCMs noted that the Japan proposal was a good starting point for further consideration.

436. Some CCMs noted that papers prepared by SPC indicated that "it is clear that purse seine sets on whale sharks are a combination of both targeted sets and inadvertent capture. Interactions with toothed whales appear to be mostly incidental rather than set targeted specifically at these animals. On the other hand, most sets on baleen whales do appear to be targeting a specific interaction, even if temporary, between the whales and tuna"(WCPFC7-2010-IP/01). Some CCMs informed the SC7 that they will be proposing a ban on targeted sets on whale sharks and cetaceans at WCPFC8.

437. FFA members noted that they had submitted a proposal to WCPFC7 to prohibit purse seine sets on whale sharks while they continue to support that measure they noted the need for release guidelines. They thanked Japan and the presenter for the information provided.

438. Some CCMs noted that there was a considerable body of work on the release of cetaceans, in particular dolphins and porpoises which had led to the development of standard practice to release these animals but that no similar standards had been developed for the release of whale sharks.

439. Some CCMs advised that sets associated with whale sharks were banned under a PNA measure which took effect from January 1st 2011. As part of this measure, PNA procedures require that if a whale shark is inadvertently encircled in the purse seine net, the master must ensure that all reasonable steps are taken to ensure its safe release, including by stopping the net roll and not recommencing fishing operation until the shark has been released.

440. Given the range of circumstance that the handling guidelines should cover, it was agreed that an electronic working group, led by the Ecosystem and Bycatch Convenor, be established to review (by email) the development of a proposal to be put forward for consideration by TCC7 and WCPFC8.

441. With regard to the ISSF bycatch mitigation project, some CCMs noted the importance of consulting with coastal states in the development and undertaking of activities under this project.

442. It was noted that CCMs, including all relevant coastal states will be incorporated into the notification and planning process leading up to the bycatch reduction research to be implemented in the region.

Recommendations

443. SC7 recommended the following:

a. SC7 supports avoiding any mortality of whale sharks and cetaceans by fishing activities.
b. SC7 supports the development of best practice guidelines for release of encircled whale sharks without injury while considering the safety of the crew.

c. SC7 supports the development of best practice guidelines for release of encircled cetaceans without injury while considering the safety of the crew.

d. SC7 recommends that the guidelines mentioned in b. and c. above be developed by an electronic discussion group led by the convener of the Ecosystem and Bycatch Theme. The results from this group should be forwarded from SC to the TCC7 for further consideration by WCPFC8.

b. FAD bycatch mitigation

444. Kurt Schaefer presented an overview of the 2011 ISSF/IATTC EPO purse seine research cruise for investigating potential solutions for reducing fishing mortality on undesirable sizes of bigeye and yellowfin tuna and sharks, when associated with drifting FADs (EB-WP-13). Schaefer presentation documented the results of a 73-day research cruise undertaken, during the period of May 11 to July23, 2011 to the equatorial eastern Pacific Ocean (EEPO) aboard the Ecuadorian-flag purse-seine vessel Yolanda L., under a charter agreement between the vessel owner and the International Seafood Sustainability Foundation (ISSF), and in collaboration with the Inter-American Tropical Tuna Commission (IATTC).

445. There were five specific research activities, upon which the scientific committee of the ISSF by-catch program agreed fit within the objectives of the overall project, and should be undertaken during this first cruise to the EEPO.

446. The first objective was to test different designs of FADs that may not entangle turtles or sharks, including the potential for using biodegradable materials.

447. The second objective was to evaluate the accuracy of the catch predictions by the fishing captain from the tuna aggregations associated with FADs, and the potential improvements in those estimates through the use of additional complimentary equipment and methods.

448. The third objective was to determine whether there were spatial and/or temporal differences in the behavior of skipjack, bigeye, and yellowfin tuna within aggregations associated with FADs, in order to reveal potential opportunities for avoiding the capture of undesirable sizes of bigeye, yellowfin, and other non-target species, while maximizing the capture of skipjack tuna.

449. The fourth objective was to investigate the behavior of tunas and sharks captured within a purse-seine net, to determine if species-specific aggregations occur, and the spatial and temporal characteristics of such aggregations, if they exist.

450. The fifth objective was to determine the at-vessel mortality, post-release survival, and the physiological, biochemical, and molecular responses of sharks incidentally captured by purse seiners.

Discussion

451. The Chair noted that the SC had an opportunity to provide input into future experiments conducted within the ISSF purse seine bycatch mitigation study as it will be conducted in the WCPO.

452. A CCM asked to what depth the ROV could be deployed. It was noted that the maximum dive depth of the ROV was 200m, but that it had only been deployed to a maximum depth of around 80m with tuna schools in the EPO. It was also noted that below 50m it was too dark to work effectively and that the sound of the ROV dispersed the tuna. Drop cameras may therefore be more effective in future.

453. A CCM noted that the focus on purse seine FAD bycatch mitigation was the reduction of the catch of juvenile bigeye and that work relating to the limiting the depths of nets in the Philippines has shown some positive results.

454. A CCM noted the important collaboration with industry in conducting the project but noted that the cost of chartering vessels was beyond the ability of some CCMs to undertake. It was noted that ISSF intends to charter vessels within the region when similar studies are undertaken in the WCPO.

455. A CCM asked whether there was any information in relation to shark and turtle mortality due to entanglement on regular FADs and duration that regular FADs could be expect to last as compared with eco-FADs. The likelihood of FAD loss was considered to be low given the regular "exchange" of FADs among fishers, so it is not realistic to believe that many FADs are lost and pose a risk of "ghost" fishing. It was also noted that very low numbers of turtle entanglements have been recorded by IATTC observers where FADs are lifted as a normal part of purse seine operations and the aprons checked by observers.

456. FFA members also noted that it was important that food security related issues be considered in the work program of the WCPFC. It was suggested that the starting points be:

a. a preliminary assessment of the volumes of food fish discarded in regional tuna fisheries, especially in tropical fisheries near developing states (conducted by SPC), and;
b. a proposal for the WCPFC to begin looking at the impact of tuna fishing on key food stocks, noting that Resolution 2005-03 identified mahi mahi, rainbow runner and wahoo as important for sustainable livelihoods.

Recommendations

457. SC7 also noted that it was important that food security related issues be considered in the strategic research plan of the SC. It was suggested that the starting points be:

a. a preliminary assessment of the volumes of food fish discarded in regional tuna fisheries, especially in tropical fisheries near developing states (conducted by an agency such as SPC), and;
b. a proposal for the WCPFC to look further at the impact of tuna fishing on key food stocks, noting that Resolution 2005-03 identified mahi mahi, rainbow runner and wahoo as important for sustainable livelihoods.

c. Kobe III Bycatch Working Group Report

458. Simon Nicol presented EB-WP-14 which reported on the first meeting of the Kobe process joint technical working group on bycatch and provided a provisional summary of progress on implementation of the Kobe II recommendations for review inter-sessionally by the scientific committee. The presentation outlined the 12 month work plan for the technical working group. Activities include:

a. Harmonization of data collection which will specify the minimum data standards and data fields that should be collected across all RFMOs with a view to allowing interoperability;
b. Development of harmonized identification guides and release protocols for seabirds, sharks, sea turtles and marine mammals;
c. Identifying and recommending research priorities for collaborative work on bycatch by RFMOs; Progressing the WCPFC BMIS database website to encompass needs of all RFMOs;
d. Collaboration on ecological risk assessments by RFMOs for sharks.

459. The future of the working group will be determined by the RFMOs after completion of this work plan.

Discussion

460. A CCM expressed concerns with regard to the fact that there was no limit on the number of participants in the working group. However, the working group was unlikely to become unwieldy since the specific interests of members will be focussed over a range of issues. It is therefore intended to maintain open participation in the working group to all members and to review its progress in 12 months' time.

461. A CCM reiterated the importance of the inclusion of food-security related issues into the Ecosystem and Bycatch Management Working Group

d. Summary of EB-WP-12 (Review of Chinese scientific observer programme in the Pacific Ocean in 2010)

462. Dr Dai Xiaojie presented a review of Chinese scientific observer programme in the Pacific Ocean during 2010 (EB-WP-12). During 2010, observers were trained and dispatched to four Chinese longline vessels operating on the high seas of Central and Eastern Pacific Ocean.

i. Trip 1 covered the time period from Aug 26 to Dec 19, 2010, in the areas of N10°21′-S9°46′, E178°58′～W152°15′.
ii. Trip 2 covered the time period from Sep 25 to Jan 17, 2011, in the areas of S03°46′～S09°26′, W149°52′～W154°19′.
iii. Trip 3 covered the time period from Oct 2, 2010 to Jan 13, 2011, in the areas of N6°00′～S10°49′, W169°05′～W146°50.
iv. Trip 4 covered the time period from Oct 13, 2010 to Feb 19, 2011, in the areas of N4°38′～S14°45′, E178°01′～W130°07′.

463. The observers collected all the data of catch captured by longline fishing gear. Observers also measured bycatch information including discards.

Discussion

464. The initiative of China in placing observers on board vessels was commended by SC7, particularly given the large size of the Chinese longline fleet.

465. A CCM asked whether photographs had been taken to assist in species identification as the figures presented in relation to the catch of some sharks, for example oceanic white-tips, appear to be higher than expected. Another CCM concurred with this observation since the high incidence of oceanic whitetip sharks appeared to be atypical for longliners operating the gear configuration of the vessels being observed (using line shooters and deep sets). Misidentification of these sharks seemed possible. It was noted that photos were not being taken but that the observers were trained for one week which included species identification prior to undertaking trips and given SPC identification manuals.

466. A CCM noted that only 80 per cent of the catch was recorded and asked whether line retrievals were observed for their entire duration or only partially. China advised that observers overall worked for about 80% or more of the time taken for line retrievals due to their long duration.

467. A CCM asked whether there were plans to increase the level of observer coverage on Chinese longline vessels. China advised that observers had been deployed only on large freezer vessels undertaking lengthy trips from bases on the mainland, and not on board smaller ice boats operating

offshore. There was the intention to deploy observers on small offshore vessels in the future, and in 2011 the number of observers was increased in order to meet the minimum observer requirements of WCPFC. China advised that it shall conduct observer programmes according to Commission requirements.

468. A CCM sought information on the level of mortality of captured turtles. China advised that the best practice protocols and hook removal equipment developed in the US are provided to captains and crew. Observers record the condition and fate of turtles, including the hook location, and observations are made for each animal (including carapace size). Use is made of the SPC training material for recording this information.

469. Given the endangered status of leatherback turtles, interest was expressed in the high leatherback turtle bycatch relative to other species recorded by Chinese observers. Two CCMs noted that the incidence of leatherback turtle catch rates seemed higher than expected, particularly given the gear configuration used by the vessels. This appeared to be an atypical high incidence in the areas where the vessels were operating but the possibility of leatherback migration routes was discussed. A CCM further suggested that observers collect data on the hook number on which the turtles are caught and the condition of the turtles on capture and release. Moreover, it was noted that turtle interactions were also an opportunity to tag turtles.

470. A CCM asked whether line shooters were used on the vessels during the observed trip. It was noted that this was the case.

AGENDA ITEM 6 DATA AND STATISTICS THEME

471. P. Maru (Cook Islands) convened the data and statistics theme. S. Sauni and D. Tagami were selected as the rapporteurs for agenda items 6.1.a, S. Bishop and J. Amoe were selected as rapporteurs for agenda items 6.1.b and 6.1.c, and S. Hoyle and I. Unterweger were selected as rapporteurs for agenda items 6.2 through to 6.4.

6.1 Data gaps

a. Data gaps of the Commission

472. P. Williams presented SC7-ST-WP-01 *Scientific data available to the Western and Central Pacific Fisheries Commission*.

473. This paper reports on the major developments over the past year with regard to filling gaps in the provision of scientific data to the Commission.

474. All CCMs with fleets active in the WCPFC Convention Area have now provided 2010 annual catch estimates, with the exception of the Vietnamese purse seine and gillnet fisheries. For the first time, several CCMs provided estimates for the key shark species (which is in accordance with the change in the requirements to include the key shark species catches). In general, the timeliness of the provision of aggregate catch/effort data continues to improve with the nearly all CCMs providing data by the deadline of 30th April 2011. The quality of aggregate data provided has also improved with a reduction in the number of notes assigned to the aggregate data in recent years. Some CCMs provided aggregate shark species catch data (e.g. Japan for 1994-2009; Chinese Taipei 2007-2010) for the first time. The key gaps in aggregate catch and effort data include:

- Incomplete spatial coverage in the Chinese longline aggregate data (see SC7 Information paper ST-IP-03) **;**
- Missing shark species data for most CCMs;
- Missing aggregate catch/effort data from Philippines, Indonesia and Vietnam;
- Lack of tuna catch in Spanish longline aggregate data.

475. With respect to operational catch/effort data, all Pacific Islands CCMs have now provided authorisation to SPC to release their historical operational data to the WCPFC, and the USA and EU-Spain have indicated that operational data for their longline fleets will be released for submission to the WCPFC in the near future.

476. With respect to Regional Observer Programme (ROP) data, the following were significant developments in the past year:

- All Pacific Island CCMs have now provided authorisation for SPC to release their ROP data to the WCPFC;
- Authorisation for the ROP data from the two sub-regional observer programmes (US Multilateral Treaty and FSM Arrangement) to be provided to the WCPFC has been granted;
- The WCPFC and SPC/OFP received the following provisions of observer data in recent months:
  - The provision of ROP trip data for a Chinese Taipei longline vessel fishing in 2009/2010;
  - The provision of ROP trip data for US longline vessel fishing in 2010;
  - The provision of observer data to the SPC/OFP for 30+ trips conducted on Philippines purse seine vessels operating in Philippine waters (non-ROP trips) in 2010;
  - The provision of observer data to the SPC/OFP for 6 trips conducted on Vietnamese longline vessels operating in Vietnam waters (non-ROP trips);PFC Other observer data provisions

477. However, there is now a significant backlog in ROP data provision and processing, mainly due to overwhelming stress on the resources of national and regional observer programmes the requirements for 100% coverage in the purse-seine fishery. Improving the provision of scanned data from national programmes to the SPC/OFP remains a significant challenge.

478. The Western Pacific East Asia Oceanic Fisheries Management Project (WPEA OFM) which provides support to the Philippines, Indonesia and Vietnam with respect to establishing tuna fishery data collection and management systems is now into the second of a three-year term. Over the past year, the main developments include:

- More comprehensive port sampling, cannery and logsheet data from Philippines;
- For the first time, Logsheet, port sampling and observer data provisions from Vietnam
- For the first time in more than a decade, Logsheet and port sampling provisions from Indonesian

479. However, there remains significant work to improve the coverage and quality of logsheet, port sampling and observer data, and the reliability of annual catch estimates for certain gears. For Indonesia, the main data gap is the exclusion of the archipelagic waters catches in their annual catch estimates. For the Philippines, the main data gap is the reliability of the historical estimates for their small-scale artisanal

hook-and-line fisheries (70,000 t/year), and for Vietnam, the main data gap is the complete lack of historical annual catch estimates.

480. In regards to the attribution of catch under chartering arrangements, the Solomon Islands notified the WCFPC Secretariat this year that a number of foreign-flagged vessels licensed to fish in the Solomon Islands waters should be considered as chartered to the Solomon Islands. The flag states of these vessels were subsequently contacted and, in at least one case, there appears to be double-counting of catches of these chartered vessels in their annual catch estimates and aggregate catch/effort data which will need to be resolved.

Discussion

481. CCMs noted the importance of accurate and detailed fishery information, including operational level catch and effort data, for more reliable stock assessments. Most CCMs highlighted issues in support of this, that:

a) advice from the external reviewers of the yellowfin assessment stressing that real progress will be achieved through more data and knowledge, rather than more modelling; and,
b) the value that operational data made to several assessments this year.

482. CCMs welcomed the progress on data gaps reported in SC7-ST-WP-01, especially with respect to improvements in data from Indonesia, Philippines and Vietnam, and progress in the provision of operational data from some CCMs. Data on vessel numbers required to be submitted with aggregate catch and effort data to enable the WCPFC to produce and release public domain data in accordance with the 3 vessel rule was provided by one CCM but have yet to be provided by four other CCMs.

483. SC7 underscores the importance on the timeliness of data submission and utility of historical data, particularly with respect to the history of a fishery, to improve stock assessment. SC7 recommends that SC7-ST-WP-01 be forwarded to TCC7 for their consideration. Some CCMs noted the importance of this decision so that the Compliance with Conservation and Management Measures working group can consider it as a priority input to the development of the Compliance Monitoring Scheme.

484. The meeting noted that while most CCMs provided data on time April 30th 2011, there were cases where data were incomplete. One CCM explained that while the timeliness of their data submission has improved, the deadline of data submission (April 30th) is too early to complete compilation for the longline fishery. The SPC Secretariat advised that the resubmission of more complete data at a later date (e.g. July) may be too late for the assessments but are still used in analytical work leading up to SC meetings and therefore the resubmissions of more complete data are encouraged. The meeting also noted that historical data is important and that CCMs should be encouraged to generate historical data that is earlier than what was previously submitted to the WCPFC.

485. The meeting noted that bigeye tuna catch of 4,133 mt taken by Chinese longline vessels in 2009 in waters of Kiribati was not reported in the catch for China nor Kiribati. A question was raised as to the impact on the overall assessment this year and whether this data would be resubmitted. SC7 recognizes the importance of this missing data in projection work that will be carried out after SC7 to better guide management advice. The meeting further noted that this issue should therefore be resolved as soon as possible.

486. The meeting noted that Kiribati has in place bilateral access arrangements which include data provision requirements. The meeting was also advised that China would only make a decision as to

whether this catch should be attributed to China through the TCC process. It was also noted that some Chinese longline vessels have moved into the WCPFC area from the Indian Ocean.

487. The SPC Secretariat explained that the impact of potential under-reporting of bigeye tuna in 2009 and 2010 would result in a more optimistic projections and management advice that would not be an accurate reflection of the actual status.

488. Some CCMs reminded the meeting of a WCPFC7 decision requiring CCMs that are not able to provide scientific data to provide a draft plan to TCC of how impairments to the provision of data will be dealt with. Some CCMs encouraged those CCMs which have yet to notify of their intent to provide operational catch/effort data to give priority to issues associated with the provision of operational data in the plans they provide to the TCC along with issues associated with reporting the vessel number data requited to apply the 3 vessel rule for data release.

489. SC7 noted reporting on valuable information on Scientific Data gaps. Some CCMs offered the following suggestions that could add value to the report:

a) the Report should make it clear that the Scientific data Rules covered by the report are a binding obligation on Commission Members as this has not always been clearly understood in the past;
b) the Scientific Data Rules require that aggregated catch and effort data shall be provided and areas of national jurisdiction and high seas. The Data Gaps report does not seem to cover this requirement and;
c) the report provide information on coverage of this requirement in order to provide more reliable information for scientific analyses of issues such as the projected impact of management options.
d) amend the Scientific Data Rules to provide information in the way the aggregated fisheries data are produced;
e) note that the recent Kobe III meeting recommended that tuna RFMOs establish a common format for reporting on data gaps, and we encourage the WCPFC Secretariat to cooperate with other Secretariats in this direction, while ensuring that the Data Gaps report continues to serve the scientific data needs of the WCPFC.

490. The WCPFC Secretariat reminded the SC that WCPFC7 adopted Kobe II recommendation on the immediate action to prohibit tuna vessels transferring between RFMO areas. This action would provide useful background information to tuna vessels that move from the Indian Ocean to the Pacific Ocean.

491. Some CCMs noted that the problems with longline bigeye catch data which are indicated in the Data Gaps report and information paper (ST-IP-03), indicate very serious failings with the monitoring of the current system of flag based bigeye catch limits. This is a serious problem for the scientific committee because the stock projections show that it is clearly more difficult to assess the impact of the current measures when the Committee is not able to get an accurate estimate of the level of longline bigeye catches.

492. The meeting was asked to consider adopting a better process for submitting data earlier than the 30th April deadline to allow more time for conducting the assessments.

Recommendations

493. SC7 recommended that SC7-ST-WP-01 be forwarded to the TCC, so that the Compliance with Conservation and Management Measures working group can consider it as a priority input to the development of the Compliance Monitoring Scheme.

494. The SC7 recommends that CCMs consider the implications of adding text in the *Scientific data to be provided to the Commission* – Section 5 (the provision of aggregated size data) to be consistent with the requirement to provide information on the statistical methods used to produce other types of fishery data (i.e. Section 1 – Annual catch estimates and Section 4 - Aggregated Catch and effort data). CCMs are requested to report their progress on this issue to SC8. The recommended text to be added in Section 5 is:

The statistical and sampling methods that are used to derive the size composition data shall be reported to the Commission, including reference to whether sampling was at the level of fishing operation or during unloading, details of the protocol used, and the methods and reasons for any adjustments to the size data.

495. The SC7 recommends that CCMs consider the implications of adding text in the *Scientific data to be provided to the Commission* to ensure scientists are provided with information on changes in the way fishing takes place that are not captured in the available data. CCMs are requested to report their progress on this issue to SC8. The recommended text to be added to Sections 3, 4 and 5 in this document is:

Information on operational changes in the fishery that are not an attribute in the data provided are to be listed and reported with the data provision.

496. The SC noted delays in the provision of complete data sets by the April 30th deadline in accordance with the WCPFC data rules '*Scientific data to be provided to the Commission*'. CCMs are encouraged to develop better processes to provide data to the WCPFC earlier than the April 30th deadline, to allow for earlier development of stock assessments and sufficient time for CCMs to consider in advance of SC meetings.

497. The SC noted the importance of historical data to reduce uncertainties in the scientific work of the Commission. SC recommended that CCMs consider ways to improve the submission of historical data, and its use for scientific purposes.

498. The SC encouraged the WCPFC Secretariat to cooperate with other tuna RFMOs to establish a common format for reporting on data gaps, as recommended at the Kobe III meeting.

499. The SC noted the catch attribution issues relating to Chinese longline catches in Kiribati waters and the under-reported catches stemming from 2009 and 2010 by these Chinese vessels licensed to fish in Kiribati. SC encouraged China to resubmit their data for 2009 and 2010. SC noted that Kiribati has not been provided complete records for these data, by China, but would submit it to the Commission if it was provided to them. China claims to have met all their data reporting obligations according to the agreement between Kiribati and China. Noting the influence of the unclaimed bigeye catches (approximately 4,000mt in 2009) on the bigeye assessment and projection outcomes for WCPFC8, the SC forwarded this to the TCC for their consideration. The SC further noted that any projections produced would be more accurate with these data included.

500. The SC noted the increase of Chinese vessels in to the WCPF-CA from waters beyond the WCPO. The SC further noted that Kobe II recommendations state that tuna fishing vessels should not be transferred between different RFMO areas, unless in accordance with the rules of that RFMO..

b. Species composition of purse-seine catches

Summary of SC7-ST-WP-03 (Misreporting of purse seine catches of skipjack and yellowfin)

501. T. Lawson presented SC7-ST-WP-03. The paper summary is as follows:

502. A consultancy agreement between WCPFC and SPC for a project on the collection and evaluation of purse-seine species composition data was first established in April 2009; the project was continued in April 2010 and April 2011. From August 2010 until March 2011, observers were contracted to do paired grab and spill sampling during six trips on purse seiners of Chinese Taipei, Korea and the United States. However, one trip was unsuccessful because the grab sampler disembarked prior to fishing and four were unsuccessful because (a) the crew would not allow the spill sampler to follow the correct sampling protocol and (b) the spill sampler did not effectively communicate with the crew. This situation will improve with the recent recruitment by the OFP of a *Data Collection Officer* for a two-year period with funding from New Zealand. The DCO's initial role will be to undertake spill sampling during paired sampling trips, following which he will be responsible for organising paired sampling trips, and the briefing and debriefing of the spill samplers. Paired sampling onboard a Japanese purse seiner were under discussion when the tsunami hit Japan in March 2011; following the disaster, these trips were postponed.

Discussion

503. The SC acknowledged the work completed to date on project 60 and general support was expressed for the continuation of the work with inclusion of further data to correct for possible biases.

504. Inclusion of the purse seine species catch composition information was identified as important data for inclusion in stock assessments of all tropical species. As the current stock assessment utilised the spill sample-corrected data there was concern regarding the uncertainty of the estimate of selectivity bias for larger fish and the implications of this bias to the current stock assessment. As work to date has come primarily from trips with small fish on anchored FADS; it was agreed that further work needs to collect data from un-associated schools to allow sampling of larger fish that will provide better estimates.

505. Some members noted with disappointment the lack of effectiveness of the project activities and support the proposals for the SC to recommend the no-cost extension for the project to January 2012 and to review the financial status of project 60 at SC8.

506. To improve the availability and use of purse seine composition data, the SC suggested the scope of work for Project 60 be amended to include the provision of a plan for improvement of the availability and use of purse seine catch composition. This plan should form the basis of the recommended review of the project to be conducted at SC8. Some members preferred this plan be made available for consideration at WCPFC8.

507. Japan offered to support through paired sampling of catch through grab and spill on Japanese vessels in the future to provide a comparison with species composition of port sampling of landing

categories. The 3 regions where these comparisons are possible are 1) Japan 2) Pago Pago (Samoa) and 3) Noro (Solomon Islands). The project is looking to put new data collection officers in Noro to do these comparisons.

508. The SC noted that the SPC receives ISSF cannery data on a quarterly basis and recommends better understanding on species sorting for possible use in data analysis. It was reported that SPC continue to receive ISSF data and it is appreciated as there has been limited use of it in the past. One of the issues is when there are categories of small fish – whether there is species sorting and catches by species in the smallest category of fish in some of the cannery data that is received. Data from new ISSF participating companies were received last year.

Recommendations

509. The Scientific Committee noted the importance of this work and therefore recommends a no-cost extension of Project 60 through 2012, and the SC will review the financial status of the project at SC8.

510. The SC requested that the scope of work for project 60 be amended to include the provision of a plan for improvement of the availability and use of purse seine catch composition data applying the results from the Project. This plan should form the basis for the recommended review of the future of the Project to be conducted at SC8. This plan should be available for consideration by the Commission at WCPFC8.

Summary of SC7-ST-WP-02 (Misreporting of purse seine catches of skipjack and yellowfin)

511. J. Hampton presented SC7-ST-WP-02. A summary of the paper is provided below:

512. This paper compares logsheet-declared estimates of species composition, in particular the percentage of skipjack in purse seine sets (%SKJ), with independent estimates provided by observers. The main findings are as follows:

a) The %SKJ in observed associated sets is substantially higher on logsheets compared to estimates derived from the visual estimates of purse seine catch by species by observers;
b) The %SKJ in observed unassociated sets is also over-reported on logsheets in comparison to observers' estimates, but the difference is not as great as for associated sets;
c) For many fleets, the frequency of associated sets declared on logsheets as containing 90-100% skipjack appears to be unrealistically high (~63% of sets as declared on logsheets, compared with ~23% of sets as recorded by observers);
d) The visual estimates of species composition provided by observers are reasonably consistent with their sampling data;
e) These results support the current methodology of estimating the three-species (skipjack, yellowfin, bigeye) species composition of purse seine catches using observer sampling data (corrected for 'grab' sampling selectivity bias), as compared to the previous method of using the sampling data to disaggregate only yellowfin and bigeye tuna; and

513. The apparent consistency between the observers' visual and sample-based estimates of species composition is encouraging and may allow greater use of the visual estimates to be made in routine fishery monitoring.

Discussion

514. CCMs acknowledged the work completed on the misreporting of purse seine catches on logsheets and the importance of this work in relation to stock assessments.

515. With respect to the accuracy of observer visual sampling; although species composition won't be 100% accurate there is a large amount of data aggregated over a long time period and this gives a significant difference in terms of the trends it is showing. Members noted the encouraging conclusion that observer visual and sample based estimates of the skipjack proportions were generally consistent and recommended further work towards utilising observers' visual estimates of purse seine species composition in routine fishery monitoring.

516. It was asked if there were any reasons to explain the observed discrepancy of percentage skipjack reported being larger for associated sets than for un-associated sets. Although no definitive answer could be provided one possible explanation could be that associated sets are primarily smaller fish, and there may be no price differential between species at this size. If no price differential exists then there may be less impetus to report. This issue could be addressed through education with skippers.

517. A suggestion was put forward to use information of species composition from canneries as a comparison. Although this has been considered, a problem with this approach is that possibly the same sort of mixing is occurring in the cannery statistics and thus these data are not likely to be definitive. Individual records are frequently only partial catches from individual vessels, as vessel catches may get split up and go to different canneries, making it increasingly difficult to compare log sheet with cannery records.

518. With respect to misreporting, several members request that SC7-ST-WP-02 be referred to the TCC, noting the importance of accurate purse seine catch composition data for scientific purposes, and requesting that the TCC recommend actions to end the misreporting.

519. The Convenor noted additional information papers relevant to this agenda item; SC7-ST-IP-02, SC7-ST-IP-07, and SC7-ST-IP-09.

Recommendations

520. SC7 noted inconsistencies amongst fleets in the reporting of skipjack and yellowfin+bigeye on purse seine logsheets, and considering the importance of accurate purse seine catch composition data for scientific purposes, recommended that ST-WP-02 be referred to the TCC.

c. Data issues with the ISC

521. The WCPFC Science Manager, S. Soh, provided a brief report on the progress of reconciling inventories of data holdings of WCPFC and ISC.

522. A WCPFC data holdings inventory was sent to ISC on 4th July 2010. ISC produced a document SC7-ST-IP-10 *Data holding status of ISC and WCPFC* noting data holdings for category 1(annual catch), 2 (aggregated catch and effort) and 3 (size frequency) data.

523. The SC was advised to refer to the document SC7-ST-IP-10 for details, and any questions on this matter should be referred to Peter Williams (SPC) or Ren-Fen Wu (ISC).

Discussion

524. There was no discussion under this agenda item.

Recommendations

525. The SC noted the progress made in reconciling the data holdings between ISC and WCPFC, as reported in ST-IP-10.

6.2 Regional Observer Programme (ROP)

526. The Regional Observer Program Manager, K. Staisch, made a brief summary of SC7-ST-IP-08, *Summary of Regional Observer Audits*.

527. The ROP Secretariat commenced its audits of Regional Observer Programme (ROP) interim authorised observer programmes in late 2010 and to date has completed audits on 14 of the 23 countries or organisations that are part of the ROP. The remaining audits will be completed late in 2011 and in early 2012. Refer to Table 1&2 of the paper.

528. The purposes of the audits is to ensure that Commission standards are being applied and/or are being developed and maintained by programmes that wish to gain ROP full authorisation before the due date of June 2012.

529. In most cases the programmes audited were well developed and were following the agreed Commission standards to the best of their ability. However there were some areas that needed improvement.

530. Since the introduction of the 100% observer coverage for purse seiners, most observer programmes have coped well in supplying observer numbers , but all programmes have said that they require continual training to upgrade the observers, and to ensure they have enough for all the demands put on them by the WCPFC different gear type coverage requirements.

531. Many programmes (not all) require extra debriefers for their debriefing programmes, and this should be a priority to be rectified. This is an area that is developing in many PI countries, but funding and recognition of this important aspect of observing is taking time in getting some national programmes up to the amount of debriefers they require. The reason some still require debriefers is that the trainers and programmes of the many programmes have concentrated on making sure they have enough observers to cover the 100% observer coverage, and they have done well to get approximately 630 observers trained to ensure the 100% coverage of purse seiners and the other gear type coverage will be well maintained. Debriefing cannot be developed overnight and all areas are being addressed by national programmes to increase their debriefing numbers.

532. There still is a need to increase the number of available observers for most programmes, as this will allow for some attrition of the observers, as well as being able to cover the expected increased need for observers to satisfy long line and carrier observer coverage requirements.

533. The quality of the observers needs to be monitored carefully, as it has been reported that the data collections held by SPC indicated that a small percentage of observer data is not useable, because it is collected incorrectly, or is not collected at all. This is clearly a waste of valuable resources, and shows the need to ensure that all observers trained before the recent introduction of the PIRFO standards may need to be re assessed against these standards.

534. Entrance criteria for training needs to be rigidly applied during the initial selection process to ensure only the best applicants are given positions in the course to be trained as ROP observers.

535. The sending of data to the SPC or WCPFC after each observer trip is extremely important and unfortunately some programmes are having (mainly technical) problems in sending copies of the data in a timely manner. SPC and WCPFC ROP have been working hard to rectify this problem by supplying equipment, personnel and other means in transferring the data in a quick and timely manner.

536. There is a need to assure that observers are covered by insurance when travelling, on board vessels, and when working as an observer on shore. Many programmes had some insurance for observers but not all observers were covered for all the periods they worked as observers. This was being looked at and being rectified by most programmes where it was found to be a problem.

537. Health checks (Medicals) by programmes on their observers varied from being comprehensive to none at all. The Commission does not have a standard for health checks, however it is recommended given the issues that some programmes have had with observers being unfit to carry out trips on vessels because of health constraints, that all programmes adopt a standard that requires observers to have a full health check (medical) when first trained and then a regular check should occur after this. This has been suggested to be every 18 months to two years.

538. Even though some of the programmes may still be deficient in areas of debriefing at the deadline in June 2012, (noting that an estimated 90 debriefers still need to be trained across all programmes) it is the intention to authorise these programmes as standards like this do require time to develop properly, in doing so the Commission ROP will continually check to ensure this area is being developed and is satisfied, it is expected that all debriefing requirements with the help of FFA, SPC, WCPFC and NMFS should be in place within 2 years.

Discussion

539. The SC discussed the critical importance of observer debriefing for an effective observer program and sought clarification on the progress on the debriefing component of the ROP. The FFA/SPC debriefing format is used during the debriefing of all PI countries; other countries have their own formats. Unfortunately for all PI countries with the exception of two programmes there are only a very small number of debriefers trained and qualified. The process of training debriefers is in place and is ongoing for PI member country observer programmes. There is a need for a number of dedicated certified debriefers with proper facilities to operate in most PI countries. It was noted, that the number of debriefers available in most PI countries is inadequate, and it will take time and money to get these programmes up to a respectable level of debriefing. Most countries are aware of the needs to have more debriefers, but in most cases had no allocation of space or funds to allow debriefers to operate. There is ongoing training of debriefers to build up capacity and quality in PI countries, but it will take 2-3 years to be able to get the required numbers for comprehensive and accurate debriefing of all observer trips. It was noted that NZAID has recently provided funding for an Observer Debriefing Training Officer for the PIRFO. The position is based in SPC.

540. Some CCMs noted report very clearly on the progress that has been made and the challenges that still require to be met. Implementation of the 100% purse seine observer coverage has required a very substantial effort from the FFA Members involved, and the SPC-OFP. These efforts have been strongly supported by a range of donors, particularly New Zealand, who was thanked for this support. It was noted that a large volume of information, including scientific information is now flowing from the 100% purse seine coverage. There is a backlog which is being worked on, and there are a range of issues to be addressed to ensure the ROP is fully effective, which are mainly the responsibility of the TCC. Some

CCMs were pleased to read of the new developments in electronic data capture and entry onboard, and observer information systems to make the data more accessible. Overall, the establishment of the ROP and the implementation of 100% observer coverage has been a massive undertaking, but it is clearly a very important asset for improving the availability of scientific information. For this, the OFP and WCPFC and national administrations involved deserve huge credit.

Recommendations

541. The SC noted ST-IP-08 and the progress made in auditing the Regional Observer Programmes.

6.3 West Pacific East Asia Oceanic Fisheries Management Project

542. The WCPFC Assistant Science Manager, A. Beeching, provided a brief summary of the WPEA OFM Project.

543. A brief review of the Steering Committee Meeting for the WPEA OFM Project noted the presence of the UNDP Regional Technical Adviser, J. Padilla. The project finances were found to be in good order, and a very recent independent audit of the Commission, which included individual projects such as this one, was deemed to satisfy the needs of the main project funder (GEF). An application has been submitted for a further support from Korea. Individual country reports for Indonesia, the Philippines and Vietnam listed activities and associated costs to date, and briefed the Steering Committee on potential issues. The project annual work plan and budget for 2012 will be completed by the end of 2011.Once a draft terminal evaluation report is submitted in mid-2012, it will be possible to submit a proposal for a second project, which funders indicate would be well received if it linked with other GEF funded initiatives such as the FFA/SPC OFM project

Discussion

544. Some CCMs thanked the GEF for providing funding for this important project and UNDP for its oversight. CCMs also acknowledged with appreciation the work delivered by SPC and WCPFC and congratulated Indonesia, Philippines and Vietnam for the progress to date.

Recommendations

545. The SC noted the progress made through the WPEA-OFM Project as outlined in ST-IP-12, and support the continuation of this work.

6.4 Tagging initiatives

546. J. Hampton made a brief presentation on the activities of the Pacific Tuna Tagging Project (PTTP) Steering Committee during SC7. He noted that project activities, and past and future work plans were outlined in SC7-ST-IP-05.

547. It was noted that the report of the Fifth Steering Committee meeting for the Pacific Tuna Tagging Project has been posted for several days for consideration by meeting participants.

Discussion

548. No discussion was had under this agenda item.

Recommendations

549. The SC adopted SC7-ST-WP-04 the Summary Report of the Fifth Steering Committee Meeting for the Pacific Tuna Tagging Project.

AGENDA ITEM 7 COOPERATION WITH OTHER ORGANISATIONS

10.1 The status of cooperation and relations

550. The WCPFC Secretariat detailed the organisations with which WCPFC has a formal relationship, and then updated SC7 on the status of cooperation and relations with other organisations since SC6. These included an MOU between WCPFC and North Pacific Anadramous Fisheries Commission (NPAFC) signed in December 2010; a Memorandum of Cooperation on the Cross Endorsement of Regional Observers signed with IATTC in July 2011; and following KOBE III, WCPFC is participating in the regular posting of the Consolidated List of Authorised Fishing Vessels (CLAV) of all registered fishing vessels in the tRFMOs. The Commission has directed the Secretariat to undertake a review of the MOU with ISC, which to be addressed at WCPFC 8.

Discussion

551. Some members expressed that they place a high degree of importance on updating the MOU between WCPFC and the ISC as the amendments that were prepared by the Secretariat and presented to WCPFC6 in Tahiti in 2009 were a good way of better defining the relationship between the two organisations, including the relationship between the ISC and this committee. These countries expressed disappointment that there has been no progress on this issue, especially since it was recommended by the independent review of science, which was accepted by the Commission. They urged the Secretariat and the members of the ISC to progress this issue before WCPFC 8.

552. A statement was communicated to the SC7 from SEAFDEC, which read as follows:

> The Southeast Asian Fisheries Development Center or SEAFDEC is an inter-governmental organization established in 1967, with the aim to promote sustainable fisheries development in the Southeast Asian Region. Taking into accounts the important of tuna fisheries in the Region that serve to increase the economic and livelihoods, SEAFDEC has developed several programs to support the 4 major tuna countries namely Indonesia, the Philippines, Thailand and Vietnam especially on improving the national tuna statistic as well as reduction of by-catch issues in longline fisheries since 2008. SEAFDEC will continue our collaborative works with members by strengthening the existing program including enhancing the capacity on observer program, species composition in tuna cannery etc. SEAFDEC also looks forward to cooperate with the WCPFC secretariat in near future to ensure our implementation will benefit not only to our member countries but also support the WCPFC requirement.

AGENDA ITEM 8 SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

8.1 Consideration of the special requirements of developing States pursuant to Part VIII of the Convention

553. FFA members, 15 of whom are Small Island developing States, stated that many of the CCMs here will be aware that the inclusion of this item is required by the WCPFC Rules of Procedure: specifically, Rule 2.

554. FFA members would like to note for the Committee some of the benefits they have received as SIDS. The annual SPC stock assessment and data workshops have been greatly beneficial to them and they would like to see that their participation in such workshops is maintained.

555. The source of funding for FFA members' attendance to these workshops has been made possible through the Japanese Trust Fund which is administered by the WCPFC Secretariat. For their other special requirement needs, funding has been provided through the Special Requirement Fund established in pursuant to Regulation 7 of the WCPFC Financial regulations.

556. One important emerging obligation that will also begin to put more responsibility on SIDS & Territories in relation to bycatch mitigation and implementation. FFA members would like to ask if this could also form part of the assistance usually provided annually to SIDS & Territories. In order to avoid duplication, perhaps as a starting point, a list of existing capacity building programs related to bycatch issues could be established and where possible coordination of new capacity building programs is facilitated through the Commission.

557. FFA also conveyed its appreciation to those CCMs that have contributed to the Special Requirement Fund and in particular to the United States, Australia and Chinese Taipei for their individual contributions made during the 2010/2011 fiscal year.

558. FFA members expressed their appreciation for the financing of capacity building activities by the Japanese Trust Fund over the last couple of years. There were 10 projects supported by the JTF in 2011 compared to 11 projects in 2010. They also noted that the JTF has also provided a co-financing support to the WPEA in Indonesia, Philippines and Vietnam.

559. Tonga, aware that phase one ends soon, wished to offer on behalf of the CCMs, thanks to Dr Suzuki for administering the fund to date

AGENDA ITEM 9 FUTURE WORK PROGRAM AND BUDGET

9.1 Strategic Research Plan of the Scientific Committee

560. SC7 formulated an informal small group (ISG) to develop draft strategic research plan for 2012 – 2016, facilitated by D. Kirby (Australia). SC7 reviewed the draft strategic research plan provided by the ISG and adopted it (Attachment J).

9.2 Review of the Scientific Committee Work Programme

561. The WCPFC Science Manager presented a progress report on 2010 work programme activities other than science services from the SPC-OFP as follows:

a) (Project 14) The progress the West Pacific East Asia Oceanic Fisheries Management Project was reviewed at the Third Project Steering Committee meeting. The continuation

of the project was supported with allocated funds of USD 25,000 used in the co-financing of the project.

b) (Project 35) SC7 reviewed SA-WP-01 (Bigeye tuna age, growth and reproductive biology) as an output of this project and supported continuation of biological sampling and analysis.

c) (Project 39) SC7 reviewed SA-WP-05 as the output of this three-year project (Regional study of the stock structure and life-history characteristics of South Pacific albacore). The final report will be submitted by the end of August 2011.

d) (Project 42) Because of the importance of tag recovery, the 2011 Pacific-wide tagging project fund ($10K) supported to a locally-based Tag Recovery Officer in Pohnpei.

e) (Project 57) SC7 reviewed MI-WP-03 and MI-WP-04 funded from 2010 budget. The 2011 budget ($20K) has been secured for any further research on reference points requested by SC7 in 2011.

f) (Project 60) ST-WP-03 was reviewed as the output of this project (Collection and Evaluation of Purse-Seine Species Composition Data). This project will continue but no funding support is required.

g) (Project 61) As requested by the Commission (Para 101, WCPFC7 Report), SPC-OFP participated in the ISC's Data preparation WS for the NP striped marlin stock assessment in January and May 2011 funded from 2010 budget.

h) (Project 64) New Zealand provided a progress report on this project (Collation of South Pacific striped marlin data and CPUE analysis) and the project outputs will be presented at SC8.

i) Unobligated budget of $30K has been secured for any further research requested by SC7 in 2011.

j) The research results on FAD bycatch mitigation funded by PNG ($25K) will be provided at SC8 as part of ISSF's Purse Seine Bycatch Mitigation Project and research cruises.

Discussion

562. SC7 agreed to refine the list of SC Work Programme that was established at SC3 (Attachment O of the SC3 Summary Report) intersessionally and review at SC8.

9.3 Development of 2012 Work Programme and budget, and projection of 2013-2014 provisional work programme and indicative budget*

563. The indicative Scientific Services Provider budget for 2012 is $792k.

564. Annex 1 of 2012 MOU with the Scientific Services Provider may contain additional activities, including:

a) Indicator papers for bigeye, yellowfin or skipjack tuna for those years when a stock assessment is not conducted. Japan offered their support, and it was noted that it may be possible to consider western pacific striped marlin CPUE standardisation at the same time.

b) Possible production of stock status indicators for south pacific swordfish, noting that this may be confirmed at WCFPC8 when data available for this work may be better evaluated.

565. SC7 identified the following four assessments to be conducted by the Scientific Service Provider and presented to SC8:

a) A stock assessment for south pacific albacore
b) A stock assessment for south western Pacific striped marlin, noting that the assessment would have a smaller scope than the recent bigeye assessment, with fewer runs.
c) Stock assessments for oceanic whitetip and silky sharks.

566. SC7 recently completed stock assessments for the three tropical tuna species, bigeye, yellowfin and skipjack and stock assessments of those species will not be conducted in 2012.

567. SC7 identified several high priority projects in 2012. These projects include:
a) The peer review of the bigeye tuna stock assessment. SC7 obligated 30K in the 2011 budget to conduct the peer review.
b) Scientific support for the management objectives workshop to identify and evaluate candidate limit reference points (SPR and biomass). SC7 obligated 20K in the 2011 budget (Scoping the use of reference points) for this project.
c) Scientific support for the management objectives workshop to identify and evaluate candidate target reference points especially for skipjack. SC7 requested the Commission to carry over the 30K in the 2011 budget and obligate 30K in the 2012 budget. (Technical support of Management Objectives workshop) for this project.
d) The development of harvest control rules for the management objectives workshop. The SC proposed 30K in the 2012 budget for this project.
e) Bigeye aging and maturity project.

568. The proposed ageing and maturity project would collect samples in 2012/2013 for subsequent analysis in 2014/2015, noting that the latter phase would be more costly than the earlier one. This project requires an allocation of 55K for 2012. Work on depletion based reference points requires more detailed information on spawning biomass and that simultaneous gonad and otolith sampling of bigeye could be funded prior to the next bigeye stock assessment, perhaps prioritising research in region 4, where less information has been gathered to date.

569. The SC recommends to the Commission that Project 60 be granted a no cost extension for 2012.

570. The SC recommends to the Commission the SC work programme and budget for 2012 and indicative budget for 2013 and 2014, as follows:

Table 1. List of Scientific Committee work programme titles and budget for 2012, and indicative budget for 2013–2014, which require funding from the Commission's core budget (in USD).

Research Activity / Project with priority	2012	2013	2014
Project 14. WPEA OFM	25,000	25,000	25,000
Project 35. Refinement of bigeye parameters	55,000	70,000	75,000
Project 42. Pacific-wide tagging project	10,000	10,000	10,000
Technical support for Management Objective Workshop (target reference points)	Carried over ($30K)		
Harvest control rules	30,000	30,000	
SUB-TOTAL	120,000	135,000	110,000
UNOBLIGATED BUDGET	76,000	83,000	91,000
SPC-OFP BUDGET	792,000	871,200	958,320
GRAND TOTAL	**988,000**	**1,089,200**	**1,159,320**

Discussion

571. On behalf of the PNA, FSM expressed their appreciation for the extension of JTF.

AGENDA ITEM 10 ADMINISTRATIVE MATTERS

10.1 Rules of Procedure

572. The Chair opened a discussion on proposals to alter the rules of procedure. None were proposed.

10.2 Peer review of stock assessments*

573. SC7 formulated an informal small group (ISG) to develop the process for the peer review of the 2011 bigeye tuna stock assessment, facilitated by M. Miyake (Japan).

574. The informal small group to review the organization and prepare Terms of Reference for the 2012 WCPFC peer review presented the results of its studies. The SC7 agreed that the peer review of the 2011 bigeye tuna assessment should be conducted in a way to contribute to future bigeye assessments.

575. SC 7 agreed that the peer review panel be comprised of 3 independent reviewers. This panel would be selected and contracted early enough so that the 2011 assessment results (possibly including all the input data, modeling software, output of basic runs as well as all the sensitivity runs), can be given to the panel for advanced reviewing.

576. SC7 agreed that in 2012, the Panel will hold a Workshop to review the 2011 assessment and provide advice for future assessment work. The Workshop would spend approximately 2 days on peer review of the 2011 assessments, and a further 3 days on reviewing and advising on various aspects of subsequent assessments.

577. Regarding the participants in the Workshop the SC decided to limit attendance to the Peer Review Panel members and scientists directly involved in the bigeye assessments.

578. Peer Review Panel should send the draft report of its results to SPC for review and response. Once it is finalized, the report and response from SPC should be submitted to the Executive Director, in advance of SC8 where it will be considered.

Formation of the Peer Review Panel

579. The peer review panel should be composed of 3 scientists that have significant expertise and experience on all aspects of stock assessments, preferably in relation to tuna stock assessments. The reviewers should not be directly involved with current WCPFC bigeye assessments. The peer review contract may be offered to individuals. The WCPFC Secretariat will approach the IATTC to request the provision of a reviewer.

Selection Procedure and Timeframe

580. While keeping the selection procedures open, transparent and time-efficient, SC7 agreed the procedures given below will be followed:

a) Each CMM may recommend one candidate through their official WCPFC contacts by 15 October 2011;
b) The Chair and Vice-Chair of the Commission, the SC Chair and the Executive Director will select five candidates for short listing, and circulate the shortlist with their CV to all of the official WCPFC contacts by 1 November 2011;
c) The official WCPFC contacts will rank the five candidates with scores 1 (most preferred) to 5 (less preferred) and submit these rankings to the Science Manager by 20th November 2011.

581. The three candidates who receive the lowest scores will form the Peer Review Panel, and will subsequently be contracted. If any of the three individuals are unable to undertake the review, the shortlisted candidate with the next lowest score will be invited to join the Peer Review Panel. The Peer Review Panel should be finalized by 15 January 2012.

Budget

582. The Peer Review Panel would be composed of three reviewers in total and the total allocated budget is 30000 USD.

583. SC7 reviewed the draft peer review process and adopted it for the Commission's consideration and endorsement. The adopted terms of reference for the review are provided in Attachment K.

10.3 Future operation of the Scientific Committee

584. R. Campbell chaired this session which was tasked with reviewing the performance of the new meeting structure adopted for SC7, and if required, recommending revisions to be applied to future SC meetings. He outlined a number of options for improving the performance of future SC meeting and following discussion of these options the following recommendations were adopted:

a) Hold the Data and Statistics Theme before the Stock Assessment Theme.

b) Add blocks of time to the Indicative Schedule where draft recommendations developed by the Theme conveners are reviewed and adopted.

c) A small group (led by the Management Issues Theme convener) to review inter-sessionally the option of moving the agenda items presently within the Stock Assessment Theme on discussion and adoption of management advice and implications for each species to an agenda item within the Management Issues Theme.

d) SC8 to retain the process adopted for SC7 that important papers within the Biology, Methods, and Fishing Technology Themes are to be presented either at the SPC Pre-Assessment Workshop or at the Scientific Committee meeting within the most appropriate Theme. SC8 is to decide on the future need of retaining the Biology, Methods, and Fishing Technology Themes.

e) A review of the time allocated to each Theme to be undertaken when the Indicate Schedule for SC8 is prepared.

f) A document "Guidelines for Theme Conveners and SC Chairs" is to the drafted inter-sessionally. This task will be led by the SC Chair in consultation with the SC Vice-Chair and Theme convenors.

10.4 Next meeting

585. SC8 is provisionally scheduled for 7-15 August 2012, with the venue to be determined intersessionally and agreed at WCPFC8.

10.5 Selection of officers

586. P. Maru will end her first term as Vice-Chair of the Scientific Committee in December 2011. SC7 deferred the selection of a new Vice-Chair toWCPFC8.

587. After serving for over ten years, P. Dalzell has resigned as the convener of the Ecosystem and Bycatch Theme. SC7 selected Jone Amoe (Fiji) as a co-convener and the second co-convenor will be determined intersessionally before SC8. SC appreciated Paul Dalzell's hard work and enormous contribution to the work of the Commission.

588. Noting the workload of the SC Chair (N. Miyabe) who currently also co-convenes the Stock Assessment Theme, M. Ogura was selected to replace him as co-convener of the Stock Assessment Theme. The USA will consider providing a co-convener for SC8.

AGENDA ITEM 11 - OTHER MATTERS

589. Three documents were selected for consideration by SC7, as requested by the Commission (Para 424 of WCPFC7 Report). Documents related to whale sharks (WCPFC-2010-DP-09) and cetaceans (WCPFC-2010-DP-17 (Rev 2)) were reviewed under Ecosystem and Bycatch Theme session, and the document WCPFC-2010-30 was noted and no comments were received.

AGENDA ITEM 12 - ADOPTION OF THE REPORT OF THE SEVENTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

12.1 Adoption of the Summary Report and Executive Summary of the Seventh Regular Session of the Scientific Committee

590. SC7 adopted the Summary Report for the Seventh Regular Session of the Scientific Committee. The Secretariat was requested to prepare an Executive Summary to assist with presentation of this report to other subsidiary bodies and to the Commission.

AGENDA ITEM 13 - CLOSE OF THE MEETING

591. The SC Chair thanked all participants for their contributions to the meeting, and in particular noted the efforts of the theme conveners and informal small group facilitators.

592. Ueta Fa'asili, the representative from Samoa, spoke on behalf of the FFA member countries and thanked the FSM Government, the WCPFC Secretariat, the Convenors and Rapporteurs for their hospitality and hard work.

593. Steve Retalmai, the representative from FSM, thanked the Secretariat and expressed appreciation to all staff and participants who contributed to the meeting outcomes. He also expressed his appreciation to the SC Chair, SC Vice-Chair, and the Executive Director (ED).

594. The ED, Professor Glenn Hurry, thanked all participants for making the meeting a success, and thanked the Government of FSM for its logistical support for the meeting. He also appreciated the efforts made by the Commission staff and all participants.

595. The meeting closed at 19:30 on Thursday, 17 August 2011.

Attachment A

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Seventh Regular Session

Pohnpei, Federated States of Micronesia
9-17 August 2011

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Attachment B

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Seventh Regular Session

Pohnpei, Federated States of Micronesia
9-17 August 2011

EXECUTIVE DIRECTORS WELCOME STATEMENT

To be inserted

Attachment C

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Seventh Regular Session

Pohnpei, Federated States of Micronesia
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KEYNOTE SPEECH – GOVERNOR OF POHNPEI

To the Chair of the Scientific Committee, Dr Naozumi Miyabe, The Manager of the SPC-Oceanic Fisheries Programme, Dr John Hampton, The Executive Director of WCPFC, Professor Glenn Hurry, and the representatives of Members, Cooperating Non-members and Participating Territories of the Commission, Observers, Ladies and Gentlemen.

Kaselehlie and welcome to Pohnpei. The Commission has been part of our lives here now since 2004 and it's my pleasure to welcome you to our islands. For many of you who have been here before, I welcome you back. This year I understand we have two of the Commission's meetings here in Pohnpei, and this is indeed an honor as it brings considerable benefits to a range of businesses in our community.

Pohnpei is the largest of the four states of the Federated States of Micronesia and it includes the national capital and national government offices, as well as the largest and most active business community in Micronesia. We are proud to host what we anticipate will be a very successful meeting in support of the management of tuna and tuna-like species in the Western and Central Pacific Ocean. The importance of these marine resources to all small island states, including the FSM , cannot be overstated.

I understand that our tuna fisheries in the Western and Central Pacific Ocean harvest around 60% of the world's tuna. Total tuna catch has been increasing and a provisional total tuna catch in the Convention Area was estimated at 2.4 million mt in 2010, the second highest annual catch on record.

I am a fisherman myself and those sorts of figures in terms of the numbers of individual fish that are caught worry me. You may not know but here in Pohnpei people catch and use a lot of skipjack and yellowfin tuna as part of their normal diet. These fish are really important to us and I encourage you to visit the local markets while you're here to see for yourself. Without access to these local fish, a lot of our people, not just in Pohnpei but across the Pacific, are going to go hungry. So what I want from the scientists gathered here today is a promise that when you decide how much of our tuna people can catch commercially in the future that you make sure there is enough left for us in Pohnpei to eat.

I am somewhat reassured to know that the well regarded Secretariat of the Pacific Community (SPC) scientists are monitoring the health of these tuna fish stocks. I know that the SPC provides scientific advice on these stocks to the Commission and to the Forum Fisheries Agency and to the PNA or Parties to the Nauru Agreement in Majuro, and this is good because it means you all get a consistent message on the health of our fish.

This year, the SPC will be presenting stock assessments for all four of the main tuna species targeted by industrial fisheries in our region's waters. That is, skipjack tuna, yellowfin tuna, bigeye tuna and albacore tuna. It is now the job of the Scientific Committee at this SC7 to agree to scientific advice in support of the sustainable management of these fisheries to provide food and income for the foreseeable future.

Thank you for this opportunity to provide these brief remarks. I wish you a positive, productive and constructive meeting and an enjoyable stay in beautiful Pohnpei…….and don't forget: you take good care of my fish!

Attachment D

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

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SC7 AGENDA

AGENDA ITEM 1 OPENING OF THE MEETING

1.1 Welcome address
1.2 Meeting arrangements
1.3 Issues arising from the Commission
1.4 Adoption of agenda
1.5 Reporting arrangements
1.6 Intersessional activities of the Scientific Committee

AGENDA ITEM 2 REVIEW OF FISHERIES

2.1 Overview of Western and Central Pacific Ocean (WCPO) fisheries*
2.2 Overview of Eastern Pacific Ocean (EPO) fisheries
2.3 Annual Report (Part 1) from Members, Participating Territories and Cooperating Non-Members (CCMs)
2.4 Reports from regional fisheries bodies and other organizations

AGENDA ITEM 3 STOCK ASSESSMENT THEME

3.1 WCPO bigeye tuna
- 3.1.1 Review of research and information
  - a. Review of Project 35
  - b. Review of 2011 stock assessment
- 3.1.2 Provision of scientific information
  - a. Status and trends*
  - b. Management advice and implications*

3.2 WCPO yellowfin tuna
- 3.2.1 Review of research and information
- 3.2.2 Provision of scientific information
  - a. Status and trends*
  - b. Management advice and implications*

3.3 Requests from CMM 2008-01

a. Fishing effort for bigeye and yellowfin tuna from other commercial tuna fisheries*

3.4 WCPO skipjack tuna

3.4.1 Review of research and information

3.4.2 Provision of scientific information

a. Status and trends*

b. Management advice and implications*

3.5 South Pacific albacore

3.5.1 Review of research and information

a. Review of Project 39

b. Review of 2011 stock assessment

3.5.2 Provision of scientific information

a. Status and trends*

b. Management advice and implications*

3.6 South Pacific swordfish

3.6.1 Review of research and information

3.6.2 Provision of scientific information

a. Status and trends*

b. Management advice and implications*

3.7 Southwest Pacific striped marlin

3.7.1 Review of research and information

3.7.2 Provision of scientific information

a. Status and trends*

b. Management advice and implications*

3.8 North Pacific striped marlin

a. Status and trends*

b. Management advice and implications*

3.9 Northern stocks

3.9.1 North Pacific albacore (CMM 2005-03)

a. Status and trends*

b. Management advice and implications*

3.9.2 Pacific bluefin tuna (CMM 2010-04)

a. Status and trends*

b. Management advice and implications*

3.9.3 North Pacific swordfish

a. Status and trends*

b. Management advice and implications*

AGENDA ITEM 4 MANAGEMENT ISSUES THEME*

4.1 Terms of Reference

4.2 Limit reference points for the WCPFC

4.3 Review of CMM 2008-01

4.4 Management Objectives Workshop

AGENDA ITEM 5 ECOSYSTEM AND BYCATCH MITIGATION THEME

5.1 Ecosystem effects of fishing
5.2 Sharks*
5.3 Seabirds*
5.4 Sea turtles*
5.5 Other species and issues
a. Guidelines for the release of encircled animals
b. FAD bycatch mitigation

AGENDA ITEM 6 DATA AND STATISTICS THEME

6.1 Data gaps
a. Data gaps of the Commission
b. Species composition of purse-seine catches
c. Data issues with the ISC
6.2 Regional Observer Programme (ROP)
6.3 West Pacific East Asia Oceanic Fisheries Management Project (WPEA)
6.4 Tagging initiatives (PTTP)

AGENDA ITEM 7 COOPERATION WITH OTHER ORGANISATIONS

7.1 The status of cooperation and relations

AGENDA ITEM 8 SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES
8.1 Consideration of the special requirements of developing States pursuant to Part VIII of the Convention

AGENDA ITEM 9 FUTURE WORK PROGRAM AND BUDGET

9.1 Strategic Research Plan of the Scientific Committee
9.2 Review of the Scientific Committee Work Programme
9.3 Development of 2012 Work Programme and budget, and projection of 2013-2014 provisional work programme and indicative budget*

AGENDA ITEM 10 ADMINISTRATIVE MATTERS

10.1 Rules of Procedure
10.2 Peer review of stock assessments*
10.3 Future operation of the Scientific Committee
10.4 Next meeting*
10.5 Selection of SC officers

AGENDA ITEM 11 OTHER MATTERS

AGENDA ITEM 12 ADOPTION OF THE REPORT OF THE SEVENTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

12.1 Adoption of the Summary Report and Executive Summary of the Seventh Regular Session of the Scientific Committee

AGENDA ITEM 13 CLOSE OF MEETING

Attachment E

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
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ABBREVIATIONS AND ACRONYMS USED BY THE WCPFC

[To be updated]

ACAP	Agreement for the Conservation of Albatross and Petrels
AFMA	Australian Fisheries Management Authority
AHTG on Data	Ad Hoc Task Group on Data
ALB	albacore (*Thunnus alalunga*)
AV	average recruitment over the period 1998-2007 in the bigeye stock assessment
Bcurrent	average biomass over the period 2004–2007
Bt	biomass at year t (used in projections)
BET	bigeye tuna (*Thunnus obesus*)
BFAR	Bureau of Fisheries and Aquatic Resources (Philippines)
BI-theme	Fish Biology theme group
BMSY	biomass that will support the maximum sustainable yield
c&f	cost and freight
CCM	Members, Cooperating Non-members and participating Territories
CCMM working group	Compliance with Conservation and Management Measures working group
CN	China
the Convention	The Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
the Convention Area	The area of competence of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
CPUE	catch per unit of effort
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
EB-theme	Ecosystems and Bycatch Mitigation theme group
EEZ	exclusive economic zone

EPO	eastern Pacific Ocean
ERA	ecological risk assessment
ETBF	Eastern Tuna and Billfish Fishery (Australia)
EU	European Union
F	fishing mortality rate
FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
Fcurrent	average fishing mortality rate over the period 2004–2007
FFA	Pacific Islands Forum Fisheries Agency
FMSY	fishing mortality that will support the maximum sustainable yield
FSM	Federated States of Micronesia
$F_{SSB\text{-}ATHL}$	fishing mortality that maintains spawning stock biomass (SSB) above the average level of its ten historically lowest points (ATHL)
FT-theme	Fishing Technology theme group
GEF	Global Environment Facility
GLM	general linear model
GRT	gross registered tonnage
GSI	gonad somatic index
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ID	Indonesia
IOTC	Indian Ocean Tuna Commission
ISC	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
ISSF	International Sustainable Seafood Foundation
IUCN	International Union for the Conservation of Nature
JTF	Japan Trust Fund
LL	longline
LL-ALL	all longline catch
LRP	limit reference point
m	meters
ME-theme	Methods theme group
MFCL	MULTIFAN-CL (a stock assessment modeling approach)
MH	Marshall Islands
MIMRA	Marshall Islands Marine Resources Authority
MOU	memorandum of understanding
MRAG	Marine Resource Assessment Group
MSE	management strategy evaluation
MSY or *MSY*	maximum sustainable yield
mt	metric tonnes
NFRDI	National Fisheries Research and

	Development Institute (Korea, Philippines)
NPAFC	North Pacific Anadromous Fisheries Commission
OS	Off shore
PFRP	Pelagic Fisheries Research Program (Hawaii, USA)
PH	Philippines
PNA	Parties to the Nauru Agreement
PNG	Papua New Guinea
PTTP	Pacific Tuna Tagging Programme
RFMO	regional fisheries management organization
RMI	Republic of the Marshall Islands
SA-theme	Stock Status theme group
SB or *SB*	spawning biomass
SEAPODYM	spatial ecosystem and population dynamics model
SIDS	small island developing state
SKJ	skipjack tuna (*Katsuwonus pelamis*)
SPC-OFP	Oceanic Fisheries Programme of the Secretariat of the Pacific Community
SPTT	South Pacific Tuna Treaty
SPR	spawning stock biomass per recruit
SRP	Special Requirements Fund
SSB	spawning stock biomass
SST	sea surface temperature
STFO	small tuna on floating objects
ST-theme	Data and Statistics theme group
TCC	Technical and Compliance Committee of the WCPFC
TW	Taiwan (Chinese Taipei)

Attachment F

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

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LIST OF DOCUMENTS

MEETING INFORMATION

WCPFC-SC7-2011/01	Meeting notice and information
WCPFC-SC7-2011/02	Provisional agenda
WCPFC-SC7-2011/03	Provisional annotated agenda
WCPFC-SC7-2011/04	Indicative schedule
WCPFC-SC7-2011/05	Registration form
WCPFC-SC7-2011/06	Guidelines in submitting meeting papers
WCPFC-SC7-2011/07	List of documents
WCPFC-SC7-2011/08	Provisional agenda for Theme Sessions
WCPFC-SC7-2011/09	Provisional agenda for head of delegation (HOD) meeting (1600-1700, 8 August 2011)
WCPFC-SC7-2011/10	Provisional agenda of the PTTP Steering Committee Meeting
WCPFC-SC7-2011/11	Provisional agenda of the WPEA OFM Project Steering Committee
WCPFC-SC7-2011/12	Provisional agenda of the JTF Steering Committee Meeting
WCPFC-SC7-2011/13	Provisional agenda for the Tutorial Session of TUMAS

GENERAL PAPERS

Working Papers

GN-WP-1	Williams, P. and P. Terawasi. **Overview of tuna fisheries in the western and central Pacific Ocean, including economic conditions – 2010.** SPC and FFA
GN-WP-2	IATTC. **Tunas and billfishers in the Eastern Pacific Ocean in 2010.**
GN-WP-3	Secretariat. **Issues arising from the Commission.** Secretariat
GN-WP-4	Secretariat. **Background information on peer review of the 2011 stock assessment of bigeye**
GN-WP-5	Secretariat. **Draft Strategic Research Plan**
GN-WP-6	**Work programme of the Scientific Committee**

Information Papers

GN-IP-1	Secretariat. **Intersessional activities of the Scientific Committee**
GN-IP-2	Z. Suzuki. **Status report of the Japan Trust Fund as of August 2011**
GN-IP-3	Secretariat. **Cooperation with other organizations**
GN-IP-4	Secretariat. **WPEA OFM Project Steering Committee**
GN-IP-5	Secretariat. **Summary of 2010-2011 WPEA OFM Project Report**
GN-IP-6	Secretariat. **WPEA OFM Project Financial Statement**
GN-IP-7	Indonesia. WPEA OFM Project Progress Report
GN-IP-8	Philippines. WPEA OFM Project Progress Report
GN-IP-9	Vietnam. **WPEA OFM Project Progress Report**
GN-IP-10	Secretariat**. Conservation and Management Measures (WCPFC7-2010/30)**
GN-IP-11	ISC, **Report of the 11th Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North pacific Ocean.**
GN-IP-12	WPEA OFM PSC. **Report of the third Session of the WPEA OFM Project Steering Committee Meeting**.
GN-IP-13	JTF Coordinator. **Report of the Steering Committee Meeting of Japan Trust Fund.**

ECOSYSTEM AND BYCATCH MITIGATION THEME

EB THEME – Working Papers	
EB-WP-01	S. Clarke, S. Harley and S. Hoyle. **An indicator-based analysis of key shark species based on data held by SPC-OFP.** SPC-OFP
EB-WP-02	Shelley Clarke [1], Kotaro Yokawa [2], Hiroaki Matsunaga [2], and Hideki Nakano[2]. **Analysis of North Pacific shark data from Japanese commercial longline and research/training vessel records**. [1] Oceanic Fisheries Programme, Secretariat of the Pacific Community, [2] National Research Institute of Far Seas Fisheries, 5-7-1 Orido, Shimizu-ku, Shizuoka-ken, 424-8633, Japan.
EB-WP-03	W. Walsh [1] and S. Clarke [2]. **Analyses of Catch Data for Oceanic Whitetip and Silky Sharks reported by Fishery Observers in the Hawaii-based Longline Fishery in 1995-2010**. [1] University of Hawaii, Joint Institute for Marine and Atmospheric Research, Pelagic Fisheries Research Program, Honolulu, HI 96722, USA; [2] Secretariat of the Pacific Community, Oceanic Fisheries Programme, Noumea, New Caledonia.
EB-WP-04	S. Clarke. **A status snapshot of key shark species in the western and central pacific and potential mitigation options**. SPC-OFP
EB-WP-05	S. Clarke. **A Proposal for a Process for Designating WCPFC Key Shark Species for Data Provision and Assessment**. SPC-OFP
EB-WP-06	P. Lehodey[1], I. Senina[1], B. Calmettes[1], John Hampton[2], Simon Nicol[2], Peter Williams[2], J. Jurado Molina[2], M. Ogura[3], H. Kiyofuji[3], and S. Okamoto[3]. **SEAPODYM working progress and applications to Pacific skipjack tuna population and fisheries. [1]** Marine Ecosystem Department, CLS, France; [2] Oceanic Fisheries Programme, SPC, New Caledonia; [3] National Research institute of Far Seas Fisheries, Japan.
EB-WP-07	Y. Inoue, K. Yokawa, H. Minami, D. Ochi, N. Sato and N. Katsumata. **Distribution of seabird bycatch at WCPFC and the neighboring area of the southern hemisphere**. Ecologically Related Species Group, Tuna and Skipjack Resources Division, National Research Institute of Far Seas Fisheries, Fisheries Research Agency, Japan
EB-WP-08	E. Melvin [1], T. Guy [1] and N. Sato [2]. **Preliminary Report of 2010 Weighted Branch-line Trials in the Tuna Joint Venture Fishery in the South African EEZ**.

	[1] Washington Sea Grant, University of Washington, Box 355020, Seattle, WA 98195; [2] Ecologically Related Species Section, National Research Institute of Far Sea Fisheries.
EB-WP-09	H. Minami, D. Ochi and N. Sato. **A comparison of two blue-dyed bait types for reducing incidental catch of seabirds in the experimental operations of the Japanese southern bluefin tuna longline**. Ecologically Related Species Group, Tuna and Skipjack Resources Division, National Research Institute of Far Seas Fisheries, Fisheries Research Agency
EB-WP-10	K. Bigelow. **Seabird interaction rates estimated from observer data (2004-2011) in the Hawaii-based shallow and deep-set longline fisheries**. NOAA Fisheries, Pacific Islands Fisheries Science Center, Honolulu, Hawaii, USA.
EB-WP-11	D. Itano [1] and V. Restrepo [2]. **Status of the Purse Seine Bycatch Mitigation Project and research cruises funded by the International Seafood Sustainability Foundation with notes on the development of best practices for the live release of encircled animals. [1]** Pelagic Fisheries Research Program, Honolulu, Hawaii, 96822, USA.; [2] International Seafood Sustainability Foundation, P.O. Box 11110, McLean, Virginia, USA 22102
EB-WP-12	Y. Chen, X. Dai, J.F. Zhu and X. Chu. **Review of Chinese scientific observer programme in the Pacific Ocean in 2010**. Shanghai Ocean University, China.
EB-WP-13	K. M. Schaefer and D.W. Fuller. **An Overview of The 2011 ISSF/IATTC Research Cruise for Investigating Potential Solutions for Reducing Fishing Mortality on Undesirable Sizes of Bigeye And Yellowfin Tunas, and Sharks, in Purse-Seine Sets on Drifting FADs**. Inter-American Tropical Tuna Commission La Jolla, California, USA
EB-WP-14	WCPFC Secretariat. **Report of the First Meeting of the Kobe Process Joint Technical Working Group on Bycatch, La Jolla, CA, July 11, 2011.**
EB THEME – Information Papers	
EB-IP-01	Shelley Clarke, Shelton Harley, Lea Protoy and Peter Williams. **A progress report on the shark research plan.** Oceanic Fisheries Programme, Secretariat of the Pacific Community.
EB-IP-02	T. Lawson. **Estimation of Catch Rates and Catches of Key Shark Species in Tuna Fisheries of the Western and Central Pacific Ocean Using Observer Data.**
EB-IP-03	L. Fitzsimmons. **Bycatch Mitigation Information System**. SPC-OFP
EB-IP-04	Valerie Allain [1], Simon Nicol [1], Jeffrey Polovina [2], Marta Coll [3], Robert Olson 4], Shane Griffiths [5], Jeffrey Dambacher [6], Jock Young [6], Jesus Jurado Molina [1], Simon Hoyle [1], Tim Lawson [1], Johann Bell [1]. **Report of the international workshop on opportunities for ecosystem approaches to fisheries management in the Pacific Ocean tuna fisheries**. [1] SPC-Secretariat of the Pacific Community, BPD5-98848, Noumea, New Caledonia; [2] NMFS-National Marine Fisheries Service, 2570 Dole Street, Honolulu, HI 96822, USA; [3] ICM-CSIC Institut de Ciències del Mar, Passeig Maritim de la Barceloneta, 37-49, 08003 Barcelona, Spain; [4] IATTC-Inter-American Tropical Tuna Commission, 8604 La Jolla Shores Drive, La Jolla, CA 92037-1508, USA; [5] CSIRO-Commonwealth Scientific and Industrial Research Organisation, 41 Boggo Road, Dutton Park, QLD, 4102, Australia; [6] CSIRO-Commonwealth Scientific and Industrial Research Organisation, GPO Box 1538, Hobart, TAS 7001, Australia.
EB-IP-05	J. Jurado-Molina[1], K. Bigelow[2], S. Hoyle[1], S. Nicol[1], K. Briand[1]. **Developing a spatially adjusted CPUE for the albacore fishery in the South Pacific.** [1] Oceanic

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EB-IP-06	J. Jurado-Molina[1], P. Lehodey[2], I. Senina[2], S. Nicol[1]. **SEAPODYM perspectives as management tool for albacore (*Thunnus alalunga*) in the South Pacific Ocean. [1]** Oceanic Fisheries Programme, Secretariat of the Pacific Community, B.P. D5 - 98848, Noumea, Cedex, New Caledonia.; [2] MEMMS (Marine Ecosystems Modelling and Monitoring by Satellites), CLS, Satellite Oceanography, Division, 8-10 rue Hermes, 31520 Ramonville, France.
EB-IP-07	Melanie Abecassis[1], Patrick Lehodey[2], Inna Senina[2], Jeffrey Polovina[3], Beatriz Calmettes[2], Peter Williams[4]. **Application of the SEAPODYM model to swordfish in the Pacific Ocean. [1]** Joint Institute for Marine and Atmospheric Research, 1000 Pope Rd, Honolulu, HI 96822, USA; [2] MEMMS (Marine Ecosystems Modelling and Monitoring by Satellites), CLS, Satellite Oceanography Division, 8-10 rue Hermes, 31520 Ramonville, France ; [3] Pacific Islands Fisheries Science Center, NOAA, 2570 Dole Street, Honolulu, HI 96822, USA ; [4] Oceanic Fisheries Program, SPC, New Caledonia.
EB-IP-08	ISC Shark Working Group. **Report of the ISC's shark working group workshop, 19-21 April 2011.** International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean.
EB-IP-09	FFA. **FFA Members proposed CMM to prohibit purse seine fishing associated with whale sharks** (WCPFC-2010/DP-09).
EB-IP-10	Australia. **Proposed CMM mitigating fishing impacts on cetaceans** (WCPFC-2010-DP-17 (Rev 2)).

MANAGEMENT ISSUES THEME

MI THEME – Working Papers	
MI-WP-01	J. Hampton, P. Williams. **Analysis of purse seine set type behavior in 2009 and 2010**. SPC-OFP
MI-WP-02	SPC-OFP. **Projections based on 2011 assessments (Excel file).** SPC-OFP
MI-WP-03	Ann Preece, Rich Hillary and Campbell Davies. **Identification of candidate limit reference points for the key target species in the WCPFC (Consultancy report)** CSIRO Marine and Atmospheric Research, P O Box 1538, Hobart, Tasmania 7001 Australia
MI-WP-04	S. J. Harley and N. Davies. **Evaluation of stock status of bigeye, skipjack, and yellowfin tunas against potential limit reference points**. Oceanic Fisheries Programme, SPC.
MI-WP-05	John Sibert [1], Inna Senina [2], Patrick Lehodey [2]. **Prospects for effective conservation of bigeye tuna stocks in the Western Central Pacific Ocean. [1]** University of Hawaii, Honolulu, USA sibert@hawaii.edu; [2] CLS, Marine Ecosystems Department, Ramonville, France.
MI THEME – Information Papers	
MI-IP-01	S. Hoyle, F. Bouyé, and S. Harley. **TUMAS: a tool to allow analysis of management options using WCPFC stock assessments.** SPC-OFP
MI-IP-02	R. Campbell. **Convener's Draft Terms of Reference for Management Issues Theme**.

	CSIRO, Australia
MI-IP-03	WCPFC Secretariat. **Draft Objectives for the Workshop on Management Objectives.**

DATA AND STATISTICS THEME

ST THEME – Working Papers	
ST-WP-01	P. Williams. **Scientific data available to the Western and Central Pacific Fisheries Commission**. SPC-OFP
ST-WP-02	J. Hampton and P. Williams. **Misreporting of purse seine catches of skipjack and yellowfin-bigeye on logsheets**. SPC-OFP
ST-WP-03	T. Lawson and P. Sharples. **Report on Project 60: Collection and Evaluation of Purse-Seine Species Composition Data.** SPC-OFP
ST-WP-04	PTTP Steering Committee. Report of the PTTP Steering Committee
ST THEME – Information Papers	
ST-IP-01	P. Williams. **Estimates of annual catches in the WCPFC Statistical Area.** SPC-OFP
ST-IP-02	T. Lawson. **Purse-Seine length frequencies corrected for selectivity bias in grab samples collected by observers.** SPC-OFP
ST-IP-03	P. Williams. **Issues with Chinese longline fleet data submitted by the WCPFC**. Oceanic Fisheries Programme (OFP), Secretariat of the Pacific Community (SPC), Noumea, New Caledonia
ST-IP-04	Peter Williams [1], Shelton Harley [1] and Robert Campbell [2]. **South Pacific swordfish data available for stock assessments**. [1] Oceanic Fisheries Programme (OFP), Secretariat of the Pacific Community (SPC), Noumea, New Caledonia.; [2] CSIRO Marine and Atmospheric Research, Aspendale, Australia
ST-IP-05	S. Nicol[1], B. Leroy[1], S. Caillot[1], J. Hampton[1], A. Lewis[1], A. Williams[1], T. Usu[2], B. Kumasi[2], L. Kumoru][2]. **Pacific Tuna Tagging Project progress report and workplan for 2011-2012.** [1] Secretariat of the Pacific Community (SPC), Ocean Fisheries Programme (OFP), Noumea, New Caledonia; [2] National Fisheries Authority, Port Moresby, Papua New Guinea.
ST-IP-06	P. Williams. **Status of observer data management**. SPC-OFP
ST-IP-07	Rafael V.Ramiscal [1], Alma C. Dickson [1], Marlo Demoos[1], William S. de la Cruz [1], Isidro Tanangonan [1], Ronald Begonia [1] and Jonathan O. Dickson [2]. **Fisheries Observers Preliminary Assessment of Purse Seine / Ring Net Fishing in Phillipine Major Fishing Grounds During the FAD Fishing Closure CY 2010.** [1] NMFDC, Bureau of Fisheries and Aquatic Resource (BFAR); [2] Capture Fisheries Division, BFAR, PCA Bldg., Elliptical Road, Quezon City, Philippines
ST-IP-08	Secretariat**. Summary of regional observer programme audits**
ST-IP-09	S. I. Lee, Z. G. Kim, J. T. Yoo, D. W. Lee, D. N. Kim, D. Y. Moon and H. S. Sohn. **Pilot research on species composition of Korean purse seine catch at cannery sites.** National Fisheries Research and Development Institute, Busan, Republic of Korea
ST-IP-10	ISC. **ISC Data Exchange with WCPFC.** International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

STOCK ASSESSMENT THEME

SA THEME – Working Papers	
SA-WP-01	S. Nicol [1], S. Hoyle [1], J. Farley [2], B. Muller [3], S. Retalmai [4], K. Sisior [5], A. Williams [1]. **Bigeye tuna age, growth and reproductive biology (Project 35)**. [1] Oceanic Fisheries Programme, Secretariat of the Pacific Community, B.P. D5 - 98848, Noumea, Cedex, New Caledonia. [2] CSIRO Marine and Atmospheric Research, Wealth from Oceans Flagship, PO Box 1538, Hobart, TAS 7001, Australia. [3] Marshall Islands Marine Resources Authority. Box 860, Majuro, Marshall Islands 96960. [4] National Oceanic Resource Management Authority, PO Box PS122, Palikir, Pohnpei, FM 96941, Federated States of Micronesia. [5] Bureau of Marine Resources, Ministry of Natural Resources, Environment and Tourism, PO Box 359, Koror State, PW 96940 Palau.
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ANNUAL REPORT – PART 1 – all related with A2.3

Symbol	CCMs
AR-CCM-01	**Australia**
AR-CCM-02	**Canada**
AR-CCM-03	**China**
AR-CCM-04	**Cook Islands**
AR-CCM-05	**European Union**
AR-CCM-06	**Federated States of Micronesia**
AR-CCM-07	**Fiji**
Covered by its territories	***France***
AR-CCM-08	**French Polynesia**
AR-CCM-09	**Japan**
AR-CCM-10	**Kiribati**

AR-CCM-11	**Korea**
AR-CCM-12	**Marshall Islands**
AR-CCM-13	**Nauru**
AR-CCM-14	**New Caledonia**
AR-CCM-15	**New Zealand**
AR-CCM-16	**Niue**
AR-CCM-17	**Palau**
AR-CCM-18	**Papua New Guinea**
AR-CCM-19	**Philippines**
AR-CCM-20	**Samoa**
AR-CCM-21	**Solomon Islands**
AR-CCM-22	**Chinese Taipei**
AR-CCM-23	**Tokelau**
AR-CCM-24	**Tonga**
AR-CCM-25	**Tuvalu**
AR-CCM-26	**United States of America**
AR-CCM-27	**Vanuatu**
AR-CCM-28	**Wallis and Futuna**
Covered by USA Annual Report	***American Samoa***
	Guam
	Northern Mariana Islands
AR-CNM-29	**Belize**
AR-CNM-30	**Ecuador**
AR-CNM-31	**El Salvador**
AR-CNM-32	**Indonesia**
AR-CNM-33	**Mexico**
AR-CNM-34	**Panama**
AR-CNM-35	**Senegal**
AR-CNM-36	**Thailand**
AR-CNM-37	**Vietnam**

NGO and Others

Greenpeace	Greenpeace Brief

Attachment G

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Seventh Regular Session

Pohnpei, Federated States of Micronesia
9–17 August 2010

TERMS OF REFERENCE FOR THE MANAGEMENT ISSUES THEME

Terms of Reference for the Management Issues Theme

The overall purpose of the Management Issues Theme is to provide scientific advice to the Commission on management measures, both existing and potential, that can assist the Commission achieve its adopted management objectives. Ideally, the impacts of management measures adopted by the Commission should be considered before implementation and scientific research can help inform the Commission on the utility of potential management options.

Specific functions of the Management Issues Theme will include:

- Review and evaluate the potential of existing CMMs in achieving their stated management objectives and the trade-offs associated with reconciling multiple objectives;
- Evaluate the utility of additional management measures on achieving the stated objectives of existing CMMs and the overall management objectives adopted by the Commission;
- Review, evaluate and identify appropriate reference points and harvest strategies that will assist the Commission achieve its management objectives;
- Develop, and review, biological, economic and social performance indicators against which the achievement of management objectives can be assessed;
- Develop, and review, appropriately structured multi-species, multi-fleet, bio-economic and / or ecosystem-based operational models that can be used to evaluate management measures;
- Develop, and review, user-friendly software to assist fishery managers in understanding the implications of potential management measures and longer-term strategies;
- Identify research and data required to support the evaluation of management measures;
- Provide advice and make recommendations to the Commission on the above.

Attachment H

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Seventh Regular Session

Pohnpei, Federated States of Micronesia
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TERMS OF REFERENCE FOR THE WORKSHOP ON MANAGEMENT OBJECTIVES

Terms of Reference for the Workshop on Management Objectives

The overall aim of the Workshop should be to clarify the Commission's management objectives and assist the Commission understand both the role of appropriate reference points and the process of evaluating potential management measures in the achievement of these objectives.

Specific objectives for the Workshop could include:

- Clarify the Commission's management objectives in terms of biological, economic and social issues (e.g. sustainability of stocks and catches, maintenance of catch rates, profits, and employment, food security etc).
- Assist managers to understand the process required to formally operationalize and quantify management objectives to assist with the provision of scientific advice to the Commission and so that they can be incorporated into methods used to evaluate the utility of management measures.
- Review the role of biological, economic and social performance indicators against which the achievement of management objectives can be assessed;
- Identify and discuss the role played by appropriate reference points in achieving management objectives;
- Provide guidance on identifying stock specific limit and target reference points for the key target species and how assessment uncertainty and appropriate levels of risk can be incorporated.
- If warranted, review the role of feedback decision-rules (or harvest strategies) for updating management measures in response to assessment outcomes and the role and methods used to evaluate management strategies and identify the trade-offs in achieving specific management objectives;
- Clarify to the Commission the role that scientific research and the Scientific Committee can play in this process and, to this end, identify a work program to progress the above tasks.

Attachment I

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Seventh Regular Session

Pohnpei, Federated States of Micronesia
9–17 August 2011

JAPAN DRAFT GUIDELINES FOR THE RELEASE OF WHALE SHARKS FROM PURSE SEINE NETS

Japans Draft Guidelines for the Release of Whale Sharks from Purse Seine Nets

There are potentially three situations for safe and live release of encircled whale shark during purse seine operations. First of all, if fishermen found whale shark in the net, the net should be rolled up until whale shark cannot swim or move relatively freely.

- ***remain in the net until rolling up the net***
  a. Fishermen attempt to lead the head to approach nearest corkline by rolling up the net under the ventral and tail side.
  b. Release cork rope of the head side.
  c. Roll up the net of the tail side to run the head on the corkline
  d. Control the net carefully to keep whale shark calm down because if they wriggle, their body could be entangled in the net.
  e. Wait for escaping from the net themselves (whale shark swim away from the net)

- ***keep pushing the head to escape from the net***
  Whale shark sometimes attempts to escape from the net and keep pushing the head to the net when the net is rolling up. In this case, fishermen swim and approach to whale shark along with the rope and cut off the net horizontally nearly from their lower jaw. They can escape easily from the cut off point. Fishermen must swim away as fast as possible after cutting off the net without touching its tail fin.

- ***entangled in the net***
  Whale shark sometimes is entangled in the net by swimming and twisting the body. If whale shark cannot escape from the net himself or herself, the net must be cut off by knife attached long pole or fishermen step down and cut off the net.

Attachment J

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Seventh Regular Session

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STRATEGIC RESEARCH PLAN OF THE SCIENTIFIC COMMITTEE

2012-2016

Prepared by the Secretariat

I. INTRODUCTION

1. The Convention and the Commission

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

The Commission is tasked with developing and adopting specific measures to promote these objectives, as detailed in Articles 5 and 6 of the Convention. The fundamental duties of the Commission must be supported by science-based information concerning:

- assessments of the impact of fishing on the marine resources of the western and central Pacific Ocean (WCPO);
- protection of biodiversity and promotion of ecosystem based approaches to management;
- minimization of waste, pollution and impacts on both target and non-target or associated or dependent species (NTADS);
- prevention or elimination of overfishing and excess fishing capacity;
- collection, compilation and dissemination of complete and accurate fisheries data and information from national and international research programmes.

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

2. The Scientific Committee

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

or NTADS in the Convention Area and to assist development and assess information resulting from a regional observer programme.[2]

The Convention requires that the Scientific Committee recommend a research plan to the Commission[3]. The first Strategic Research Plan was prepared as an adaptive research plan to support the Scientific Committee's objective of providing the best available scientific advice. It had an initial period of five years, from 2007 to 2011. This second five-year Strategic Research Plan is prepared for the period 2012 to 2016. It will be used to guide the development of annual work plans of the Scientific Committee and will be periodically reviewed to ensure that it remains responsive to the Commission's needs.

II. RESEARCH PRIORITIES

The Commission has four overall research and data collection priorities:

- Monitoring of fishing activities through the collection, compilation and validation of data from the fishery
- Monitoring and assessment of target stocks
- Monitoring and assessment of NTADS and of the pelagic ecosystems of the WCPO
- Evaluation of existing Conservation and Management Measures (CMMs) and of potential management options

1. Monitoring of fishing activities through the collection, compilation and verification of data from the fishery

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

- estimating total fishing effort which includes incremental increases in effective effort, catches and related mortalities of target and non-target species, stratified, as appropriate, by area, time, species or stock, size, sex and other characteristics;
- monitoring the accuracy and coverage of operational-level catch and effort data, aggregated catch and effort data, and size composition data compiled by the Commission, and developing programmes to improve accuracy and coverage and to address data gaps that are identified;
- developing programmes for the collection and compilation of related fisheries data, such as gear and vessel attributes, and other information, that can be used to standardize fishing effort and estimate fishing capacity and changes in effective fishing effort;
- rescuing historical fisheries data and related metadata useful for stock assessment and effort standardization;
- developing draft standards for the collection of operational catch and effort data, port sampling data, observer data and other types of data, as required, including minimum standards for data collection forms;
- developing and testing sampling designs, including sampling protocols, for the collection of these data through observer and port sampling programmes; and

[2] Including work undertaken by scientific experts engaged by the Commission under Article 13, and for the observer programme, in conjunction with the Technical and Compliance Committee.
[3] Article 12(2)(a).

- developing programmes to assist Members, Cooperating Non-members and Participating Territories (CCMs) in meeting data-related Convention obligations.

2. Monitoring and assessment of stocks

Stock assessment and modeling are the primary scientific tools used to estimate the status of fish stocks and to evaluate the effectiveness of CMMs. Structural uncertainty in stock assessment derives, in part, from inaccurate or incomplete data from the fishery, mistaken assumptions about underlying biological and ecological processes, and an incomplete understanding of fishing gear and vessels operations. Statistical uncertainty derives from inadequate sampling protocols and inaccurate measurement of key input data. Addressing uncertainties in stock assessment provides a useful focus for assigning priorities to stock-assessment related components of the Strategic Research Plan.

Stock assessment and modeling

Research activities directly supporting stock assessments include:

- Routine application of existing methods for stock assessment, including the characterisation of statistical and structural uncertainty;
- Improvement of existing methods and development of new methods;
- Identification and refinement of biological reference points for use in stock status determination;
- Use of simulation models for testing stock assessment models and to evaluate the sensitivity of stock assessment results to violation of structural assumptions
- Improvement of data inputs to stock assessment models, in particular analyses to standardize fishing effort or catch-per-unit-effort to provide reliable indices of abundance.

Biological studies

Understanding of key biological processes and the identification and definition of regional variability in these processes in an area as large as the WCPO is required to underpin stock assessments. Enhanced understanding of these processes will reduce structural uncertainty and possible bias in stock assessments. Required studies include:

- age and growth of pre- and post-recruit segments of the population;
- reproductive parameters and capacity;
- the dependency of natural mortality on age
- length, weight and sex composition in response to environmental and anthropogenic factors;
- characterisation of stock structure;
- movement and migration;
- behavior and habitat utilisation;
- recruitment variability and the environmental influences thereon; and
- tagging studies.

Stock assessments for small pelagic and demersal species of fish benefit greatly from "fishery independent" survey data, which provide information on population size independent of data from the commercial fishery. Such data can reduce the bias and uncertainty in stock assessments. Unfortunately, routine scientific survey methods are not applicable to HMS because of the large geographical scales, the limitations of fish surveying technology and the resultant high costs. Tagging studies on all scales are the closest approximation to fishery independent data currently available to support the WCPFC.

Tagging studies provide information on rates and direction of movement, mortality, habitat utilization, aggregation and vulnerability, all of which are directly used in the stock assessments. Tagging is therefore an important tool for biological and behavioral studies of fish and has special importance in the assessment highly migratory fish stocks. Tagging activities include:

- mass tagging with conventional tags to determine large-scale population movement and mortality rates;
- specialized deployment of data storage tags, both conventional archival tags and pop-up satellite tags, to better define horizontal and vertical habitat preferences;
- deployment of other types of electronic tags to determines small-scale movements or residence times in relation to natural features and floating objects, such as seamounts and fish aggregating devices; and
- implementation of comprehensive tag recovery procedures, and studies (e.g. tag seeding) to estimate the rates of reporting of recaptured tags.

3. Monitoring and assessment of the ecosystem

The ecosystem approach to fisheries requires managers to consider more than the impact of the fishery on single target stocks. Additional considerations include assessing the impact of environmental variability on target stocks, and assessing the impact of the fishery on other species including prey, competitors, NTADS and on habitat. Research activities for the WCPFC include:

- Undertaking periodic ecological risk assessments, using Productivity-Susceptibility Analysis or other approaches, to identify priorities for enhanced monitoring, biological research, stock assessment and management intervention;
- Developing and undertaking the Shark Research Plan, including assessments to determine the status of WCPO shark stocks and the impacts from tuna fisheries; research to better understand shark biology and ecology; and improvement of shark catch data from commercial fisheries;
- establishing ecosystem indicators to monitor the effects of fishing, other anthropogenic effects and natural variability on ecosystem structure, function and biodiversity;
- identifying habitats of special significance,
- quantify fishery impacts, other anthropogenic impacts and the effects of environmental and climate variability and change on ocean ecosystems;
- estimating maximum aggregate yield of all species that can be safely removed from the ecosystem without disrupting ecosystem structure and function;
- identifying oceanographic features, processes and fishing practices that influence the distribution and abundance of fish stocks and their vulnerability to fishing gear;
- investigating trophic (predator/prey) relationships ;
- synthesising data and ideas across disciplines into ecological and ecosystem-based models; and
- conducting bycatch mitigation research including technical options to minimise bycatch and discards, including undesirable sizes of target species, and investigating depredation.
- Use of ecosystem models and related tools to assess the combined effects of fishing, oceanographic variability and socioeconomics in the context of multispecies fisheries and multiple management objectives.
- Assessment of the discards of food fish in industrial fisheries and evaluation of implications for food security.

4. Evaluation of existing CMMs and potential management measures

The impacts of existing and potential CMMs and potential management measures on target stocks, NTADS and the ecosystem as a whole (including socioeconomic impacts) should be considered by the Commission, where possible, before the implementation of such measures, including the potential impact of any conditions and exclusions. Scientific research may inform the Commission when considering management options, through the provision of information on the effectiveness of management measures in achieving their objectives and the trade-offs associated with reconciling multiple objectives.

Further insights can be obtained from computer simulations incorporating uncertainty in our current understanding of population, fishery and ecosystem dynamics. Such simulations may range in complexity from simple projections or equilibrium yield analyses incorporated into single species stock assessment models, to more complex multi-species Management Strategy Evaluation (MSE) models. MSE models consider the stock, fleet and ecosystem dynamics, fishing impacts, data collection, stock assessment, potential management response and the degree of implementation and compliance as a single integrated system. The research required to develop an MSE framework for the WCPFC Convention Area includes:

- Development of an appropriately structured multi-species operational model that incorporates, inter alia, the effects of oceanographic and climate variability and change;
- Development of behavioral models of fleet dynamics, including bio-economic models which integrate resource and fleet dynamics;
- Quantification of management objectives and the development of biological, social and economic performance indicators against which the achievement of management objectives can be assessed;
- Development of candidate feedback decision-rules for updating management measures in response to assessment outcomes;
- Characterisation of uncertainty and risk in the evaluation of management measures;
- Development of computer software, or adaptation of existing software, to integrate the above models with modules simulating data generation, assessment, management response and implementation.
- The development of user-friendly software to assist fishery managers in understanding the implications of potential management measures and longer-term strategies.

III. IMPLEMENTATION AND REVIEW

Monitoring the implementation of this Strategic Research Plan will be the responsibility of the Chair of the Scientific Committee in collaboration with the Executive Director. Members of the Commission, including Cooperating Non-members, Participating Territories, observers, scientific experts and the Secretariat will share responsibility for implementation of the Plan. Opportunities to take responsibility for activities supporting implementation of components of the Plan will be considered at each meeting of the Scientific Committee.

At each regular session of the Scientific Committee the Ecosystems and Bycatch, Management Issues, Statistics, and Stock Assessment Themes will be convened. The Fish Biology, Fishing Technology, and Methods Themes will meet as required by the SC. Issues relating to biology, methods, and fishing technology that are of relevance to the stock assessments to be undertaken in a given year will be considered by the stock assessment preparatory workshop. Theme sessions will review the elements of the Plan relevant to their respective terms of reference and will develop operational work programmes consistent with the Plan. Coordination of the review and work programme development will rest with the Chair of the Scientific Committee in consultation with conveners of the Theme Groups, the manager of the Scientific Services Provider and the Executive Director.

Opportunities to involve individuals and institutions from developing countries and territories should be a strong feature of the implementation of the Plan. Promoting such involvement should be aimed at both utilising available expertise from developing countries and territories, and at providing important opportunities for building scientific and technical capacity within those countries and territories.

Full implementation of the Strategic Research Plan will likely be beyond the means of the Commission's core budget. Extra-budgetary funds from voluntary contributions of Members and other sources will be required and actively sought by the Commission. Nevertheless, adoption of the Plan by the Scientific

Committee and subsequent strong support from the Commission is a prerequisite to securing the necessary extra-budgetary funds.

An independent external review of the Plan may periodically be requested by the SC. The Scientific Committee will be responsible for preparing the terms of reference for the review. The Scientific Committee will present the report of the review to the next regular session of the Commission.

IV. RELATIONS WITH OTHER ORGANIZATIONS

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

1. Technical and Compliance Committee

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

2. International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) is informed of relevant elements of the Plan that may have a bearing on the research conducted by the ISC. This commitment, together with a commitment to collaboration, consultation and coordination, is reflected in the Memorandum of Understanding developed between the Commission and the ISC. The ISC will be invited to participate in each regular session of the Scientific Committee.

3. Inter-American Tropical Tuna Commission

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the Director of the Inter-American Tropical Tuna Commission (IATTC) is informed of any element of the Plan directly relevant to the functions of IATTC. This commitment, together with a commitment to collaboration, consultation and coordination, is reflected in the Memorandum of Understanding between the Commission and the IATTC. The MOU provides for collaboration with respect to the collection and sharing of data and information, subject to data sharing protocols of each organization, the development and implementation of joint research initiatives and the harmonization of conservation and management measures. Due to the fact that frozen tagged tuna will move between ocean basins for processing, collaboration with IATTC on tagging programmes would be desirable. Collaboration in developing and implementing joint research activities would also be useful. The IATTC will be invited to participate in each regular session of the Scientific Committee.

4. Secretariat of the Pacific Community – Oceanic Fisheries Programme

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

the capacity to report directly to the Commission on science matters. The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that SPC-OFP is consulted at regular intervals between regular sessions of the Scientific Committee on progress with implementation of the Plan. An MOU between the Commission and SPC-OFP reflects these arrangements.

5. Indian Ocean Tuna Commission

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the Director of the Indian Ocean Tuna Commission (IOTC) is informed of any element of the Plan directly relevant to the functions of the IOTC. Strong similarities exist between the fisheries and fishery management concerns and objectives of each regional fisheries management organization (RFMO). Implementation of research plans by both organizations will benefit from open and transparent communication in many areas, including research related to purse seine and longline fisheries, data collection and verification, illegal, unregulated and unreported (IUU) fleets, capacity and vessel registries. The geographic areas of concern to each party overlap in Southeast Asia, further reinforcing the need for collaboration. Tuna tagging programmes are active within both Commission areas, which will test the ability of both organizations to organize a single, coherent tag recovery and reward system in cooperation with coastal states and distant water fishing nations.

6. Food and Agriculture Organization of the United Nations

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

Attachment K

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Seventh Regular Session

Pohnpei, Federated States of Micronesia
9–17 August 2011

TERMS OF REFERENCE FOR THE PEER REVIEW OF THE 2011 BIGEYE TUNA STOCK ASSESSMENT

Terms of Reference

The Panel would prioritise the tasks listed below. The review panel may comment and make recommendations upon issues additional to those listed below.

1. Evaluate and determine what stock structure is most appropriate for the bigeye tuna stock assessment with consideration of a Pacific wide assessment.
2. Comment on the adequacy and appropriateness of data sources for stock assessment. Evaluate the use (robustness) of modified data from sampling bias studies. Identify data uncertainties and its effects on assessments results. Recommend methods to resolve data uncertainties.
3. Review the assessment methods: determine if they are reliable, properly applied, and adequate and appropriate for the species, fisheries, and available data.
4. Evaluate the assessment model configuration, assumptions, input data and configuration, and primary sources of uncertainty, parameters (fishery, life history, and spawner recruit relationships), determine if data is used appropriately, input parameters seem reasonable and primary sources of uncertainty are accounted for.
5. Particular attention is to be paid to the following;
    A) Length of older individuals and the impact it has on the stock assessment results.
    B) Potential for regime shift in recruitment. Consider whether shifts in recruitment are real or are caused by model artefacts.
    C) Appropriateness of the stock recruitment relationship.
    D) Availability of bigeye to purse seine and not being available to longline.
    E) Investigate the cause of residual patterns in the length composition data and determine how it can be resolved.
    F) The use of CPUE indices in the assessment (purse seine, pole-and-line and/or longline) and consider the regional weighting of these standardized indices.
    G) Determine if the manner in which the movement and tagging data are modeled is appropriate.
    H) Determine if the spatial structure of the model is appropriate.
6. Evaluate the adequacy of the sensitivity analyses in regard to completeness and incorporation of results.

7. Comment on the proposed reference points and management parameters (*e.g., MSY, Fmsy, Bmsy, MSST, MFMT*); if possible and feasible, estimate values for alternative reference points (or appropriate proxies) and view on stock status.
8. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status. This would include the methods of projection under hypothetical various options in future management measures (on effort? On catch? By fisheries? Etc.)
9. Suggest research priorities to improve our understanding of essential population and fishery dynamics, necessary to formulate best management practices.