行政院及所屬各機關出國報告
（出國類別：出席國際會議）

參加第十七屆鮪旗魚常設委員會及第三屆中西太平洋漁業委員會科學協調小組會議報告

出國人：

服務機關	職稱	姓名
行政院農業委員會漁業署	簡派技正	郭宗海
國立臺灣大學海洋研究所	副教授	孫志陸
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出國地區：　馬紹爾群島共和國首都馬久諾市
出國期間：　九十三年八月六日至二十五日
報告日期：　九十三年九月三十日

系統識別號:C09303671

公 務 出 國 報 告 提 要

頁數: 136　含附件: 是

報告名稱:

參加第十七屆鮪旗魚常設委員會及第三屆中西太平洋漁業委員會科學協調小組會議報告

主辦機關:

行政院農業委員會漁業署

聯絡人／電話:

陳汾蘭／33436206

出國人員:

郭宗海　行政院農業委員會漁業署　遠洋漁業組　簡派技正

出國類別: 其他

出國地區: 馬紹爾群島

出國期間: 民國 93 年 08 月 10 日 -民國 93 年 08 月 25 日

報告日期: 民國 93 年 09 月 30 日

分類號/目: F9／漁業（養殖業）　F9／漁業（養殖業）

關鍵詞:　SCTB;IATTC;WCPFC;Tuna and tuna-like species

內容摘要: 本次會議對於主要漁獲魚種之資源狀態有以下之結論：一、正鰹：由於近年來正鰹資源補充量大，資源無過漁問題，預估在此高補充量情形下，持續生產量可達120萬公噸，因此目前並無需考慮管理問題，但須審慎因應以正鰹爲主要目標魚種之圍網混獲黃鰭鮪及大目鮪幼魚的問題。此外，該魚種近年來漁獲穩定並無過漁疑慮，且混獲問題應分開討論。二、黃鰭鮪：2004年之資源評估結果顯示中西太平洋之黃鰭鮪資源可能沒有發生過漁的情況（Fcurrent/FMSY<1），且資源狀況亦顯示沒有過漁的情形（Bcurrent/BMSY>1）。赤道海域之黃鰭鮪資源可能接近完全開發的狀態，未來任何的漁獲死亡率的增加，可能不會在長期上產生產量的增加，卻可能將黃鰭鮪資源推向過漁的狀態。資源量之生物參考點顯示，若保持目前的漁獲量時，長期平均的資源量將保持在高於MSY之水準。而生產量評估顯示可能需要對漁獲量加以限制，以防範特定年齡群資源量的過度開發；圍網漁業在赤道海域對資源已有相當的衝擊。而Probability distribution for F ratio（Fcurrent/FMSY）分析結果，相當的樂觀，即使維持目前的漁獲死亡率，過漁的發生機率仍小於大目鮪的情形。三、大目鮪：2004年資源評估結果顯示之參考點呈較去年樂觀的現象，1999-2001年之漁獲死亡率接近MSY水準（Fcurrent~FMSY），而資源量水準則高於MSY（Bcurrent>BMSY），結論爲若維持目前之漁獲死亡率將會導致產生過漁的風險。此外，未來若加入量過低時，中西太平洋之大目鮪將會與東太平洋大目鮪有相同的情形發生。四、南太平洋長鰭鮪：目前資源無過漁疑慮，資源量約在無漁業開發狀態下60%的水準，但部份區域CPUE有下降的趨勢（Localized Depletion），主要受到評估所需資料不足所影響，但此問題應不影響該魚種資源評估結果。

本文電子檔已上傳至出國報告資訊網

摘要

本次會議對於主要漁獲魚種之資源狀態有以下之結論：

一、正鰹：由於近年來正鰹資源補充量大，資源無過漁問題，預估在此高補充量情形下，持續生產量可達 120 萬公噸，因此目前並無需考慮管理問題，但須審慎因應以正鰹為主要目標魚種之圍網混獲黃鰭鮪及大目鮪幼魚的問題。此外，該魚種近年來漁獲穩定並無過漁疑慮，且混獲問題應分開討論。

二、黃鰭鮪：2004 年之資源評估結果顯示中西太平洋之黃鰭鮪資源可能沒有發生過漁的情況（$F_{current}/F_{MSY}<1$），且資源狀況亦顯示沒有過漁的情形（$B_{current}/B_{MSY}>1$）。赤道海域之黃鰭鮪資源可能接近完全開發的狀態，未來任何的漁獲死亡率的增加，可能不會在長期上產生產量的增加，卻可能將黃鰭鮪資源推向過漁的狀態。資源量之生物參考點顯示，若保持目前的漁獲量時，長期平均的資源量將保持在高於 MSY 之水準。而生產量評估顯示可能需要對漁獲量加以限制，以防範特定年齡群資源量的過度開發；圍網漁業在赤道海域對資源已有相當的衝擊。而 Probability distribution for F ratio（$F_{current}/F_{MSY}$）分析結果，相當的樂觀，即使維持目前的漁獲死亡率，過漁的發生機率仍小於大目鮪的情形。

三、大目鮪：2004 年資源評估結果顯示之參考點呈較去年樂觀的現象，1999-2001 年之漁獲死亡率接近 MSY 水準（$F_{current}$~F_{MSY}），而資源量水準則高於 MSY（$B_{current}>B_{MSY}$），結論為若維持目前之漁獲死亡率將會導致產生過漁的風險。此外，未來若加入量過低時，中西太平洋之大目鮪將會與東太平洋大目鮪有相同的情形發生。

四、南太平洋長鰭鮪：目前資源無過漁疑慮，資源量約在無漁業開發狀態下 60%的水準，但部份區域 CPUE 有下降的趨勢（Localized Depletion），主要受到評估所需資料不足所影響，但此問題應不影響該魚種資源評估結果。

目次

參加第十七屆鮪旗魚常設委員會及 第三屆科學協調小組會議報告

壹、目的

鮪旗魚常設委員會（Standing Committee on Tuna and Billfish，SCTB）乃為促進中西太平洋（West and Central Pacific Ocean）鮪類資源之養護及合理利用，由太平洋共同體（Pacific Community，PC）於十七年前所成立之常設科學會議，其目的在提供鮪類研究之科學家及團體或組織一個漁獲統計資料交換、科學研究及資源評估討論之論壇，範圍包括：一、協調漁獲資料之收集、彙整及分送之原則及程序；二、探討之中西太平洋主要鮪類及相關魚種生物、生態、環境及漁業之研究；三、研究資料需求與提供研究方法的整合管道，包括促進共同合作研究及以經濟有效的方式達成上述的目的；四、探討鮪類及相關魚種資源狀況之訊息，並提供資源狀況的說明；五、提供中西太平洋鮪類有關資料、研究及資源評估等各種科學議題之建議。SCTB 特別鼓勵相關沿岸國及區域性組織、及在該區域有漁撈活動之遠洋國家或國際鮪漁業管理組織之科學家參與。

此外，中西太平洋鮪漁業保育及管理多邊高層會議（Multilateral High Level Conferences，MHLC）已於二〇〇〇年九月四日簽訂「中西太平洋高度洄游魚群養護及管理公約」議定書，未來公約生效後將成立「中西太平洋鮪魚委員會」（Western and Central Pacific Fisheries Convention，WCPFC）以管理該區高度洄游魚類，且 WCPFC 下設有科學委員會以獲取最佳之科學資訊，並提供研究或保育管理之報告及建議案，而我國將可成為 WCPFC 會員，並參與科學委員會運作。目前籌備會（Preparatory Conference，PrepCon）正進行籌備成立 WCPFC 工作，其下設有科學工作小組（WG.II）以研議推動科學架構安排事宜，並開始接洽 SCTB、北太平洋臨時科學委員會（Interim Scientific Committee，ISC）、美洲熱帶鮪類委員會（Inter-American Tropical Tuna Commission，IATTC）及有關漁業組織，以檢視上述組織現行發展及可應用的相關資料格式、資源評估、科學成果及建議等。另於二〇〇二年間第二屆 PrepCon 決議在 WG.II 下設科學協調小組（Scientific Committee Group，SCG），以協助執行 WG.II 任務中需要專門科學及技術考量方面的工作，尤

其是探討可接受臨時性科學資訊及建議的可能程序等；另為儘量鼓勵科學及技術專家參與及符合成本效益，SCG 緊接著 SCTB 會議後舉行。

我國為主要鮪漁業國家之一，在太平洋區域無論是近海或遠洋鮪漁業均佔有舉足輕重之地位，基於 SCTB 是現行中西太平洋區域重要之漁業科學會議之一，且其結果將成為 WCPFC 採納臨時性科學資訊及建議的重要參考，因此積極參與 SCTB 及 SCG，即時因應 SCTB 與 PrepCon 互動發展，並瞭解該區域中各鮪類資源狀態及各漁業國之動態，對我國在未來 WCPFC 的參與及漁船在中西太平洋區域的作業權益將甚有幫助。此外，鑒於二〇〇三年之 SCTB 16th 會議中，備受爭議之大目鮪因二〇〇二及二〇〇三年之資源評估結果有著極大的差異，故本次會議將對大目鮪資源再次的評估，以確定現今之大目鮪資源狀態是否過漁或存有過漁之危機，並將於 SCG 3rd 會議中作成管理意涵之建議，以成為管理依據。因此，預期大目鮪資源評估結果將是本次 SCTB 17th 及 SCG 3rd 的重要討論事項。另，SCG 3rd 會議將討論大目鮪管理選項之議題，而討論結果亦為 WCPFC 中之重要議題。

貳、與會過程

一、代表團成員：本居 SCTB 會議於本年（二〇〇四年）八月九至十八日在馬紹爾群島共和國首都馬久諾市（Majuro，Republic of Marshall Islands），與會團體包括我國、澳洲、加拿大、歐盟、法國、印尼、日本、韓國、中國大陸、紐西蘭、越南、菲律賓及太平洋島國等計二十五個國家及屬地，以及太平洋共同體秘書處（Secretariat of the Pacific Community，SPC）、太平洋漁業論壇漁業局（Forum Fisheries Agency，FFA）、歐盟（European Union）、美洲熱帶鮪類委員會（IATTC）及聯合國農糧組織（FAO）等代表，共計七十五人參與。日本代表團成員涵蓋產官學界包含官方代表二員（水產廳）、產業界代表二員及遠洋水產研究所十員；中國大陸則由上海大學水產學院宋利明副教授代表出席；我國代表團由本署遠洋漁業組郭簡派技正宗海率團。本次科學協調小組（SCG 3rd）接續 SCTB 17th 於八月十九至二十一日在同地點舉行，與會團體包括上述二十五個國家及屬地，以及 SPC、FFA、IATTC、EU 及 FAO 代表。

SCTB 17th 及 SCG 3rd 會議我國代表團團員及參加會議行程如下表所示：

8月	日	星期	議程		團長	團員	團員
				單位	農委會漁業署	臺灣大學海研所	對外漁業合作發展協會
				姓名	郭宗海	孫志陸	周世欽
				職稱	簡派技正	副教授	助理研究員
	9	一	SCTB 17th	預備會議：方法、統計、漁撈技術工作小組會議 全席會議：國家報告、統計、方法、漁撈技術及生物學研究工作小組會議、資源評估工作小組會議			
	10	二					
	11	三					
	12	四					
	13	五					
	14	六					

15	日		休假（無安排議程）						
16	一		全席會議：生態系及混獲研究工作小組、研究及統計規劃、PrepCon WG.II 議題討論、執行摘要清稿及議定						
17	二								
18	三								
19	四	SCG 3rd	主要魚種資源狀況及管理意涵、討論 PrepCon VI 要求之議題（管理選項）、討論生態系、混獲及其他科學研究項目、資料標準及其相關議題、.確認工作小組結構						
20	五								
21	六								

二、會議過程

（一）SCTB 17th 會議：本次會議由韓國籍蘇博士擔任主席（Dr. Sung Kwon Soh）依據 PrepCon VI 之建議，將原本的工作小組結構調整後，包括統計工作小組（Statistics Working Group，SWG）、漁撈技術小組（Fishing Technology Working Group，FTWG）、方法論工作小組（Methods Working Group，MWG）、資源評估工作小組（Highly Migratory Species Stock Assessment Working Group，SAWG）、生物學研究工作小組（Highly Migratory Species Biology Working Group，SBWG）、生態系及混獲研究小組（Ecosystem and Bycatch Research Working Group，EBWG）等六個工作小組。會議前先於八月九至十日進行 SWG、FTWG 及 MWG 的前置會議，正式會議期間則於八月十一日至十八日共計八日，大會開始於八月十一日，於當日上午八時至十一時進行與會人員的註冊、開幕式、審訂 SCTB 16th 會議報告及對於 WCPO 鮪漁業進行整體的漁業及經濟概況的說明，之後至下午五時三十分期間隨即進行國家報告。十一至十八日期間大會分別進行 SWG、FTWG、MWG、SAWG、SBWG 及 EBWG 等會議，最後討論其他相關事務及修訂會議之執行摘要報告後，會議於十八日下午五時三十分左右結

束。

（二）SCG 3rd 會議：本屆 SCG 3rd 會議於八月十九日至二十一日舉行，由日本代表 Yuji Uozumi 擔任主席。第一天討論主要四魚種資源現況及管理意涵、交感效應（Interaction）；第二天討論有關公約內有關資料提供之權利與義務及科學研究優先順序；最後一天則就本次會議紀錄進行討論。

三、會議內容概要

（一）SCTB 17th 預備會議

本年（九十三）八月九至十日預備會議進行，由孫志陸教授參加方法工作小組（Method Working Group，MWG），周世欽助理研究員參加統計工作小組（Statistic Working Group，SWG）及漁撈技術工作小組（Fishing Technology Working Group，FTWG）預備會議。

1. 方法論工作小組預備會議（主席：美國 John Sibert；時間：八月九日上午九時下午六時及八月十日上午九時至中午十二時三十分）：本次方法工作小組預備會議之主要內容，主要列出 2003 至 2004 年之工作任務，如完成模擬分析、綜述 2004 年之大目鮪資源狀況、執行大目鮪漁業之模擬、綜述 SPC/OFP 之大目鮪資源評估結果、評估目前 IATTC 所使用的 Reference point 等，並建議強化 MULTIFAN-CL、發展統計棲地模式（如 SHBS-MEST、SHBS-MEST-LLq、SHBS-MFIX 等）之努力量標準化、降低資源評估的不確定性（包括改善印尼與菲律賓之漁獲統計資料及實施標識放流研究等）。其中，部份重要內容概述如下：

－模擬研究結果：於報告 MWG-3 及 MWG-4 中討論數種資源評估模式，如 MULYIFAN-CL、SCALIA、FOX 及 SCHAEFER Production Model、A-SCALA，提出建議如後：

(1) 因 MSY 相關之參考點絕對值估計較為缺乏，故一般使用相對值較佳。

(2) 一般而言，相對之資源量 B(t)/B(0)較優於絕對之資源量 B(t)。

(3) 生產量模式（特別是 FOX Model）在資源評估上的表現通常優於以複雜的整合模式所推估之相對資源量。

(4) MULTIFAN-CL 與 SCALIA 在估計自然死亡率時皆有嚴重的問題，在某些以 MULTIFAN-CL 分析的例子中，可以藉由校正後之自然死亡率進行改善。

－降低資源評估的不確定性部份，除改善印尼與菲律賓之漁獲統計資料及實施標識放流研究等外，尚有以下建議：

(1) 開發估計年齡別自然死亡率之方法，並應用於模式中分析。

(2) 與 IATTC 合作研究，以究明中西太平洋或整個太平洋之鮪魚資源狀態，並達到區域性的一致性。

(3) 持續改善努力量標準化的方法（如 SHBS-MEST、SHBS-MEST-LLq、SHBS-MFIX 等），包括增加選取的因子及在模式中努力量標準化的彈性應用。

(4) 應進行圍網漁業之努力量標準化，並將結果與 IATTC 之標準化後的結果進行比較。

(5) 開發以簡單之生產量模式之應用並比較所估計之資源量及生物參考點。

(6) 開發並應用 Longhurst large marine ecosystem regions 於 MULTIFAN-CL 分析。

－會議報告如下：

(1) Extracts from SESAME: A Simulation-Estimation Stock Assessment Model Evaluation Project Focused on Large Pelagic Species－MWG-3

(2) Comparison of Stock Assessment Methods Using an Operational Model－MWG-4

(3) Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean－SA-2

(4) Improvement of the Schaefer Model and its Application－MWG-2

(5) Performance Indices, Reference Points and Use of CUSUM Plots for Monitoring the Performance of the Longline Fishery off Eastern Australia－MWG-1

(6) Relative Abundance Indices of the Japanese Longline Fishery for Bigeye and Yellowfin Tuna in the Western and Central Pacific－SA-7

(7) Possible Utility of Catch Limits for Individual Purse-Seine Vessels to Reduce Fishing Mortality on Bigeye Tuna in the Eastern Pacific Ocean

(8) Importance of the Assumed Steepness of the Spawner-Recruitment Relationship

2. 漁撈技術小組預備會議（主席：美國 David Itano；時間：八月十日上午八時三十分至下午五時五十分）

(1) 應用漁撈技術以降低混獲－本議題之相關工作報告如下：

a. Trial Setting of Deep Longline Techniques to Reduce Bycatch and Increase Targeting of Deep-Swimming Tunas－FTWG-7a

b. Assessment of Methods to Minimize Seabird Mortality in Hawaii Pelagic Longline Fisheries－FTWG-7b

c. Performance Assessment of an underwater Setting Chute to Mitigate Seabird Bycatch in the Hawaii Pelagic Longline Tuna Fishery－FTWG-7c

d. State of Knowledge for Minimizing Turtle Bycatch in Pelagic Longline Fisheries－FTWG-7d

e. Effect of Bait Color on Sea Turtle-Longline Fishing Gear Interactions: Can Blue Bait Reduce Turtle Bycatch in Commercial Fisheries?－FTWG-7e

f. Survivorship and Dive Behavior of Olive Ridley (*Lepidochelys Olivacea*) Sea Turtles after Their Release from Longline Fishing Gear off Costa Rica－FTWG-7f

g. Reducing Juvenile Bigeye Tuna Mortality in FAD Sets－FTWG-7g

會議中尚有人提及以 Fish Oil 降低海鳥混獲的技術，但相關之應用及產生降低混獲的機制則尚不明確。

(2) 訓練資訊－本議題之相關工作報告如下：

a. Documentation and Classification of Fishing Gear and Technology on Board Pelagic Longline Vessels- Hawaii Module－INF-FTWG-2

b. Handbook for the Identification of Yellowfin and Bigeye Tunas in Frozen Condition－INF-FTWG-4

c. Handbook for the Identification of Yellowfin and Bigeye Tunas in Fresh Condition－INF-FTWG-5

會議中並無討論，於報告後隨即結束此議題。而上屆會議（SCTB 16th）有關圍網之漁獲物中黃鰭鮪及大目鮪幼齡魚比例為討論的重點，但於本次會議中對於黃鰭鮪與大目鮪幼齡魚的辨識已予明確的解決。

(3) 漁撈技術之相關資訊－本議題之相關報告如下：

a. Brief Overview of WCPO Purse Seine and Longline Fisheries 2003－Peter Williams

此外，各國進行簡略之漁業別船數及漁獲量說明，並無太多討論。

(4) 圍網船之生產力－本議題之相關工作報告如下：

a. Average Purse Seine Vessel Production in the Western and Central Pacific Ocean (WCPO) by Fleet for the Period 1980-2003－FTWG-3

b. Using Malmguist Indices to Measure Changes in Total Factor Productivity of Purse Seine Vessels while Accounting for Changes in Capacity Utilization, the Resource Stock and the Environment－FTWG-5

會中對於報告 FTWG-5，討論該指標（Malmguist Indices）是否可以應用於努力量標準化，此外亦討論 Total Factor Productivity 所需之因子，但並無明確結論。

(5) 漁船及漁具－本議題之相關工作報告如下：

a. Review of Vessel and Gear Attribute Data Held by SPC and FFA－FTWG-1

b. Vessel and Gear Attributes Useful for the Long-Term Monitoring and Management of WCPO Tropical tuna Fisheries－FTWG-2

報告後並無相關討論。

(6) 人工集魚器（FADs）－本議題之相關工作報告如下：

a. The Development, design and recent Status of Anchored and Drifting FADs in the WCPO－INF-FTWG-1

b. An Analysis of the Main Factors Influencing the Catch of Bigeye Tuna in Purse Seine Drifting FAD Sets and a Comparison with Log Sets－FTWG-4

本議題未引發任何有關大目鮪及黃鰭鮪幼齡魚比例及辨識之問題，故報告後亦無相關討論。

(7) 漁撈能力（Harvesting Capacity）及努力量管理（Effort Management）－本議題之相關工作報告如下：

a. 漁撈能力

(a) Extracts from “Brief Review of World Tuna Fisheries”－INF-FTWG-1a

(b) Abstract from ”Review of Longline Fleet Capacity of the World”－INF-FTWG-1b

(c) Management of Tuna Fishing Capacity: Conservation and Socio-Economics (FAO)－INF-FTWG-1c

(d) A Survey of Purse Seine Fishing Capacity in the Western and Central Pacific Ocean, 1988 to 2003: Executive Summary－INF-FTWG-1d

會中並無相關於上述資訊報告內容之討論，但日本代表 Peter Miyake 於相關資訊報告發表後，隨即提及先前於日本北海道舉行之漁撈能力研討會會議，並於會議中尋求曾參與會議之人員，進行該次會議內容之說明，故有關圍網之漁撈能力（Fishing Capacity），再次被談論；而有關此 Sapporo 研討會會議之內容，由 FFA 代表 Chris Reid 與會說明後，但在此會議中並無相關討論。因為漁撈能力與「中西太平洋之大目鮪及黃鰭鮪管理方案選項」此二議題具關聯性，據研判日方似將於 SCG 3rd 會議中討論。

b. Palau Arrangement 及中西太平洋之努力量管理

(a) FFA Initiatives Related to the Palau Arrangement, Purse Seine management and management of Bigeye Fishing Mortality in the WCPO－FTWG-6

本報告主要說明 Palau Arrangement 之船數限制及 Vessel Day Scheme。於報告後，韓國籍主席 Sung Kwon Soh 隨即提問，此報告已是具體的管理方案，不適於本會議場合中報告及討論，應於 SCG 會議中之管理方案選擇議程（Management Options）論及較為恰當，故要求 FFA 代表 Chris Reid 更改報告標題或是報告的型態（如工作報告或資訊報告）；但美國及 IATTC 代表（分別為 Gary Sakagawa 及 Michael Hinton）則發

表不同意見，認為此預備會議為非正式會議，故所有議題皆可被討論，且該報告要視為工作報告或是資訊報告，或是報告的標題，應由作者決定，而非會議中決定；故此問題於會中便無太多的討論即告結束。但，預計此議題可能於 SCG 3rd 會議中之「中西太平洋之大目鮪及黃鰭鮪管理方案選項」議程中再度被討論。

此外，於報告 FTWG-6 中有關 FFA 登記之 205 艘圍網船，我國於 1999 年之 42 艘減為 2004 年之 33 艘船，且說明其間中國與歐盟皆有 4 艘船。原文如后「The new bilateral access category was created to provide for new entrants taking account of the decline in bilateral access vessel numbers for Taiwan. This has occurred because a significant number of Taiwanese owned vessels have reflagged to Marshall Islands and Vanuatu and now operate under the FSM Arrangement and a small number have been sold to Chinese interests. An allocation of 4 vessels has been made to China and 4 to the European Union.」；報告中之各國圍網船數分佈如下表所示。

Purse seine license numbers

Category	April 1997	April 1999	April 2002	April 2003	May 2004
1. Multilateral Access					
U.S. Treaty	50	50	29	40	40
2. Bilateral Foreign Access					
Japan	35	35	35	35	35
Taiwan	40	40 (+2)	41	41	33
South Korea	29	29	27	27	27
Philippines	10	10	10	10	10
Sub-total (1+2)	164	166	142	153	145
3. Domestic / Locally-based					
All parties	41	41 (-2)	40	45	52
4. New Bilateral Access					
China	0	0	1	3	4
European Union	0	0	0	4	4
Total ((1+2) + 3+ 4)	205	205	183	205	205

接續的議程(8).－Organization of FTWG Plenary Session、議程(9).－Future Role and Direction of FTWG-Like Group 及議程(10).－其他事項，則因時間不足，於會中省略。

3. 統計工作小組預備會議（主席：SPC 之 Tim Lawson；時間：八月九日上午九時至下午三時）

(1) 統計工作小組預備會議有兩篇工作報告如下：

a. Legal Aspects Governing Fisheries Data－SWG-8：本報告主要說明在 WCPFC 公約內有關公約海域範圍之定義、統計資料的標準、漁獲統計資料的項目、各會員國提供資料的義務及資料管理等。

b. Information Regarding Anticipated Data-Related Tasks for the WCPFC Scientific Committee－SWG-6：本篇報告主要說明 WCPFC 之 Scientific Committee 有關漁獲統計資料等相關的工作及過去報告中與統計工作小組之相關資料整理，包含如下：

(a) Draft the terms of reference of the Statistics Working Group

(b) Draft a resolution on the scientific data to be provided by members of the Commission under Article 23 of the Convention.

(c) Draft a resolution on the principles and procedures for the dissemination of scientific data by the Commission.

(d) Develop a catalogue of scientific data held by the Commission and a list of data gaps.

(e) Specify the contents of an annual report on the status of the collection, compilation and dissemination of data to be provided by the scientific experts engaged under Article 13 of the Convention.

(f) Monitor the status of data collection in the Philippines and the Pacific Ocean waters of Indonesia.

(g) Develop a strategy for improving the capacity of members to meet the data requirements of the Commission.

(h) Establish standards for the collection of scientific data, including operational catch and effort data, port sampling data and observer data.

(i) Develop the scientific aspects of the regional observer programme to be developed under Article 28 of the Convention.

(j) Establish procedures for evaluating the quality of the scientific data compiled by the Commission.

(k) Harmonize data collection standards for the Western and Central Pacific Ocean and the Eastern Pacific Ocean in collaboration with the Inter-American Tropical Tuna Commission (IATTC).

(l) Establish an agreement on the exchange of tuna fisheries data between IATTC and the Commission.

(m) Harmonize the procedures for the compilation and dissemination of data by the Commission and the Interim Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC).

(n) Apply for the Commission to become a member of the Coordinating Working Party on Fishery Statistics (CWP).

(o) Establish a Partnership Agreement between the Commission and the Fisheries Resources Monitoring System (FIRMS).

c. 由於此二篇報告乃是將公約內有關漁獲統計資料部份及歷年來相關於統計工作之內容摘要整理，故於預備會議中並無太多的討論，分別在文件宣讀後即結束。

d. 會中我方被詢問有關觀察員計畫之相關問題，我方僅做概

略性的回答，主要係說明我國的觀察員計畫自 2001 年即開始實施，目前有九位觀察員分配到三大洋執行任務，於 2003 年期間計有六位觀察員執行任務，總觀測天數約達 900 天；惟目前應處於發展中階段。

e. 此外，於中場休息期間，我方代表詢問 SPC 之 Peter Sharples 及 Tim Lawson 有關港口採樣計畫之規劃及量測魚體的適合時間等問題；Peter Sharples 表示，一般而言皆先與船長溝通，欲量測船艙內某部份的漁獲物，所以便可利用卸魚的時間，進行體長量測。故量測魚體的適合時間可能是在卸魚期間，但 Peter Sharples 亦表示每個港口卸魚的情形皆有不同，且船長的意見也必需要被尊重，所以必需先行與船長溝通為重。至於其他的資訊，如港口採樣計畫之規劃及執行內容，可於會後透過 e-mail 溝通並取得相關資訊以作參考。此外，SPC 進行之港口採樣所包含的港口計有 24 處，可謂是較為全面的作法，故我國欲在太平洋島國進行港口採樣時，以 SPC 之規劃作為參考，應是較容易進行。

（二）SCTB 17^{th} 全席會議

1. 全席議會（Plenary Session）（主席：韓國 Sung Kwon Soh；時間：八月十一日上午九時至下午六時）：本會議上午九時開始，俟地主國（Republic of Marshall Islands）代表致辭並由會議主席 Sung Kwon Soh 回應後，進行第十六屆 SCTB 會議報告定稿及本次會議議程審定。首先，由 SPC 之 Peter Williams 及 FFA 之 Chris Reid 進行「中西太平洋鮪漁業綜述」（GEN-1，Overview of Fisheries, Including Economic Condition）。接續議程為國家報告，計有二十一篇依排定順序進行報告。我國代表僅被問及有關沿近海鮪延繩釣漁業之魚種組成及其作業型態等問題，我方回應沿近海鮪延繩釣漁業之目標魚種視季節性而變動，其漁獲物如黑鮪及黃鰭鮪有部份銷往日本之生魚片市場。此外，中國之國家報告指出於 2003 年之延繩釣漁獲量倍增，且漁場在 150°W 至 130°W

之間水域，為 WCPFC 與 IATTC 重疊之敏感區域，故引起與會各國代表的疑問，但亦無詳細的討論。另，PNG 之國家報告中，說明該國現有 33 艘圍網船，且已將臺灣投資之圍網船之漁獲量納入該國之漁業生產中，總計圍網之漁獲量約三十幾萬噸。於國家報告後，由區域性漁業組織進行報告，計有 FFA 及 IATTC，提出報告後隨即結束會議。

2. 全席會議之統計工作小組會議（主席：SPC 之 Tim Lawson；時間：八月十二日上午八時三十分至十時）：主席 Tim Lawson 針對統計工作小組預備會議之內容進行報告，說明目前資料之狀態包括：作業日誌（Logsheet）之涵蓋率、資料分送使用的情形、各國觀察員計畫執行情形，SCTB 16th 之工作目標等。會中針對公約範圍進行討論，由於過去劃分中西太平洋之範圍是以西經 150 度為界，異於公約所規範的範圍，因此將會影響到資料提供。其中，美國代表 Gary Sagakawa 及 John Sibert 則認為考慮資源之分佈狀況，而資料提供之範圍亦應配合資源評估分析之需要，故建議於資源評估工作小組會議時，再另行討論之。關於 SPC 提供 Public Domain 有關 TASK II 資料的部份，目前並無包括國別或船隊別之漁獲量及努力量等資料。故歐盟代表 Alain Fonteneau 認為 SPC 在撰寫年報或是提供 Public domain 資料時，除漁獲量、努力量外，應將加入魚種組成、體長、港口採樣之魚種別體長資料。

3. 全席會議之漁撈技術工作小組會議（主席：美國 David Itano；時間：八月十二日上午十時十五分至十一時三十分）：主席 David Itano 針對漁撈技術工作小組預備會議之內容進行報告，此外另將目前預備會議中未完成之工作報告做一說明。其中，報告 FTWG-4 及 FTWG-6 於本會議中再次進行報告。FTWG-4 報告內容主要說明圍網漁業使用 FADs 漁獲時，初步分析影響大目鮪幼魚漁獲量的主要因子，而此報告屬科學性質；另，FTWG-6 報告則是屬於漁業管理性質，主要是提出透過 Fishing Vessels Day（FVD）的規劃，管理大目鮪漁獲死亡率，並認為每個會員可分配 21,175 個 FVDs，稱為 Party Allowable Effort（PAE），而

此 PAE 是可移轉的。會中，歐盟代表提問有關 Definition of a Fishing Day 是否有科學根據或是其他的依據？但 FFA 之 Chris Reid 並無明確回答。此外，主席亦概述於預備會議中所提及之 Sapporo 會議內容。今後漁撈技術工作小組未來扮演的角色及方向部份，主席提出部份的未來工作內容，如努力量的標準化、漁業特性分析及混獲議題等。此外，此部份會在 SCG 3rd 會議中討論。

4. 全席會議之方法工作小組會議（主席：美國 John Sibert；時間：八月十二日上午十一時三十分至十二時）：本次方法工作小組會議之主要內容，係由主席 John Sibert 說明目前之預備會議內容，其重點主要列出 2003 至 2004 年之工作任務，如完成 2004 年模擬分析、綜述本年之大目鮪資源狀況、執行大目鮪漁業之模擬、評估目前 IATTC 所使用的 Reference point 等，並建議繼續強化 MULTIFAN-CL、發展統計棲地模式之努力量標準化。有關模擬分析之結論，有以下建議：為降低資源評估時之不確定性，強烈建議加強印尼及菲律賓之漁獲統計資料蒐集與改善及大規模的標識放流研究、發展年齡別之自然死亡率分析、與 IATTC 合作，並建立資料分析時之一致性、持續改善有關努力量標準化的方法、有關圍網努力量標準化時所選用的因子及處理分析應更進一步的整理及細緻化等，並將與 IATTC 之結果比較、調查大目鮪幼魚漁獲量的增加與加入量變動間之關係。此外，於議程中建議在進行資源評估時，應以不同的方法，如生產量模式、MULTIFAN-CL、ASCALA、FOX 等模式同時進行並比較之，如此所得之結果較為客觀。會中美國 Gary Sakagawa 建議，對於資源評估應建立決策的規則（Decision Rule），或是管理的程序（Management Procedure），如此才能改善目前以科學研究確認資源狀態的流程。

5. 全席會議之生物學研究工作小組會議（主席：紐西蘭 Talbot Murray；時間：八月十二日下午二時至五時）：會議首先進行有關年齡成長、標識放流研究及其他相關於資源評估之研究等報告。有關鯊魚年齡成長之研究報告（BIO-5），係以鯊魚之脊椎

骨上之年輪研究之；會中我方提問鯊魚脊椎骨上的年輪是否為一年一輪，但並無回應。有關黃鰭鮪之食性分析研究報告（BIO-1），主要的討論是黃鰭鮪之食物中有燈籠魚及蝦類，應為深海散漫層（Deep Scattering Layer）中之生物，故黃鰭鮪之食性與其垂直分佈特性及洄游分佈應有密切關係。有關以耳石之 Sr：Ca（鍶鈣比）追溯正鰹的洄游歷史及系群區分（BIO-7），指出不同海域之正鰹因所處緯度高低不同，其海域環境水溫也不同，故其耳石之鍶鈣比型態亦有所不同；此外，若正鰹洄游的範圍涵蓋高低緯度海域時，其耳石之鍶鈣比序列則會有過渡區產生，且於過渡區前後的鍶鈣比亦有差異。有關 BIO–6 報告中之紐西蘭曳繩釣漁業捕獲之長鰭鮪體長採樣僅有幼齡魚之樣本，但會中歐盟及 IATTC 等代表認為在分析長鰭鮪資源時應擴大並全面性採樣，配合該魚種之洄游及分佈生態，不應限於幼齡魚，如此才能健全資源評估分析。此時，美國 John Sibert 及 John Hampton 表示因無預算，故無法執行此任務。於會後，我方與 Tim Lawson 及 Régis Etaix-Bonnin（原長鰭鮪工作小組主席）溝通，認為十七年來長鰭鮪之體長資料庫已建立，故以後可以由各國之科學家分享資料共同研究。

6. 全席會議之資源評估工作小組（主席：加拿大 Max Stoker 及日本 Naozumi Miyabe；時間：八月十三日上午八時三十分至下午五時、八月十四日上午八時三十分至中午十二時三十分）：會議首先進行以下報告：

(1) 大目鮪及黃鰭鮪之 CPUE 分析（SA-7，Relative abundance indices of the Japanese longline fishery for bigeye and yellowfin tuna in the western and central Pacific）：我方提問該研究所使用的資料係為日本遠洋或近海之延繩釣資料？此外，亦無對於努力量之空間分佈等資料。作者認為此為研究中之重要項目，但於報告中並無交代清楚。另，其他國家代表認為未來應對 HBS 之標準化方法重新評估。

(2) 大目鮪資源之 MULTIFAN-CL 模式分析（SA-2，Stock

assessment of bigeye tuna in the western and central Pacific Ocean)：本報告說明 2003 年之中西太平洋大目鮪資源評估結果，顯示大目鮪資源目前並沒有過漁情形發生（$F_{current}/F_{MSY}$=0.89-1.02），且本年之資源狀況（$B_{current}/B_{MSY}$=1.25）較去年樂觀，但若保持目前漁獲死亡率之水準時，可能導致發生過漁的風險。於會中，各國代表對於本研究有相當的討論，包括：CPUE 標準化的方法、為何僅使用日本延繩釣之大目鮪 CPUE 作為模式分析之基礎、是否要納入圍網之 CPUE 進行分析、可否透過本研究訂定各國之 TAC 等等。另外，主席 Naozumi 引導該報告作者 John Hampton，對於「維持目前之漁獲死亡率將導致發生過漁的風險」之結論，進一步加以定義，並引導至是否要減少漁獲死亡率之結論，而 John Hampton 回應該研究僅作科學性建議，而有關漁業管理之建議並不適合呈現於報告中，同時主席 Max 認為本會議僅就資源現況加以討論，不涉管理議題；但 Miyabe 仍持續引導並詢問與會人士有關意見；此時，我方代表表示應先究明各研究區域之漁業別對大目鮪資源的衝擊比例，瞭解何種漁業對於大目鮪之成魚或是幼魚的影響程度，並進一步降低資源分析時之不確定性（Uncertainty），如此才能對於漁獲死亡率與漁業別的關係產生聯結，作有效的漁業管理。此外，由於會中之提問與討論有傾向漁業管理的議題，但因時間已過中午，且主席 Max 認為該研究作者有必要整理相關資料再進行結論與討論，故於中午十三時結束此議程。

(3) 東太平洋鮪旗魚漁業資源狀態（SA-9，Tuna and billfish in the EPO in 2003）：目前東太平洋之大目鮪資源已處於過漁的狀態，而對於資源的影響以延繩釣及圍網漁業最大。我方表示該研究中並沒有針對 FADs 對大目鮪資源之影響作深入的探討，且 IATTC 認為圍網所捕獲的大目鮪幼齡魚為估算加入量之指標之一，故不應減少圍網之漁獲能力。另，歐盟代表認為應多蒐集延繩釣漁業之大目鮪漁獲統計資料，以便進行

圍網及鮪釣漁業間之相互影響的研究。且有關大目鮪資源分佈的界限應有所釐清。

(4) 黃鰭鮪資源之 MULTIFAN-CL 模式分析（SA-1，Stock assessment of yellowfin tuna in the western and central Pacific Ocean）：目前中西太平洋之黃鰭鮪資源狀況良好（$B_{current}$>B_{MSY}），並無過漁的現象與顧慮（$F_{current}$<F_{MSY}）。由於前議程（大目鮪部份）中相關討論已逾越科學範圍，故於本議程中，主席訂定問題提問規範並依報告內容之章節引導提問，因此會議進行較為順暢。會中對於黃鰭鮪在估算加入量時所用的模式、洄游移動的假說（有無考慮氣候異常之影響），是否要納入圍網之 CPUE 進行分析等問題有相當的討論。而我方孫教授則提問，在單位加入生產量模式（Yield per Recruit）分析部份，所選用的模式除 Beverton and Holt Model（B-H model）外，尚有其他如 Ricker 與其另兩種模式，為何 MULTIFAN-CL 整合模式中僅利用 B-H Model？若能將多種模式應用後，比較所得之結果，那研究便更加完整？作者僅回應則任何模式皆可用來進行分析。此外，澳州代表示為何僅使用日本延繩釣之 CPUE 作為模式分析之基礎、是否要納入圍網之 CPUE 進行分析等、應與 IATTC 配合進行圍網之努力量標準化之研究。另部份國家代表指出，由於印尼之漁獲統計資料為資源評估之不確定性之重要因素，且尚未究明，故本次的結果仍有不確定性存在；且有關加入量的部份，因涉及印尼之統計資料與圍網之 CPUE 標準化是否有納入分析，故加入量可否持續並維持資源的穩定也是另一不確定的因素。

(5) 正鰹資源評估（SA-5，A standardized analysis of skipjack tuna CPUE from the WCPO drifting FAD fishery within skipjack assessment area 6 (MFCL 6)）：報告結果顯示，美國圍網船隊之 Drifting FAD 的正鰹 CPUE 有持續下降的趨勢，但並非所有國家的圍網船隊有相同的現象；而正鰹 CPUE 下降的原因有資源本身及海洋環境等因素，但尚未確定；而在影響因子

分析時，應強化變數的選取，如 SOI 等；並預期於本年完成圍網之 CPUE 標準化，以利 2005 年之正鰹資源評估。議程中，主要的問題如應釐清海洋環境資料如衛星之表水溫資料、水色資料等之應用方式，特別是應用於 CPUE 標準化時。另，為何只有分析 Drifting FAD 之資料，何不納入流木群之資料進行分析？或是區分成 unassociated 與 associated school 兩大類並分析其 CPUE Trend？此外，所選用的多項因子中，何者為 CPUE 標準化分析時之主要影響因子？等等。另 SA-6 報告（A spatially-based analysis of purse-seine skipjack CPUE from unassociated sets in the equatorial area of the WCPO, including the development of an oceanographic model for the fishery）結果顯示：a. 經標準化後之 CPUE 指標與 nominal 並無太大差異；b. 由海洋環境之模式可以解釋正鰹漁獲量分佈情形；c. 可以應用該研究之模式究明正鰹漁獲量之短暫性改變；及 d. 可考量空間分佈上的特性進一步發展該研究之模式。

(6) 長鰭鮪資源評估（SA-4，An examination of the influence of recent oceanographic conditions on the catch rate of albacore in the main domestic longline fisheries operating in the south Pacific Ocean）：結果顯示：a. 本研究已究明影響長鰭鮪漁獲率（Catch Rate）之主要因子；b. 現今模式可以回顧歷史資料，此外並可取得在高或低漁獲率發生時之指標；c. 目前因海洋環境的預測並無可信的模式（即使是短期的預測），故無法進行長鰭鮪漁獲率之預測。我方孫教授建議，由於該報告之海域為我國主要漁獲南太平洋長鰭鮪之海域，故對於長鰭鮪資源之 CPUE 分析應將我國之資料納入，如此方具代表性。另，我方亦提問該研究之 CPUE Trend 與王教授所提報告（SA-3）中之趨勢不同，其原因為何？但無具體的回答。Gary Sakagawa 亦認為在進行長鰭鮪之 CPUE 分析時，應全面考慮所有漁獲長鰭鮪國家之漁獲統計資料，如此分析才會完整；澳洲代表延續去年之問題，認為應有 Local Depletion 的現象，且不應忽視。SA-8 報告（An evaluation of recent

trends in the domestic longline fisheries operating in the south Pacific Ocean）主要是探討目前進行 MULTIFAN-CL 資源評估分析時所區分的區域，建議應區分成四個區域（以 180° 及 30°S 為區分）較為洽當。此外，因島國沒有漁獲量資料，故目前以臺灣之資料進行分析，惟尚未完成。另，各國代表亦表示當地的資料也是相當的重要，也應納入分析。

(7) 其他事項(會議中主要的意見如下)：澳洲籍 Robert Campbell 認為目前的主要魚種之資源評估工作，全部集中於資源評估工作小組，而目前僅確定大目鮪及黃鰭鮪之資源評估每年皆會執行，但其他魚種則無確的規範，故應有明確的機制，已確定各魚種之資源皆有因評估而加以監控。我方提出意見，目前應整理各魚種的資源狀況摘要提送 SCG，而有關資源評估工作小組會議是否洽當或是其間運作的流程，應留到 SCG 3rd 時討論決定。故主席認為有關本工作小組之各項議題可於下週二之會議進行討論。Gary Sakagawa 之意見亦與 Robert Campbell 相近，主要係認為各種魚種之資源評估應有明確的機制以確定於何時進行何魚種之資源評估；且應對於主要魚種之摘要應儘速完成。紐西蘭代表 Talbot Murray 認為資源評估的方法應持續改進。IATTC 認為目前所有工作小組的會議進行時間有重疊，參與不方便。有關報告格式建議可參考其他組織之報告作調整。每年之各國提供資料之時間約為五月，之後進行各魚種之資源評估的時間相當緊迫，不易進行有效評估。

7. 全席大會之生態系及混獲工作小組（主席：美國 Paul Dalzell；時間：八月十六日上午八時三十分至下午五時）

(1) 會議首先進行以下報告：

a. 模式分析

(a) A Spatial Ecosystem And Populations Dynamics Model (SEAPODYM) for tuna and associated oceanic top-predator species: Part I – Lower and intermediate trophic components－ECO-1

(b) A Spatial Ecosystem and Populations Dynamics Model (SEAPODYM) for tuna and associated oceanic top-predator species: Part II – Tuna populations and fisheries－ECO-2

上述兩篇報告主要是以鮪魚之垂直洄游為基礎，瞭解其索餌的行為，透過新生產力（New Primary Production）的模擬，以 Forage Model 並結合環境之水溫、海流等因子，模擬鮪魚之空間分佈生態及族群動力等；會中對於 Forage Model 有所討論。

(c) Tuna Meta-Population Abundance and Size Structure as Indicators of Ecosystem Impacts of Fishing－ECO-3

本篇報告指出，大目鮪、黃鰭鮪、長鰭鮪及正鰹資源量整體而言處於合理的穩定狀態；然而，估計之未開發資源量於 1980 年以後呈明顯的增加情形，而此是因為正鰹之資源量增加所致。於 2002 年時，漁業對於上述四種主要鮪類資源之衝擊，估計約從未開發資源狀態下，利用約 30%之資源。此外，若不考慮正鰹資源時，在 2002 年已開發資源與未開發資源狀態間之差異便增加，約大於 60%。

(d) Individual/Agent-based Modeling of Fishes, and Turtles－ECO-4

(e) Regime shifts in the WCPO and its tuna fisheries－ECO-5

以上兩篇報告，其中 ECO-5 是以 Pacific decadal oscillation（PDO）及 North Pacific Index（NPI）探討中西太平洋主要鮪類資源（如大目鮪、黃鰭鮪、長鰭鮪及正鰹等）之 Regime Shifts 現象，報告中指出約於 1940 及 1970 年代，發生兩次的 Regime Shifts 現象，且於 1967 至 1992 年間，氣候與生物變數之序列呈相同的趨勢。此外，我方於會中認為於 1973 至 2000 年之加入量（大目鮪、黃鰭鮪、長鰭鮪及正鰹等）

指標與氣候指標（PDO、NPI）序列呈兩個高峰期，而此兩個高峰期皆有其經濟環境上的變異，而漁業本身又是商業行為，故於此類分析進行時，除原有考慮之環境、氣候及生物因子外，亦應考慮經濟因素；並且建議可以採用生物經濟的相關模式分析比較。

b. 混獲研究

(a) Fish bycatch in New Zealand tuna longline fisheries－ECO-6：本報告係將 2000 至 2001 年 New Zealand 之鮪延繩釣漁業統計資料中之混獲部份及觀察員資料整理介紹。

(b) Progress on the researches for the solution of incidental catch of sharks, seabirds and sea turtles in Japanese tuna longline fishery－ECO-7：會中提問有關鯊魚的 CPUE 資料，係為觀察員或是漁業統計資料？另，有關以 circle hook 降低海龜混獲研究部份，於報告中似無明顯差異，但進行實驗實驗時，總努力量為何？此外，主席指出該實驗所使用的 Circle Hook 可能太小，所以效果不同。有關調整延繩釣施放深度以降低海龜混獲之設計，可參考 FTWG-7 報告內容。

(2) 建議及未來生態及混獲工作小組之任務與方向：本議程回顧 SCTB 16th 之 BBRG 工作小組（旗魚及混獲工作小組）之建議與工作方向。於會中各方提出的意見如下：

a. 本次會議對於旗魚類的討論較少，且旗魚類之資源評估也勢必要進行，故未來要如何安排？

b. 應列出主要研究的對象（如旗魚類、鯊魚類、海鳥、海龜等等）並列其優先順序，以規劃研究進行之計畫。

c. 部份工作與資源評估工作小組及生物學工作小組重疊，應釐清每個工作小組之任務，如此才能整合所有工作小組的資源。

d. 加強降低混獲的技術、估計混獲的主要物種因漁業所造成的死亡率、混獲物種之生物學研究。

e. 我方代表與會中特別說明，為因應 FAO 之 IPOA 相關議題，已進行混獲物種研究之相關努力，如我國於本年初年在高雄舉辦國際海鳥研討會；並於 2002 年時於台北舉行鯊魚研討會，並且對於鯨鯊的保育，目前已有 TAC 的設計並執行之，且持續進行標識放流研究以究明其洄游分佈；另在遠洋漁業之資料蒐集部份，如作業日誌中加入鯊魚種類別等資訊之蒐集。

f. 日方提問本次生態及混獲工作小組所整合的工作任務過多，包括混獲議題、旗魚類之研究、海洋生態系研究等等，且就 SCTB 16th 之建議中亦無相關於生態系之研究？此時，主席提出生態系相關的研究，如環境對於漁業及資源的衝擊、漁業對於海洋生態系的衝擊、混獲議題及魚類之棲地研究等項目，供作討論。

g. 以上項目中之混獲議題，在漁撈技術工作小組亦有規劃在內，故有兩個工作小組執行相同任務的情形，應避免之。David Itano 則認為混獲議題應納於漁撈技術工作小組之任務之中。

h. 應先提出 Terms of Reference；並界定清楚每個工作小組的範圍。

i. 以東太平洋的經驗，如鯊魚已為主要的目標魚種，故鯊魚之研究並非置於混獲工作小組。故可以魚種區分，如 Tuna and Tuna-like Species 及 Non-tuna Species，之後再進行調整。

j. 我方認為，Bycatch 之意義應為漁業行為之附帶產品，所以應對於 Bycatch 進行明確的定義，並且與 Incidental Catch 釐清；之後，再討論其研究的內涵為宜。

k. 主席將彙整會中討論的意見，作最後的建議於本小組的報

告中。

8. 全席會議之研究與統計規劃（主席：美國 Pierre Kleiber；時間：八月十七日上午八時三十分至中午十二時三十分）

(1) 綜述菲律賓鮪漁業漁獲統計系統及中西太平洋鮪魚之標識放流研究（Tony Lewis）：中西太平洋鮪魚之標識放流研究：本研究主要針對黃鰭鮪、大目鮪及正鰹進行，預計各進行 35,000（5 年）、30,000（8 年）及 50,000（3 年），規劃由竿釣及圍網漁業進行該計畫，預算約五百五十萬美元，計畫執行年限約 10 年。會議中主要之意見如下：

John Sibert 認為預算過高；另，認為長鰭鮪應納入標識放流研究；Talbot 認為現階段以熱帶鮪類為主，而溫帶鮪類將於下一次的實驗進行；應考慮與 IATTC 合作進行大規模之標識放流研究；應將大目鮪及黃鰭鮪之標識放流量最大化；由於竿釣漁業漁獲大目鮪及黃鰭鮪僅佔小部份，所以執行的能力有限。John Hampton 表示 OFP 應與 IATTC 考慮合作，並且尋求經費上的支持。

我方提問各魚種預計標識放流之數量是如何估計？Tony Lewis 回應此數量是依據 MULTIFAN-CL 模擬分析所需之資料數量而估計的，此外因需考慮 Recapture rate，所以估計此數量；澳洲代表認為應將觀察員計畫及鮪延繩釣部份納入；歐盟代表表示應將計畫提交大會討論並認可；日方表示相同之意見，認為應將本研究案擬好計畫書送交 Commission 審議，並確認執行該計畫的單位及人員，經認可後執行之，另若能進行更大範圍之標識放流研究更好，如與 IATTC 合作，進行太平洋大範圍之研究，目前日本於其週邊海域已進行部份魚種的標識放流研究，所與可以考慮合作研究。

(2) 綜述菲律賓鮪漁業漁獲統計系統：1970 年代菲律賓已開始進行漁獲統計資料蒐集，並計有 SCS、IPTP、FSP 等協助。2002 年鮪魚產量約為 63,000 mt，其中 37,000 mt 為黃鰭鮪及大目

鮪，26,000 mt 為正鰹，此外另有其他的鮪類 70,000 mt。目前統計資料由 BAS 負責，卸魚資料包括魚種別、漁具別、區域別及價格。現今大於 250 噸之圍網船 52 艘，其他圍網漁業之輔助船約有 250 艘，小於 250 噸之圍網船有 110 艘。手釣漁業於 2002 年約 70,000 mt，大多為大目鮪及黃鰭鮪。漁獲物處理：罐頭廠、冷凍及煙燻、外銷日本之生魚片市場。

我方提問，OFP 已用了二至三年的時間，投入菲律賓之漁獲統計系統，故有必要再次投入如此多的投資嗎？John Hampton 表示，臺灣有許多的近海小型鮪釣漁船在菲律賓合作捕魚，不知是否有提送其作業日誌及漁獲量等資料？我方代表回應，我方近幾年來已有投入漁獲統計資料的蒐集，並執行相關的計畫，但因在菲律賓週邊作業之小型鮪釣漁船，有季節性的變動，有時在印度洋作業，有時在太平洋作業，且卸魚的港口亦會產生變動，所以在資料蒐集及監控上有實際上執行的問題需解決，而此皆在進行改善中，並希能與相關國家及有關組織共同合作。

(3) 目前進行中之任務：於會中各方提出相當多的意見，本報告僅將重要內容摘述如后。John Sibert 認為部份的研究議題應可合併為一項，如此才能精簡。我方認為應將旗魚類納入資源評估的魚種之一，此外亦納入生物工作小組之任務之中。我方同意 John Sibert 的說法，感謝過去 SCTB 的努力，本次會議應完成 SCTB 17th 的建議並提送給 SCG 3rd 會議，由 SCG 會議討論研究的方向及規劃；John Sibert 表示目前的資料缺口除印尼與菲律賓之漁獲統計資料外，尚有臺灣近海與韓國之體長組成資料、日本之近海漁業資料、改善越南之漁獲統計資料、及其他項目（可參考 SCG 2nd 報告）。

各方經過討論後研訂以下項目：

a. 資源評估：目前包括大目鮪、黃鰭鮪、正鰹、長鰭鮪及其他（如劍旗魚）等。

b. 更新 OFP 之資料庫

c. 資源評估之相關細部工作：包括發展年齡別自然死亡率之估計；比較東太平洋、中西太平洋及整個太平洋之大目鮪資源評估結果；在 MULTIFAN-CL 分析中以漁獲量作為常數進行 Projection、更新 MULTIFAN-CL 及 LLq 分析中之參數估計、發展並使用簡單的生產量模式、發展 Longhurst large marine ecosystem 分析並應用於 MULTIFAN-CL、發展加入量指標、偵測最近加入量的變化、CPUE 標準化、持續改善努力量標準化的方式，包括增加變數或以更有彈性的方式處理、將圍網努力量標準化後與 IATTC 之圍網努力量標準化結果進行比較。

(4) 未來研究與資料蒐集

a. 改善漁獲統計資料：包括資料來源（如歷史資料及作業日誌資料）、改善混獲資料蒐集、改善印尼與菲律賓之資料蒐集、改善大目鮪及黃鰭鮪之種類判別、建立觀察員資料、作業日誌資料及拍賣資料間之統計關係。

b. 主要魚種之生物學研究

c. 進行大規模之標識放流研究以提供鮪魚之洄游、死亡率及其它相關之參數估計所需之資訊

d. 觀察員計畫（擴張至遠洋鮪釣漁船、次區域之觀察員及港口採樣、調整觀察員計畫所連結之相關研究（如海龜）、IUU）

e. 建立委員會之生物資料庫（特別是與資源評估相關之參數）

f. 漁捕能力及努力量的定量化：漁捕能力議題、FADs 議題、漁獲努力量標準化議題、漁船及漁具資料的蒐集與分析。

g. 因努力量管理涉及漁業管理之內涵，故各方建議刪除之。

h. 生態系相關之研究方向：發展模式或是方法、持續相關於 Forage 的資料蒐集、持續蒐集胃內容物、考慮環境對於漁業及資源的衝擊、考慮漁業對於海洋生態系的衝擊、魚類之棲地研究。

i. 混獲議題：監測與評估漁業所造成的衝擊、減緩混獲議題。我方表示應對於 Bycatch 進行定義，之後再進行相關研究的規劃。IATTC 代表表示混獲的物種係非主動漁捕之物種，同時亦為誤捕行為的一種，故不必在定義上作太多的討論。此時，紐西蘭代表表示應要釐清 Bycatch 的內涵。紐西蘭代表表示亦應著重鯊魚的研究。

(5) 長期計畫（科學工作小組或是科學委員會之時程規劃）：Gary Sakagawa 表示應於 SCG 會議中討論較為適當。庫克群島代表表示何謂科學工作小組，與 WCPFC 內之科學委員會名稱不一，有必要釐清。紐西蘭代表認為此議題應從此節議程中刪除；主席表示刪除議題第 9.項。

9. 全席會議之 PrepCon WG II 要求討論之相關議題（主席：美國 Gary Sakagawa；時間：八月十七日下午二時至五時三十分）

(1) 資料標準：會議首先進行 SWG-8 及 SWG-6 報告，首先報告 SWG-8，內容係介紹 WCPFC 公約內容中有關會員之資料提供義務，及聯合國有關資源評估之文件（UN Fish Stocks Agreement）。未來有關資料提供部份，包括漁獲統計資料及漁船資料的提供細項將於 Commission 中再進行討論。另有關公約之範圍，包括東邊與北邊之界限應有清楚的定義。此外，亦包括與其他組織之合作。John Sibert 表示資料提供的項目為何？作者回應此部份於 SWG-6 報告中。

(2) 接續進行 SWG-6 報告：我方表示，首先感謝由法規面導入，並由 SWG-6 瞭解其中的項目及相互的權利義務關係，但有關十七年來 SCTB 之資料庫的所有權問題應有所處理，建議由 SCG 3rd 討論。日方表詢問本區域有無 IUU 問題，要如何

解決？此外尚有 Joint-venture 的問題，如其漁獲量資料的蒐集，而此是否有任何的解決方式？Fiji 表示這些船都在 FFA 註冊，並無所謂 IUU 之困擾。IATTC 表示有關資料的管理問題應有區域性的註冊及船隻白名單，此外，亦應有手冊供作參考。Tim Lawson 回應本篇報告是討論有關資料的問題，而非 IUU 的問題，此外對於 IUU 的活動亦沒有相關的資訊；且有關 Joint-venture 之問題亦應於 SCG 3rd 或是 WCPFC 會議中討論。另，Tim Lawson 表示由本會議乃是建議資料標準是否適合？亦應由委員會考慮。

(3) 漁業管理選項分析：我方表示此會議應依據上次 PrepCon VI 會議決議進行，應由 SCG 3rd 進行討論，提醒主席應依法定之指示辦理；主席表示同意。會議首先進行 GEN-2 及 GEN-3 之報告，主要內容係以目前之資料說明中西太平洋中之延繩釣漁業之船隊容量（總噸數）、努力量（總鉤數）與作業區域情形之估計、漁獲量的估計，主要之結論為：目前漁捕能力處於增加的情形，需有其他的計測方式及假說加以分析；此外，亦有延繩釣及圍網漁業之努力量及漁獲量皆為增加的趨勢、MULTIFAN-CL 區域之第二及第三區之漁獲量及努力量高等等之現象；另，分別依延繩釣及圍網漁業進行細項的結論（參閱報告 GEN-2 及 GEN-3）。日方提出問題，目前報告中之資料是否有包括印尼及菲律賓之漁獲統計資料？作者回答目前並無包括。

a. 參考點：主席說明於 SCTB 之資源評估報告中（如 SA-1 及 SA-2 等），常用的兩個參考點如 $B_{current}/B_{MSY}$ 及 $F_{current}/F_{MSY}$，而所有的參考點皆為進行漁業管理前必需透過研究估算，並作為依據。目前這些參考點多以比例的形態應用，並多為各方接受。紐西蘭代表認為應設一研討會充份討論，再選擇參考點。此外，並應對一些名詞加以定義，同時配合第 2.項（控制程序）一併討論。IATTC 表示據東太平洋的經驗，縱使使用許多的參考點，但在資源評估中仍有其不確定性，而此會議應對於不同的參考點有所

討論，此外亦表示到底是由本會議討論後建議 SCG 3rd 討論決定，還是由 SCG 3rd 指定 SCTB 討論後送交 SCG 3rd 決定，因程序問題無法釐清，故結束討論。

b. 控制程序（管理程序）：主席表示此議題主要是討論進入管理之前的程序問題，重點是處理過程而非是決策。加拿大 Max Stoker 將於 SCG 3rd 另有報告。John Sibert 認為應有所討論，且有許多有關於參考點的討論，也對於控制程序及管理選項有相當的意見。主席認為此議題可留於 SCG 3rd 討論。John Sibert 認為對於 MSY 應進行討論，同時亦要討論加入量的變動，所以不應將本議題留至 SCG 3rd 討論。日方表示，我們必需討論有關資源評估的方法論，同時也要討論參考點，此外魚種之體長分佈趨勢也要列入考慮。John Sibert 表示於 1997 年時在夏威夷舉辦之 SCTB 11th 會議時，已有關於參考點之報告，應再次討論之。另，有關此議題所牽扯的範圍廣泛，應另開會，將議題分開進行討論。由於意見分歧，故結束討論。

c. 選項矩陣（Options Matrix）：有關管理選項議題，留待 SCG 3rd 會議進行討論。

(4) 工作小組結構討論

a. 評估 SCTB 17th 會議中各工作小組之結構：主席先說明已往之工作小組包括各魚種之工作小組、統計工作小組、漁撈技術工作小組及旗魚與混獲工作小組等等，今年有所變動，更改為資源評估工作小組、生物學工作小組、統計工作小組、漁撈技術工作小組、生態及混獲工作小組、方法工作小組等等；故有關工作小組的架構請討論之。由於本議題與 SCG 3rd 所討論的議題相同，留待 SCG 3rd 會議討論。

(5) 其他建議：因無其他的建議，故主席結束本會議。

10. 全席會議之會議報告清稿（主席：各工作小組主席；時間：

上午十時至下午六時）：進行清稿前，我方表示應將 Chinese-Taipei 更改為 Taiwan，但中國表示反對意見，認為目前所用的 Chinese-Taipei 比較適當；主席則表示有關我國代表團名稱，以前已有共識，故現階段應以 Taiwan 為用；另，Gary Sakagawa 表示所用代表團名於報告中應具有一致性；此時，中國代表表示在 SCG 3rd 會議時，應用 Chinese-Taipei 作為我國代表團之團名；主席表示因 SCTB 具有獨立性且沒有政治因素，故應以 Taiwan 為我國團名，而 SCG 3rd 會議具有管理意涵且對於團名已有共識，所以以 Chinese-Taipei 為團名。之後，進行報告清稿。

(1) 統計工作小組（Tim Lawson）：我方表示有關 WCPFC 公約範圍及 SPC 資料提供範圍之差異問題，將會在 SCG 會議中討論。另有關我國與美國捐助改善印尼與菲律賓漁獲統計資料文字部份，原引用 WCPFC/PrepCon VI 之文字，但其中亦有 Chinese-Taipei 之政治問題，我方提出建議改為 another donator，以去除我國與中國間之團名爭議。

(2) 方法工作小組（John Sibert）：會中意見較少，故快速通過。

(3) 生物工作小組（Talbot Murray）：我方認為本摘要報告過於簡單，至少應將會議中八篇報告作一整理，並簡略說明；主席表示會進行文字修正。

(4) 漁撈技術工作小組（David Itano）：日方代表加入依據 FAO 之資料顯示目前漁撈能力已過剩，且於中西太平洋之圍網船目前已擴張；此時，有關此文字引起廣泛討論。

(5) 生態及混獲工作小組（Paul Dalzell）：會中意見較少，故快速通過。

(6) 研究及統計規劃（Pierre Kleiber）：會中意見較少，故快速通過。

(7) PrepCon WG II 要求討論之相關議題（Gary Sakagawa）：會中意見較少，故快速通過。

(8) 資源評估工作小組（Naozumi Miyabe and Max Stocker）：主席表示有關各魚種之資源評估報告部份，因存在格式及圖表不一致的情形，此將會統一進行改善，會中請就文字內容進行清稿。日方表示在最近漁業發展一節中，除介紹漁具別及魚種別歷年來之漁獲量趨勢外，亦應將此期間重要的漁業型態變化納入文字中，如船隊的改變、延繩釣、竿釣與圍網漁業之現況、島國的漁獲量及船數增加、臺灣過去以長鰭鮪為目標魚種之延繩釣漁業近年來轉變以捕獲熱帶鮪類為主、PNG 及 FSM 之圍網漁業的發展等演變。主席同意增加文字，並以報告 GEN-1 為主摘入本報告中。但於日本的建議案文字中，特別顯示臺灣的鮪延繩釣船數為 142 艘，成長率 70%；於此，我方表示為何只將臺灣之船隊資料列於文字中，其他國家沒有，應平等處理？此時，主席回應目前許多國家之實際作業船數無法獲悉，故統一以文字處理，去除國別之船隊數量等數字，以相當程度成長序述船隊的增加。

a. 大目鮪：有關漁獲量及單位努力漁獲量部份，我方提出有關「The total catch of small bigeye tuna by purse seine fishery is uncertain,.....」之意見，認為大目鮪資源評估是正面的，那如果是處於 uncertain 的狀態時，那 2004 年的大目鮪之資源評估亦是顯示其不確定性，故如何作為依據，所以應改為「less uncertain」；此時，日方認為應還是處於 uncertain 的情形；此時，我方表示俟提出本段文字之後再討論。有關 CPUE 標準化至資源評估之資源量部份，歐盟代表提出應將東太平洋、印度洋及大西洋之大目鮪 CPUE 趨勢摘入，主席認為僅摘入簡要文字。會中各方之意見是將有關於 SHBS-MEST-LLq 之所有文字及圖表部份去除，如此文章內容才會一致。主席應各方代表要求同意修改，同時於黃鰭鮪部份亦作同樣修改。有關資源狀態部份，我方表示「The 2004 assessment results were reviewed and confirmed as comparable to the 2003....」應修改為「...reviewed and confirmed as better than the results of 2003 assessment」，之

後主席決定修改為「The 2004 assessment results were reviewed and confirmed as consistent with the 2003 assessment, although the point estimates of some reference points were slightly more optimistic in this assessment.」。

b. 黃鰭鮪：由於資源狀況良好，各方爭議較少故快速通過。

c. 正鰹：由於本年度無進行資源評估，故引用去年文字，爭議較少，故快速通過。

d. 長鰭鮪：由於本年度無進行資源評估，故引用去年文字，爭議較少，故快速通過。

（三）SCG 3rd 會議：第三屆中西太平洋漁業委員會科學協調小組會議（主席：日本 Yuji Uozumi；時間：八月十九日上午九時至下午五時三十分）：主席首先說明議程安排及其討論之內容概要、會議紀錄安排，接續說明本會議之時程。隨後會議開始，進入第一項議程。

1. 更新主要魚種資源狀態：會議主席要求 SCTB 17th 資源評估工小組主席 Max Stocker，依據 SCTB 17th 執行摘要，說明主要魚種資源狀態：

(1) 大目鮪：所估計之參考點呈較去年樂觀的現象（如 Table 1），現今的漁獲死亡率接近 MSY 水準（$F_{current}$~F_{MSY}），而資源量水準則高於 MSY（$B_{current}>B_{MSY}$），結論為若維持目前之漁獲死亡率將會導致產生過漁的風險。此外，未來若加入量過低時，中西太平洋之大目鮪將會與東太平洋大目鮪有相同的情形發生。

Table 1. Estimates of management measures based on the 2003-2004 stock assessments

Management Quantity	2004 Assessment	2003 Assessment
Most Recent Catch	96,000 MT (2003)	115,000 MT (2002)
Effort	Base case and others	All
MSY	56,000 ~ 62,000 MT	40,000~80,000 MT
$Y_{Fcurrent}$ / MSY	1.00	0.82-0.99
$B_{current}$ / $B_{current,F=0}$	0.41~0.43	0.27 ~ 0.34
$F_{current}$ / F_{MSY}	0.89~1.02	1.11~2.00

$B_{current} / B_{MSY}$	1.75~2.28	1.35~1.76

韓國代表表示，相較於去年之資源評估結果，無論是在資料或是模式分析時，其不確定性是否有降低的現象？SPC 之 John Hampton 回應，此部份已透過資料的蒐集及處理上儘可能改善。我方代表提問漁獲死亡率之定義為何？在進行資源狀況投射時（Projection），所用之漁獲死亡率是以常數處理或是其他方法處理？John Hampton 回應以 1999-2001 年之平均漁獲死亡率做為資源狀況之評估，但進行投射時，則以 2002 年之漁獲死亡率做為基礎。日方表示，從許多的觀點來看，若捕獲太多的大目鮪幼齡魚時，將會影響資源，同時也會影響後期的親魚資源量；故建議應有相當的管理措施以因應資源枯竭。此外，會中亦有相當多的討論。此時，會議主席暫停部份討論，以 SCG 2nd 報告中有關大目鮪之管理意涵進行說明，今年在降低部份不確定性後所產生的資源評估結果，顯示由於加入量的增加，今年的資源狀況較去年樂觀。我方表示，如果我們認為目前的不確定性主要來自印尼與菲律賓之漁獲統計資料時，應進一步去克服，此外有關圍網 FADs 對大目鮪資源的影響，由今年的分析結果，顯示已有所降低，故為良好的訊號。韓國代表表示，由 Table 1 中，所討論的資源狀態為四或五年前之資源狀態，故我們是依據過去的資源狀態作其管理意涵，所以我們必需要有 2001 年以後的努力量變動，如此才能依據現況，進行有效的管理意涵建議；同時我們亦應比較近年來之漁獲死亡率或是漁撈能力（Fishing Capacity）如此才能較為客觀；紐西蘭亦有相同的意見；John Hampton 回應目前我們可以先對漁獲量資料進行比較。日本提出意見，大目鮪之資源評估為四或五年前之資源水準，所以目前所作的結果應要更為明確，如降低漁獲死亡率；此外，由 Probability distribution for F ratio（$F_{current}/F_{MSY}$）顯示，若維持目前的漁獲死亡率時將有過漁的風險；而目前的研究中亦無顯示相關於漁獲效率的研究，所以 1999-2001 年之漁獲死

亡率將是一項管理的依據。日方表示，由漁獲死亡率與漁獲量間之比較相當困難，且每個國家也無法去估計各自的漁獲死亡率，但漁獲量的限制也是一種漁獲死亡率的限制，所以有關漁獲死亡率的限制應可以與漁獲量的限制並用亦無妨。但我方引用日本提出的有關船隊文字的建議案內容，表示目前各國船隊之資料並沒有公開，也沒有透明化，所以有關有效努力量的資料是不足的，故如何去評估在太平洋中各國投入的漁獲努力量？但 SPC 等並無回應。經過各方討論後，主席認為有關大目鮪之管理意涵應有初步共識，將作成初稿於中午或明日上午供各方審閱。

(2) 黃鰭鮪：2004 年之資源評估結果顯示中西太平洋之黃鰭鮪資源可能沒有過漁的情況發生（$F_{current}/F_{MSY}<1$），且資源狀況亦顯示沒有過漁的情形（$B_{current}/B_{MSY}>1$）（Table 2）。赤道海域之黃鰭鮪資源可能接近完全開發的狀態，未來任何的漁獲死亡率的增加，可能不會在長期上產生產量的增加，卻可能將黃鰭鮪資源推向過漁的狀態。資源量之生物參考點顯示，若保持目前的漁獲量時，長期平均的資源量將保持在高於MSY之水準。而生產量評估顯示可能需要對漁獲量加以限制，以防範特定年齡群資源量的過度開發；圍網漁業在赤道海域對資源已有相當的衝擊。而 Probability distribution for F ratio（$F_{current}/F_{MSY}$）分析結果，相當的樂觀，即使維持目前的漁獲死亡率，過漁的發生機率仍小於大目鮪的情形。

Table 2. Estimates of management measures based on the 2003-2004 stock assessments

Management Quantity	2004 Assessment	2003 Assessment
Most Recent Catch	456,947 mt (2003)	437,984 mt (2002)
Effort	Base case and others	GLM
MSY	248,000~310,000	381,000~554,000
$Y_{Fcurrent}$ / MSY	0.90~1.00	0.91
$B_{current}$ / $B_{current,F=0}$	0.51~0.67	0.65
$F_{current}$ / F_{MSY}	0.63~1.11	0.61
$B_{current}$ / B_{MSY}	1.75~2.46	1.59

會議主席說明 SCG 2nd 報告中有關黃鰭鮪之管理意涵，作為

本次有關管理意涵定訂的參考。韓國代表表示，目前可以用 SCG 2nd之報告作修改，但亦應將 2001 年以後努力量或漁撈能力的改變作文字整理，供作參考（日本及紐西蘭亦表示相同的意見）。日方表示，Table 2 中之 $F_{current}/F_{MSY}$ 在 0.63 至 1.11 之間，但若以 Probability distribution for F ratio（$F_{current}/F_{MSY}$）進行分析時，可能會有不同的結果，故此要如此解釋或進行比較？美國表示，目前的資源評估結果應為 1999 至 2001 年之狀態，所以應於資源評估之結果中加註說明；主席回應此將與大目鮪部份統一。日方表示 SCG 2nd 報告中有關黃鰭鮪幼齡魚部份，是否與本此評估結果相同？John Hampton 表示漁業對於資源的衝擊主要為印尼及菲律賓漁業（幼齡魚之衝擊）與圍網漁業（成魚及幼齡魚之衝擊）；日方表示，此狀況應與大目鮪的情形一致，故應引用大目鮪之管理意涵；但紐西蘭表示各漁業的衝擊在大目鮪及黃鰭鮪是不同的，所以有關成魚及幼齡魚的 $F_{current}/F_{MSY}$ 結果也是不相同的，故在管理意涵的結論不應要與大目鮪一致。日本同意撤回所提意見。

(3) 正鰹：本年度沒有執行其資源評估，故引用 SCTB 16th 會議之結果；各方均無意見。主席提出 SCG 2nd 報告中有關正鰹部份的管理意涵，請各方依現今的瞭解進行修正；我方表示有關南太平洋長鰭鮪，經分析顯示其資源量受海洋環境變動影響，相同的在正鰹資源上也有類似的情形，故在其他的熱帶鮪類（如黃鰭鮪及大目鮪）應亦有相同的考慮。

(4) 南太平洋長鰭鮪：本年度沒有執行其資源評估，故引用 SCTB 16th 會議之結果；漁業對於該資源的影響處於較低的狀態，目前的資源量為未開發資源量的 60%。但 Samoa 及 American Samoa 之 CPUE 呈下降的趨勢，此可能為 Localized depletion 的現象。主席提出 SCG 2nd 報告中有關南太平洋長鰭鮪部份的管理意涵，請各方依現今的瞭解進行修正；各方對於 Localized Depletion 有相當的討論，此可能與漁業行為及環境改變有關。主席說明有關此段文字將參考各方意見稍作修正。會議主席 Uozumi 說明 SCG 2nd 報告中之 Interactions 部

份，應有所修正。我方提出所有上午議程之文字初稿請儘速提出，以利審閱（本日十二時十分，上午會議結束）。下午進行 Interactions 部份，主席說明依據 SCG 2nd 之報告進行修改。依據美國的意見將作部份修正，仍應強調各種鮪魚間之交互作用研究的重要性，在各方無特別意見下完成本議程。

2. 回應 PrepCon VI 之要求：本議程探討 WCPFC/PrepCon/WP.24 報告；美方提問是否應有分析之時間表及各選項的優先順序？主席表示當然會有適當的分析及各選項之優先順序討論與提出建議。之後，主席提出是否可以就已整理好的管理選項表格進行討論（本會議前二日由紐西蘭代表就 WCPFC/PrepCon/WP.24 報告整理之管理選項摘要表格），並請整理之人員提出簡略說明（紐西蘭代表 Shelton Harley）。主席表示我們將於中場休息後，對於該管理選項摘要進行討論。韓國表示，目前對於此程序上有疑問，據 PrepCon VI 會議報告，本次會議應是大家進行討論，提出對於管理選項的看法及意見，並非是提出具體的選項及格式，提交 PrepCon；主席則表示，本次會議目的依據個人的瞭解應是對管理選項進行審議，並提出其優先順位等具體意見。我方表示，很高興有此參考資料，但是目前各國代表可能已閱讀 WCPFC/PrepCon/WP.24 報告，有的沒有閱讀該報告只有閱讀本次會議所提供的管理選項摘要表格，所以不知要如何討論。美國表示，此管理選項摘要表格之資料，要如何轉換到 PrepCon 會議所用並不明確。日本表示此管理選項摘要表格只是一個供研究的資料，並無實際的管理，所以應有焦點，縮小討論範圍，且選項必需務實；此外，此議程與下一議程（管理模式）之內容討論是否相似？主席表示目前並沒有選擇管理選項的問題，而是要分析管理選項，並列出其優先順位。庫克群島代表認為依據 PrepCon VI 會議報告，應對於管理選項討論後提出建議。紐西蘭代表認為應考慮的除管理選項外，亦有所需資料的取得，到管理措施實行時，所需的時程安排等等，此外亦必需區分長期與短期的管理問題。主席表示，目前所關注的不只是短期的，長期的也是在討論中。韓國表示如果本管理選項摘要表

格有含概 WCPFC/PrepCon/WP.24 報告之內容時，將感謝 Shelton Harley；此外，本次會議應是討論各種管理選項的內容及可行性，並提出管理選項的建言，而非提出優先順位。主席請 Shelton Harley 就 WCPFC/PrepCon/WP.24 報告及其整理之管理選項摘要表進行較為詳細的說明。Shelton Harley 說明由於沒有時間作 WCPFC/PrepCon/WP.24 報告之詳細閱讀與消化，故可能有些疏漏；經整理後如管理選項摘要表。有關第一項 No Controls 部份，我方提問其中在 Analyses required 項目中，為何僅有考慮 MULTIFAN-CL 分析時之需要，有無其他分析模式的考量？紐西蘭代表亦表示相同的意見；但 Shelton Harley 並沒有具體回應。有關第二項 Output Controls 部份；韓國表示，應可以先設定選定的標準及管理的目標，再進行各管理選項的評議。我方表示，同意韓國的看法，此外目前所審閱的是進行各管理選項的研究方法，而非實質的管理；主席表示，實質管理的部份並非在本會議中討論。美國表示，資源狀態已經過三年的研究與確認，認為此時並非是討論此內容。庫克群島代表表示，對於目前所進行的議程內容已有所混淆。我方表示管理選項涉及管理的成本與效率，所以有關此二項是否亦要列入評估。韓國表示，若當我們採取 Output Controls 時，是否有相關的生物參考點產生，且總容許漁獲量是否可以設定；主席表示由 SCTB 會議之資源評估結果已有提出其生物參考點，而委員會則是依結果進行決策；主席亦回應很多分析無法各案處理；韓國又提出，若無法提出總容許漁獲量的數量，那又如何對 Catch Limits 提出任何建議？此時，我方引用公約第十條有關委員會功能，說明上述討論應依據該條文內容處理。有關第三項 Input Controls 部份，FFA 表示所有遠洋漁業國家之圍網漁船及延繩釣漁船在 FFA 會員國水域作業者皆有登記，但並不包括在非 FFA 會員國海域作業之漁船及獨自在公海作業的漁船。我方表示，此與各區域之船舶登記與 WG. III 之任務有關；此外，有關管理時之資料所有權的問題應由委員會討論。美國提出，若有關管理方式分為長期及短期時，那長期與短期的定義又為何？此時，我方

亦有相同的看法。IATTC 表示何謂短期，如 EPO 部份已有執行之三個月或六個月的漁區關閉或是其它的措施即屬於短期，此外皆屬於長期。我方表示，有關管理部份都要有委員會決定；此外，漁撈能力的管理，如船噸或馬力等等，涉及管理及其他不同領域的專業因素，所以應另外考量。有關漁區漁場關閉部份，我方提出中西太平洋部份與東太平洋不同，特別是部份可關閉的區域可能會是島國的經濟水域或是在公海上，所以狀況不同，且管理的複雜度亦有別，故應有所彈性的調整（於下午五時三十分時，主席宣佈首日會議結束）。

八月二十日上午八時三十分開始，主席說明希望本議程及後面的議程能儘速完成。有關漁撈技術管制部份，我方提出在此項管制中之體長部份應屬於 Output Controls 所以似有混淆，且有些資料係與實際的作業有關，且有執行上的困難，故請在本資料上加註說明，其中特別是漁具的限制中的網具規模的限制、漁獲體長的限制、漁船的馬力及船舶電子機件的限制、輔助船的限制、FADs 使用的限制，最後我方表示此資料蒐集並非純科學資料蒐集，而且涉及到實際操作的問題，故聲明僅為個人之意見討論，並非政府立場；建議攜回研究後再因應。各方逐項討論後，將進行管理選項表格修改，之後會將資料作成本次會議的附件。

3. 生態、混獲及相關科學性議題：經各方討論後，與生態及混獲議題建議包括之項目為：(1) 環境對漁業及資源的衝擊；(2) 漁業對海洋生態系之衝擊；(3) 混獲議題；(4) 魚類之棲地研究等等。其次，在相關性科學性議題部份，經各方討論後，有以下討論。在資源評估部份，建議明年進行大目鮪、正鰹、長鰭鮪、黃鰭鮪等魚種之資源評估；我方表達因劍旗魚資源亦相當重要，建議明年應進行劍旗魚之資源評估，而其他的旗魚類亦應列入考慮，澳洲亦表達相同的建議。主要魚種研究的優先順位，經討論後依序為：大目鮪、黃鰭鮪、長鰭鮪、正鰹。旗魚類魚種研究之優先順位進行討論時，我方表示 Blue Marlin 應先對於其生物學研究如年齡成長、Maturity Ogive 等進行研究，所以認

為應以劍旗魚為優先；IATTC 表示應以 Blue、White 及 Stripe Marlin 為主。會中並無具體結論。

4. 相關統計資料之議題：依據 SWG-6 及 SWG-8 報告內容進行討論，歐盟表示有關 Public Domain 資料應包括國別及船隊別之漁獲統計資料，如此才利於科學家研究；韓國表示，一般而言遠洋漁業漁獲統計資料是具機密性，所以是否要將國別或船隊別之資料放置於 Public Domain 之中應要討論。中國提出 Commission Area 的西界是否有包括南中國海？主席認為本會議主要為科學性議題，有關於 Commission Area 則屬於管理議題。我方表示 Commission Area 與 IATTC 之範圍亦有重疊，且有關 SCTB 結束後資料庫的所有權問題亦應提請委員會處理。之後，各方並無太多的意見便結束本議程。

5. 管理模式：John Sibert 認為在資源評估時，除使用複雜的模式分析外，亦應以簡單的生產量模式或其他的模式進行分析；我方提出是否要考慮比照 CCSBT 的方式建立 Management Procedure；之後，澳洲代表提出「Evaluation of Management Scenarios Using Operational Models」之文件並進行說明與討論。我方表示，此文件相當的重要而且具體，可供給 Commission 參考與討論，並且可以與澳洲、及 CCSBT 相關之會員國討論相關的議題，此外亦有代表提出應將所有的管理委員會之相關資料彙整，供作未來參考。Fiji 表示相關的 Management Procedure 應不只此一種，是否有其他資料；主席表示此文件只是其中之一，且作為本會議的參考樣本。加拿大認為本文件應附在本次會議報告之附件；主席表示若沒有意見，將此文件列於會議報告之參考資訊當中。

6. 確認工作小組結構：SCTB 17^{th} 之主席（韓國 Soh）說明過去的工作小組（大目鮪、黃鰭鮪、長鰭鮪及正鰹、漁撈技術、方法、統計、旗魚及混獲等工作小組）已有十七年的運作經驗，而本次 SCTB 17^{th} 會議則以改變成六個工作小組（生物、生態系及混獲、資源評估、統計、漁撈技術及方法工作小組）並簡略說

明目前執行之六個工作小組的任務。日方表示劍旗魚及旗魚類的研究是否移至資源評估工作小組或是其他工作小組。資源評估工作小組主席（Max Stoker）表示旗魚類及劍旗魚之資源評估是移至資源評估工作小組，但今年並沒有報告。韓國表示每個新的工作小組應要準備其新的 Terms of Reference。我方再次強調是否要增設旗魚類之工作小組？日本表是其實有關旗魚類之研究已分散至各工作小組，所以不用在增設一個工作小組。主席表示若沒有特別的建議，結束本議程；而會議報告初稿將於傍晚完成。此外，美國表示工作小組的成立與預算有關，是否要全部成立？或是有成立的優先順位？韓國表示此工作小組乃依據 PrepCon VI 之報告成立，故原則上目前仍以六個工作小組的結構執行任務。(本日會議結束，明日九時進行會議報告的審視)

7. 第三屆中西太平洋漁業委員會科學協調小組會議—會議報告審視(主席：日本 Yuji Uozumi；時間：八月二十一日上午九時至下午二時)：主席在審視此次會議報告之前，聲明本次審視報告主要是針對文字所表現的意義是否與開會期間的內容相同，不需另外產生討論的議題，請各方代表謹記；之後便進行會議報告審視。會議在進行第一至第七項時，並無太多的爭議並快速通過；之後，便有許多的討論。

Agenda item 2.　Stock status of major tuna species 部份

第八項之原文：In the 2004 stock assessments, and in the statements below, $F_{current}$ and $B_{current}$ refer to the average fishing mortality and biomass over the period 1999-2001, respectively.

我方首先詢問此段文字目的為何？主席回應本段的目的為目前資源分析時所用資料（$F_{current}$ and $B_{current}$）的定義；但我方表示應不限於 1999-2001 年期間之資料，如 1999-2002 年，而非只有一項定義以作為此次分析之結論，並且應有不同時限範圍資料之比較；紐西蘭表示此段文字是適當的，而且表現的是此次分析的結果。韓國表示文字不能誤導，所以必需將實際分析時所

用的 Fishing Mortality 列入；IATTC 表示應詳列清楚，因為此為科學研究的結果；我方再次表示如果我們完成 2004 資源評估結果，所以資料應是使用到 2002 年，但是為何實際分析時只用到 2001 年？John Hampton 回應 2002 年的資料處於相當不確定的狀態，所以只用 1999-2001 年之資料。此時，主席表示有關此問題以於日前有所討論。韓國表示，我們有 Rules of Procedure，所以可以請主席 Review 一下，所以此時只是進行文字的審視，建議主席不要再重新開放討論。我方繼續表示有關此文字部份若不適合再討論，故表示為避免影響審察的時程，且此文自與第十項有關，建議保留至第十項時進行審視；主席同意我方要求。俟經討論與修正後，原第八項文字經折衝後，修改如下：

In the 2004 stock assessments, and in the statements below, $F_{current}$ and $B_{current}$ refer to the average fishing mortality and biomass over the period 1999-2001 respectively. The final year for which complete fishery data are available (2002) is not included in the average because fishing mortality estimates in the terminal data year are highly uncertain.

在大目鮪資源狀態部份（爭議部份為此段文字與前一段文字相關部份為 1999-2001 年平均漁獲死亡率，及資源狀況的認知），我方表示由 SA-2 報告中顯示五項 CPUE 標準化後經 MULTIFAN-CL 分析所得之 Reference Points，其中有四項分析結果皆較去年樂觀，故建議將「…some reference points are slightly more optimistic」修改為「…four out of five reference points are slightly more optimistic」，主席同意並修改；此外，日方提出在漁獲死亡率前可加入「equivalent catch」以簡化漁獲死亡率複雜的定義；但我方認為此文字與原資源評估報告 SA-2 內容並非相同，而且有過度延伸其意義，故建議刪除；美國代表亦與我方有相同的意見，之後經各方討論同意刪除「equivalent catch」之文字。修改後文字如下：

The SCG recommends that, as a minimum measure, that there be no further increase in fishing mortality for bigeye tuna from $F_{current}$.

In addition, the SCG noted that more recent effort data is urgently needed to properly estimate the actual fishing mortality since 2001. Given this situation, the SCG also recommends that more timely provision of catch and effort data from DWFN longline vessels as well as estimates of catch and catch composition from Indonesian and Philippine fisheries be obtained to address this issue. The SCG also notes the recent decrease in bigeye recruitment in the EPO and the need for more stringent management actions if such a decrease was mirrored and verified in the WCPO.

此外，我方亦表示目前所用的資源評估資料係為研究用，不能具有管理依據之意涵，特別是漁獲死亡率的部份，不能特別強調為唯一管理依據的數據（1999-2001 年之平均漁獲死亡率），且分析時應有不同時期如 1999-2001 及 2000-2002 年分析結果之比較，故應特別的註明；且有關原文字之第八項及第十項事實上有邏輯上的連貫；同時本會議之目的為提出科學性建議而非管理需求上之分析。故於會中，最大的爭議是此報告是科學性的建議，特別是在資源狀況的部份，其內容應是陳述目前的資源狀態，在管理意涵部份亦應是合理且可行的，而非在管理意涵中僅將採取至少之管理措施列於報告中（如前段文字 The SCG recommends that, as a minimum measure, that there be no further increase in fishing mortality for bigeye tuna from $F_{current}$. 中之 as minimum measure），惟此將違反科學性之建議原則，尚且有關管理意涵的部份亦應透過委員會討論同意後，程序才算完整；此於會中有相當程度的討論，其中美方的立場與我方接近，經多方討論後主席裁示由亦我方草擬聲明列於報告中，經草擬及部份文字修正後列入記錄，原文如下：

Chinese Taipei provided the following statement: Chinese Taipei raised particularly that any action in terms of measure to be recommended by SCG meetings should be reasonable to management use, which is contingent upon the approval of the Commission. However, with respect to $F_{current}$ and $B_{current}$ referred, from the previous paragraph, to the average fishing mortality and biomass over the period 1999-2001, for the purpose of comparison study, Chinese Taipei suggested that other period 2000-2002, or others could be undertaken and no implication should be used for management purposes at this stage.

Agenda item 3. Advice on technical feasibility of analyzing management options 部份

由於本次會議有關 management option 之討論乃為科學性質，而非技術層面的討論，故於會中各方建議將 Agenda item 3.之內容中之 technical feasibility 修改為 scientific feasibility。此外，本報告亦未考慮業者實際作業與管理措施之可行性，故 The operational and implementation aspects of these options were not considered in this paper.列於報告中。另，有關 FADs 之定義在此分析中是依據 WCPFC/PrepCon/WP.24 報告，但此定義與過去 SCG 2 報告中之定義相違，且與本報告之第十七項 Interaction 中之文字「SCG noted that for at least two gear types, longline and purse seine setting on floating objects (FADs and logs)...」定義不符，故我方建議將原文字「The definition of FADs is taken from WCPFC/PrepCon/WP.24. "Unless otherwise indicated a reference to FADs includes all types of floating objects, natural and artificial."」刪除，經各方討論後，主席裁示應予刪除，並請修正附件部份。

此後之項目因爭議較少，會中討論討論後修改文字並加以定稿。

參、心得與建議

一、本次會議對於主要漁獲魚種之資源狀態有以下之結論：

（一）正鰹：由於近年來正鰹資源補充量大，資源無過漁問題，預估在此高補充量情形下，持續生產量可達 120 萬公噸，因此目前並無需考慮管理問題，但須審慎因應以正鰹為主要目標魚種之圍網混獲黃鰭鮪及大目鮪幼魚的問題。此外，該魚種近年來漁獲穩定並無過漁疑慮，且混獲問題應分開討論。

（二）黃鰭鮪：2004 年之資源評估結果顯示中西太平洋之黃鰭鮪資源可能沒有過漁的情況發生（$F_{current}/F_{MSY}<1$），且資源狀況亦顯示沒有過漁的情形（$B_{current}/B_{MSY}>1$）。赤道海域之黃鰭鮪資源可能接近完全開發的狀態，未來任何的漁獲死亡率的增加，可能不會在長期上產生產量的增加，卻可能將黃鰭鮪資源推向過漁的狀態。資源量之生物參考點顯示，若保持目前的漁獲量時，長期平均的資源量將保持在高於 MSY 之水準。而生產量評估顯示可能需要對漁獲量加以限制，以防範特定年齡群資源量的過度開發；圍網漁業在赤道海域對資源已有相當的衝擊。而 Probability distribution for F ratio（$F_{current}/F_{MSY}$）分析結果，相當的樂觀，即使維持目前的漁獲死亡率，過漁的發生機率仍小於大目鮪的情形。

（三）大目鮪：2004 年資源評估結果顯示之參考點呈較去年樂觀的現象，1999-2001 年之漁獲死亡率接近 MSY 水準（$F_{current}$~F_{MSY}），而資源量水準則高於 MSY（$B_{current}>B_{MSY}$），結論為若維持目前之漁獲死亡率將會導致產生過漁的風險。此外，未來若加入量過低時，中西太平洋之大目鮪將會與東太平洋大目鮪有相同的情形發生。

（四）南太平洋長鰭鮪：目前資源無過漁疑慮，資源量約在無漁業開發狀態下 60%的水準，但部份區域 CPUE 有下降的趨勢（Localized Depletion），主要受到評估所需資料不足所影響，但此問題應不影響該魚種資源評估結果。

（五）交感效應：目前 SCTB 之主要魚種資源評估結果已包括漁業對資

源的衝擊與對於漁獲組成的潛在衝擊。而 SCG 認為至少兩種漁業型態，如延繩釣及圍網以隨附群之作業型態（如 FADs 及流木），對於非目標魚種具有潛在影響；其中，較受關注的是以正鰹及黃鰭鮪為主要對象魚種之圍網漁業混獲大目鮪的情形。未來，若正鰹的漁獲量增加時，可能會對於大目鮪及黃鰭鮪之資源狀態產生嚴重的影響。而 SCG 認為圍網利用隨附群的情形增加時，將會增加中西太平洋的大目鮪及黃鰭鮪之漁獲死亡率；此外，印尼與菲律賓之國內漁業對於黃鰭鮪資源亦有持續性的影響。在大目鮪的部份，資源評估結果顯示以大目鮪為目標魚種之延繩釣漁業對於該資源之衝擊最大；而圍網及延繩釣漁業對於複數魚種的利用及其對於資源的衝擊，並不能單純以目標魚種而無考慮其它魚種的狀況下作說明。因此，SCG 3rd 建議 PrepCon 應考慮以何種管理措施去說明過漁及其資源狀態。而 SCG 3rd 確認數種在目前可獲得資料下具有分析的彈性，且將有助於 WCPFC 評估資源管理選項。

二、本屆 SCTB 會議應為最後一屆會議，預期未來將由 WCPFC 之科學委員會執行本項任務，於 SCG 3rd 中對於 SCTB 或是 SC 之結構已有討論，其架構包括：方法、統計、漁撈技術、資源評估、生物、生態等六個工作小組，而此六個工作小組之橫向連繫將是對於鮪類資源評估之重要環節，故對於未來的發展應要密切注意。

三、心得：本次會議前，業經本署遠洋漁業組與參與之專家學者討論並檢視提報資料，及議題因應對策的研議準備，使得與會成員得以綜合各方建議，以更充份的準備及減少提報資料的敏感性；所以與會時，有關我國所提供之資料沒有爭議產生。

四、建議：SCTB 年會乃屬於科學性質之會議，整體而言，會議過程尚稱平順，其結果亦為 SCG 有關資源評估之重要參考，且 SCG 結論亦涉及未來 WCPFC 科學架構安排，其結果及後續的發展更受有關國家之關注。而下列議題，可能值得我政府及業者密切注意。

（一）近年 SPC 之 OFP 持續積極推展 MULTIFAN-CL 分析模式，並普遍應用於各主要鮪類之資源評估；其中，特別是大目鮪及黃鰭鮪

資源狀態在會議中引起廣泛討論。而目前我國已引進該模式，故實有必要加速瞭解該模式之理論架構及模式比較，俾我方知己知彼，促進與相關國家或組織在中西太平洋海域漁業科學研究之合作，增加我國對重要資源狀況之瞭解與掌握。

（二）為解析漁業資源量之分佈與變動與其棲息環境間之關係，SEPODYM（Spatial Environmental Population Dynamic Model）分析模式目前為 OFP 重要的發展模式之一。我方實有必要加速瞭解該模式之理論架構，並以此來增加我國對重要資源狀況之漁海況變動的瞭解。

（三）鑑於本次 SCTB 會議中 SPC 使用 MULTIFAN-CL 模式研析大目鮪資源衝擊之結論中，資源係深受鮪釣漁業影響至鉅，惟查其研究範圍均以西經 150 度以西為限，且未指明究竟係肇因自中西太平洋之小型延繩釣漁業，或出自近年在西經 150 度以東的新興發展之超低溫大型鮪釣漁業之結果，值得我方深入研析 2001 年後之相關資料，以資後續因應參考。

（四）太平洋主要的鮪類及類鮪類資源，部份為全洋區分佈，且視為單一系群，而目前太平洋主要的漁業組織，計有科學性之 ISC 與具有管理能力的 WCPFC 及 IATTC 等，故未來各組織間對於鮪類及類鮪類資源狀態應有共同討論之趨勢；此外，在管理方面亦可能發展為共同管理的情形。所以，有關我國對於太平洋之整體漁業狀態已不能針對各組織分別因應，而需有通盤考量，如此方能在各組織間有完整的應對及因應。

（五）有關各魚種之資源狀況，建議應加強與 SPC 或是未來 WCPFC 之科學委員會連繫互動，進行資料的交流以取得中西太平洋全盤之漁獲統計資料；此外，亦應透過學術研究單位，以不同的資源評估模式（如 ASCALA）評估主要魚種之資源狀態，並在會議中與其他學者討論。

（六）有關鮪漁業之相關研究，無論是主要魚種之資源評估、生物、生態及漁場環境，或是產業結構、經濟分析及管理層面之議題，似

乎業界的投入甚少；因此，建議無論是與鮪漁業相關之研究或是管理措施（如漁獲統計資料提供、港口採樣及觀察員計畫等等）應設一機制，讓產業界參與，如此方能有效提升我國對於鮪漁業管理的效能。

（七）由於我國為遠洋漁業之主要國家，但是有關科學家會議之參與，無論是論文的發表或是參與人數皆明顯低於其他漁業國家（如日本、美國、澳洲等），所以對於我國遠洋漁業投入的研究人力明顯與產業規模不相稱。建議設法擴大研究單位及學術單位之研究人員參與，以延續我國之遠洋漁業研究。

（八）面對 WCPFC 與 IATTC 介於 150^{O}W 與 130^{O}W 間之重疊海域問題，尤待我方力促雙方加強漁獲努力量及產量資料蒐集及評估，以助未來共同合作管理。

肆、附件

檢附本次會議我方所提出之太平洋區域鮪漁業國家報告及相關會議資料。

附件一：Update on tuna fisheries of Taiwan in the Pacific region.

附件二：Report of the Scientific Coordinating Group (SCG 3^{rd})

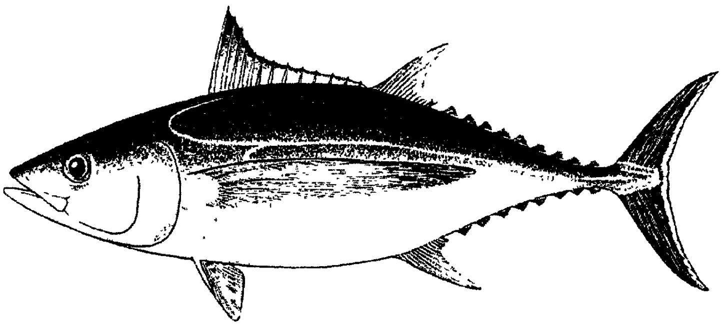
附件三：SCTB 17^{th} Executive summary

附件一

SCTB17 Working Paper

NFR–25

Update on Tuna Fisheries of Taiwan in the Western and Central Pacific Region



Overseas Fisheries Development Council of the Republic of China
And
Fisheries Agency, Council of Agriculture, R.O.C.

August 2004

This paper is prepared for the 17th meeting of the Standing Committee on Tuna and Billfish (SCTB) held in Majuro, Marshall Islands, August 9-18, 2004. Document not to be cited without permission of the authors

National Report

Update on Tuna Fisheries of Taiwan in the Western and Central Pacific Region

Overseas Fisheries Development Council, R.O.C.
and
Fisheries Agency, Council of Agriculture, R.O.C.

August, 2004

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1. Introduction

The Pacific Ocean is one of the earliest fishing grounds exploited by Taiwanese tuna fishery. Currently, there are three types of tuna fisheries operating in western and central Pacific Ocean (WCPO) : the frozen tuna longline (FTLL) fishery, the distant-water purse seine (DWPS) fishery and the fresh and/or chilled tuna longline (CTLL) fishery based upon how the catches were stored (chilled or frozen), or gear types and the vessel sizes.

2. Fleet structure

2.1 FTLL

The FTLL vessels refer to those vessels mostly greater than 100 GRT and operating in distant waters of foreign EEZ and high seas. Number of FTLL vessel in WCPO in 2003 was estimated as 142.

2.2 DWPS

Purse seine fishery was introduced into Taiwan in 1982 and has become one of the major fleets. Total number of purse seine vessel is 42, and among them 36 vessels were active in WCPO in 2003, less than that in the previous year.

2.3 CTLL

The CTLL vessels operated both in the coastal and offshore waters of Taiwan and in general, smaller than 100 GRT. However, some of them have expanded their fishing grounds to distant waters and operating in a similar pattern as FTLL vessels. In addition, they may change their fishing ground and target species bases on fishing season or market price. Number of registered CTLL vessels (<100 GRT) was estimated as about 1,180 in 2003.

3. Catch by species, for each type of Taiwanese tuna fisheries

3.1 FTLL

Historically, most of the FTLL fleets targeted on albacore for canning, but in recent years, a higher proportion targeted on tropical species for Japanese frozen sashimi market. The major fishing grounds of FTLL fleet was located in the central and southern regions (Figure 1). Due to a good catch of northern albacore, the northern region has become more and more important in some seasons.

Table 1 shows the catch estimate of major tuna and tuna-like species caught by FTLL fishery in recent five years (1999-2003) in WCPO. During 1999-2003 period, the most dominant species was albacore, accounting for about 67% of the total catch and tropical species (bigeye and yellowfin tunas) for another 26% (Figure 2). Due to the development of FTLL targeting tropical tunas, the catch of bigeye and yellowfin tunas increased in recent two years (2002-2003). The albacore catch showed a slight decreasing trend from 15,917 mt in 2000 to 11,710 mt in 2003. And the catch of albacore, bigeye and yellowfin tunas were 11,710 mt, 4,332 mt and 3,972 mt in 2003, respectively.

3.2 DWPS

Total catch and major species caught by this fishery in WCPO during 1999-2003 period are shown in Table 2. The most dominant species remained to be skipjack, accounting for about 83% of the total catch (Figure 3). Yellowfin tuna accounted for another 16%, and the bigeye tuna only accounted for 1% of the total catch. For 2003, catch of skipjack, yellowfin and bigeye tunas were 169,492 mt, 29,058 mt and 2,767 mt, respectively.

The major fishing grounds of DWPS fishery varied significantly in 2000-2003 period (Figure 4). The fishing grounds in 2001 essentially located only in areas west of 180°. However, in 2002, fishing grounds extended to as far as 151°W due possibly to the impact of El Niño. During 2001-2002 period, fishing grounds started to move westward and mainly located in the western and central part of the tropical Pacific Ocean (135°E-180°, 8°N-8°S) with sporadic efforts in areas east of 180°. In 2003, the fishing grounds moved westward and concentrated in areas west of 180°.

3.3 CTLL

The CTLL fishery might land their catch in Taiwan or foreign bases. Considering the geographical location of Taiwan, catches landed in Taiwan are believed to be mostly from WCPO including surrounding waters of Taiwan. Total catch of tuna and tuna-like species landed in Taiwan by this fleet was stable in recent five years (1999-2003) and averaged at about 45,361 mt (Table 3). The dominant species caught included yellowfin tuna (23%), billfish (30%) and swordfish (7%) (Figure 5).

As to those landed in foreign bases, we acquired information on the fishing activities of our vessels in the bases from relating trading companies and used this information to estimate the amount of catch from available commercial data. The bigeye and yellowfin catch estimates from the bases in the western and central Pacific Ocean in 2003 were 3,506 mt and 4,814 mt, respectively.

4. Final market destination of catches

Most of the albacore catches from FTLL vessels were landed at American Samoa and Fiji or transshipped to Thailand for canning, while the tropical tunas catches sent to Japan for sashimi market. Catches of DWPS fishery were mostly transshipped to

Thailand for canning, only a small proportion was sold to Japan for katsuobushi and sashimi. Fishes caught by CTLL vessels, however, were mostly sold in the domestic market or transshipped to Japan for fresh sashimi market.

5. Future prospects and developments

5.1 The Vessel Monitoring System

The experimental vessel monitoring system (VMS) was implemented continuously from previous years for the purpose of better management of our distant water fishing vessels. The government has encouraged FTLL vessels to install the VMS through an incentive program since July 1996. Essentially all purse seine vessels operating in the Pacific Ocean have installed such a system. And all FTLL vessels will be equipped VMS in October, 2004. The government recognizes that as one of the fishing nation, we are willing not only be in line with the international trend on management of fishery resources, but also to achieve the goal of the sustainable use of these resources.

5.2 The Observer Program

For purposes of better understanding the fishing activities and the bycatch issue of the longline fishery and to be in line with the international requirement for conserving marine resources, the government has launched an experimental observer program since 2001. In 2002 and 2003, there were 6 observers each year dispatched to the three major Oceans. And the number of the observer increase in 2004 is 9. During 2002-2004 period, there were 2 observers dispatched to Pacific Ocean each year boarding many FTLL or DWPS vessels. Data obtained will be reviewed and used for scientific purposes in the near future.

5.3 The Conservation Efforts Implemented by Government

In order to be in accordance with the international trend on management of marine resources, our government has initiated some programs on management and conservation of some important marine species, such as green turtle (*Chelonia mydas*) and whale shark (*Rhincodon typus*). The satellite telemetry technique has been introduced to study the migration patterns of green turtle. Also, a sanctuary area for green turtle was established in Pen-Hu Island (southwest of Taiwan) to protect their spawning and nursery ground.

In May of 2002, a shark conference was held in Taiwan to discuss the conservation and utilization of the resources in the Ocean. For the whale shark, the government has set up a system to collect catch, fishing location, weight and length information. The government has also set a total allowable catch (TAC) of 80 fish per year since July 1 of 2002, and 120 fish for July 2003 to December 2004.

Four whale sharks have been tagged successfully on April 2002 to study their migration behavior. And the 5th whale shark will be tagged in the 3rd or 4th quarters, 2004. Current information indicated that whale shark migrate between south eastern Taiwan and Philippines, and mostly stayed in water columns where temperature were between 24°C and 28°C.

Table 1. Catch (in mt, round weight) statistics of major tuna and tuna-like species caught in frozen tuna longline fishery in WCPO during 1999-2003 period.

Species / Year	ALB**	BET	YFT	SWO	MLS	BLZ	BLM	SKJ	Total
1999	13,684	1,084	977	196	209	109	18	516	16,793
2000	15,917	934	1,399	228	120	438	41	274	19,351
2001	12,330	1,043	1,522	367	83	133	11	274	15,763
2002	12,635	5,642	5,215	1,069	410	216	20	124	25,331
2003*	11,710	4,332	3,972	710	382	480	17	321	21,924

* a preliminary estimate

** the albacore catch listed in the table is for south Pacific.

Table 2. Catch (in mt, round weight) statistics of major tuna species caught in distant water purse seine fishery in WCPO during 1999-2003 period.

Species / Year	1999	2000	2001	2002	2003*
SKJ	160,453	194,499	182,531	229,415	169,492
YFT	41,905	38,579	45,853	26,068	29,058
BET	3,372	1,900	2,284	2,634	2,767
Total	205,730	234,978	230,668	258,126	201,317

* a preliminary estimate

Table 3. Catch (in mt, round weight) of tuna and tuna-like species in the fresh/chilled tuna longline fishery landed in domestic ports of Taiwan (including vessels operated in distant waters) during 1999-2003 period.

Species / Year	ALB	BET	YFT	SWO	BILL	OTH	Total
1999	382	2,673	10,347	2,720	14,486	17,018	47,626
2000	944	2,092	8,376	3,147	16,456	15,372	46,387
2001	832	3,292	12,741	3,694	15,892	9,636	46,087
2002	910	2,150	9,145	2,511	10,732	14,193	39,641
2003*	712	2,299	10,567	3,196	10,578	19,710	47,062

OTH: other species. * a preliminary estimate

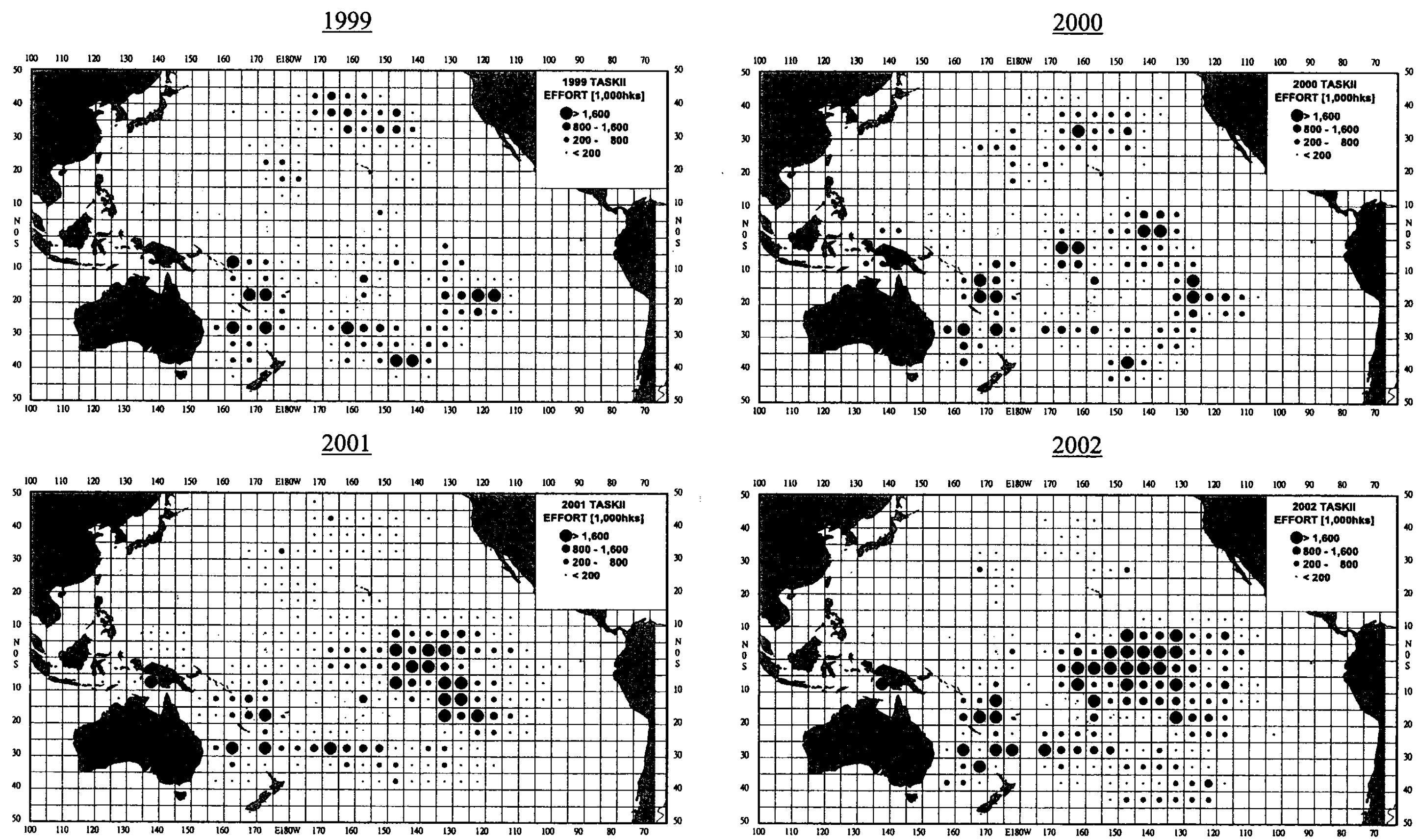

Figure 1. Effort distribution of Taiwanese frozen tuna longline fleet operating in WCPO during 1999-2002 period.

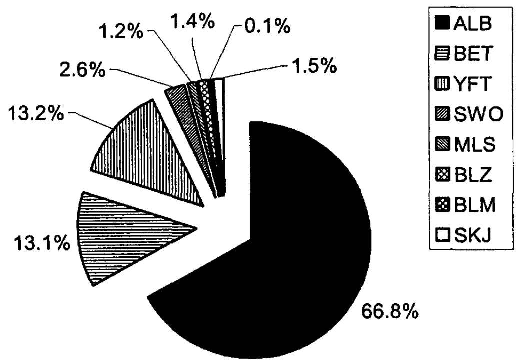

Figure 2. Mean catch percentage of major tuna and tuna-like species caught by Taiwanese frozen tuna longline fishery in WCPO during 1999-2003 period.

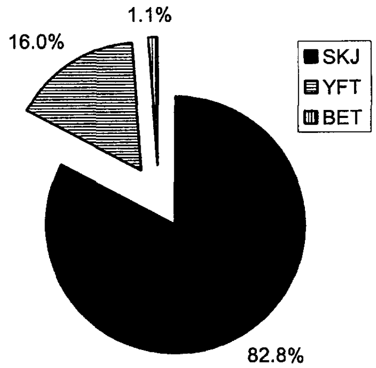

Figure 3. Mean catch percentage of major tuna and tuna-like species caught by Taiwanese purse seine fishery in WCPO during 1999-2003 period.

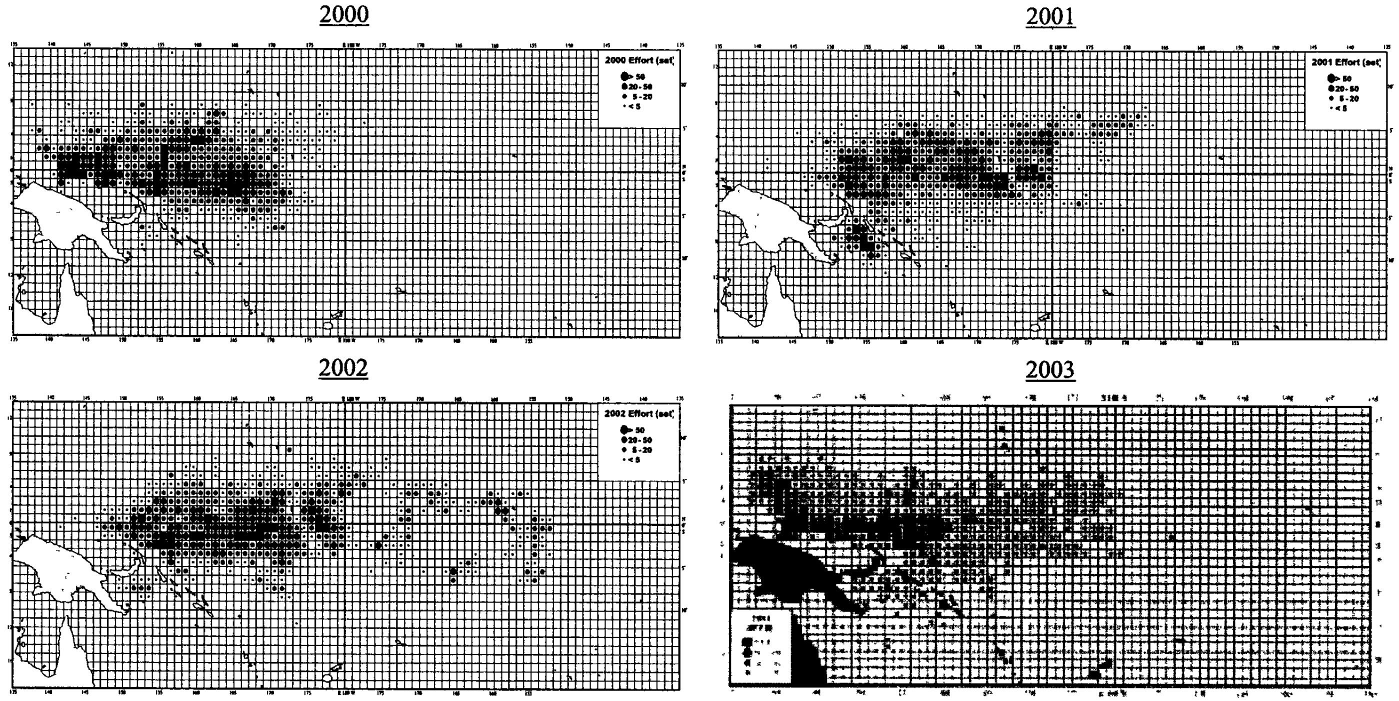

Figure 4. Effort distribution of Taiwanese distant water purse seine fleet operating in WCPO during 1999-2003 period.

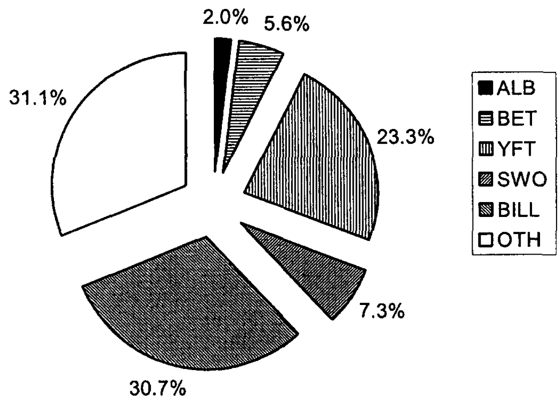

Figure 5. Mean catch composition of major tuna and tuna-like species caught by Taiwanese fresh/chilled tuna longline fishery in WCPO during 1999-2003 period.

附件二

PREPARATORY CONFERENCE FOR THE COMMISSION FOR THE CONSERVATION AND MANAGEMENT OF HIGHLY MIGRATORY FISH STOCKS IN THE WESTERN AND CENTRAL PACIFIC
Seventh session
Pohnpei, Federated States of Micronesia
6 - 7 December 2004

WCPFC/PrepCon/41
16 September 2004

REPORT OF THE THIRD MEETING OF THE SCIENTIFIC COORDINATING GROUP

1. In accordance with the terms of reference agreed by the Preparatory Conference in its second session (WCPFC/PrepCon/15, Annex V), the third meeting of the Scientific Coordinating Group took place at Majuro, Marshall Islands from 19 to 21 August 2004, immediately following SCTB17. The list of participants is attached as Annex I. A list of abbreviations and acronyms used in this report is attached as Annex VI. The meeting was chaired by Dr Yuji Uozumi (Japan).

2. The agenda is attached as Annex II. The matters considered by SCG 3 included:

(a) Stock status statements for the major target species (bigeye, yellowfin, skipjack, South Pacific albacore)

(b) Review of the scientific feasibility of providing analyses of management options.

(c) Management strategy evaluation approaches using operational models

(d) Ecosystem, bycatch and other scientific issues - including stock assessment research priorities.

(e) Data standards and other data related issues; and

(f) Identification of Specialist Working Groups of the Scientific Committee.

Agenda item 2. Stock status of major tuna species

3. SCTB17 produced stock status statements (Annex III) in accordance with the format established at SCG1. SCG3 independently considered management implications and these were added to the stock status summary statements that appear below.

4. The SCG recognised that the stock assessments used to provide advice on the status of the WCPO stocks are subject to uncertainty in the inputs and model specification and structure. It was noted that there are critical gaps in the data that are producing significant uncertainty in the assessments. Quantification of the uncertainty associated with stock structure is complex, but is a high priority.

5. The SCG acknowledged the ongoing need for development, testing and review of assessment methods. Several processes are in place to ensure that these development, testing and review activities continue, including the work of the methods working group of the SCTB, peer review through cooperation with other organizations involved in stock assessment and formal peer review and publication in the international scientific literature.

6. In discussing the stock assessments for yellowfin and bigeye stock in particular, the issue of uncertainty is significant in that the true status of stocks may be over estimated or underestimated by current assessments. Significant management implications flow from this uncertainty. Nevertheless, the following advice on stock status and management implications was formulated by SCG on the basis of the best available scientific information.

7. In the 2004 stock assessments, and in the statements below, $F_{current}$ and $B_{current}$ refer to the average fishing mortality and biomass over the period 1999-2001 respectively. The final year for which complete fishery data are available (2002) is not included in the average because fishing mortality estimates in the terminal data year are highly uncertain.

8. Chinese Taipei provided the following statement: Chinese Taipei raised particularly that any action in terms of measure to be recommended by SCG meetings should be reasonable to management use, which is contingent upon the approval of the Commission. However, with respect to $F_{current}$ and $B_{current}$ referred, from the previous paragraph, to the average fishing mortality and biomass over the period 1999-2001, for the purpose of comparison study, Chinese Taipei suggested that other period 2000-2002, or others could be undertaken and no implication should be used for management purposes at this stage.

Bigeye tuna

Stock status

9. The 2004 stock assessment is generally consistent with the result of the 2003 assessment, although the point estimates of four out of five reference points are slightly more optimistic. In particular, while the 2003 assessment indicated that overfishing was occurring ($F_{current}/F_{MSY} > 1$) in the WCPO, the 2004 assessment indicates that $F_{current}/F_{MSY} \sim 1$. Both assessments indicate that the stock is presently not in an overfished state ($B_{current}/B_{MSY} > 1$) because of high levels of estimated recruitment since 1990. The 2004 assessment also indicates that current levels of fishing mortality carry high risks of overfishing ($Probability(F_{current}/F_{MSY} > 1) \sim 67\%$). A decrease in total catch would be likely to be necessary in order to maintain the stock at sustainable levels if there is a future decrease in recruitment.

Management implications

10. The SCG recommends that, as a minimum measure, there be no further increase in fishing mortality for bigeye tuna from $F_{current}$. In addition, the SCG noted that more recent effort data is urgently needed to properly estimate the actual fishing mortality since 2001. Given this situation, the SCG also recommends that more timely provision of catch and effort data from DWFN longline vessels as well as estimates of catch and catch composition from Indonesian and Philippine fisheries be obtained to address this issue. The SCG also notes the recent decrease in bigeye recruitment in the EPO and the need for more stringent management actions if such a decrease was mirrored and verified in the WCPO.

Yellowfin tuna

Stock status

11. The 2004 stock assessment is consistent with the result of the 2003 assessment that the yellowfin stock in the WCPO is probably not being over-fished ($Probability(F_{current}/F_{MSY} > 1)$ ranged from 15-40%) and the stock is not in an over-fished state ($B_{current}/B_{MSY} > 1$). However, the stock is likely to be nearing full exploitation and any further increases in fishing mortality would not result in any long-term increase in yield and may move the yellowfin stock to an over-fished state. The assessment also indicates that the equatorial regions are likely to be fully exploited. Recruitment is estimated to have been high in recent years and a decrease in total catch is likely to be necessary in order to maintain the stock at sustainable levels if future recruitment levels return to those closer to the long-term average.

Management implications

12. Although uncertain, fishing mortality rates in recent years may have exceeded $F_{current}$, and while spatial patterns of exploitation remain uncertain, some areas in the equatorial WCPO may be heavily fished and in these areas management actions may be required. While recognizing continuing uncertainties with the current yellowfin stock assessment – especially due to inadequate data on Indonesian and Philippine catches, the SCG recommends that to reduce the risk of the yellowfin stock becoming over-fished further increases in fishing mortality (particularly on juvenile yellowfin) in the WCPO should be avoided. Given the need to understand recent changes in the fishery, the SCG also recommends that fishery statistics be made available for stock assessment purposes in a more timely manner.

Skipjack tuna

Stock status

13. No new assessment was undertaken for skipjack during 2004 therefore the current stock status is based on the assessment undertaken in 2003. The 2003 stock assessment indicates that the skipjack stock in the WCPO is not being overfished ($F_{current}/Fmsy < 1$) and that the stock is not in an overfished state ($B_{current}/B_{MSY} > 1$) owing to recent high levels of recruitment and modest exploitation relative to the stock's biological potential.

Management implications

14. Continued catches at the 1.2 million mt level are sustainable if high recruitment levels (believed to be determined by environmental factors) continue. However, any increases in purse-seine catches of skipjack may result in a corresponding increase in catches of yellowfin and bigeye tunas which recent SCG recommendations advise against - refer to discussions under Interactions section below.

South Pacific albacore

Stock status

15. No new assessment was undertaken during 2004 therefore the current stock status is based on the assessment undertaken in 2003. An examination of catch trends in 2004 indicated that total catches of albacore were relatively stable over the period from 1960 to 1995, but they have increased markedly in recent years. The 2003 assessment gave similar results to the 2002 assessment, and estimated a low impact of fishing on biomass and that the current biomass is at about 60% of initial levels largely due to a decline in recruitment. It is therefore unlikely that the stock is in an over-fished state. However, it is noted that assessments conducted on stocks such as South Pacific albacore that, apparently, have been subject to low exploitation rates provide little information on the biomass of the stock. Declines in CPUE observed in some Pacific island fisheries in recent years (particularly in 2003) appear to be a consequence of changed oceanographic conditions, though high levels of localised effort may also be impacting on CPUE in these fisheries.

Management implications

16. Current catch levels from the South Pacific albacore stock appear to be sustainable. However, CPUE may be susceptible to changes in oceanographic conditions and, in localised areas, high levels of localized effort, and these changes may impact on the performance of more localised fisheries, particularly for developing small island states dependant on these resources. It is recommended that further research is undertaken to clarify the possibility of localized depletions in these fisheries.

Interactions

17. Stock assessments, including those conducted for the SCTB, are typically done in the context of the impact of fishing on the target stock with the potential impacts on other catch components considered

qualitatively. SCG noted that for at least two gear types, longline and purse seine setting on floating objects (FADs and logs), there is a potential for considerable impacts on non-target species even if the target stock is not being adversely affected. Of particular concern is the bycatch of bigeye tuna in the purse seine fishery for skipjack and yellowfin. Further increases in catches of skipjack may have severe consequences for the status of the bigeye and yellowfin tuna stocks.

18. SCG agreed that any increase in purse seine fishing on floating objects would increase the fishing mortality on both bigeye and yellowfin tunas in the WCPO. In addition, there is a substantial impact of the domestic fisheries of Indonesia and the Philippines on yellowfin. In the case of bigeye, the assessment indicated that the biggest impacts[1] are due to longline fishing targeting bigeye. The multi-species nature of the purse seine and longline fishery means that the impacts of fishing on stock status cannot be simply addressed by reference to the target species without addressing the other species caught.

19. The SCG recommended that PrepCon should consider how to implement management measures to address overfishing and alleviate overfished stock conditions. To this end, SCG 3 has identified a number of analyses that are feasible, given available data, that would help the WCPFC assess these management options. Similar issues have faced other tuna Commissions and the approaches they have taken may also serve to guide the Commission's considerations..

Impact is defined as the extent by which the biomass is estimated to be reduced from unexploited levels due to fishing.

Agenda item 3. Advice on technical feasibility of analysing management options

20. The SCG addressed a request from PrepCon VI to "Advise on the further analyses to support the consideration by PrepCon VII and the first session of the Commission of management options and how these analyses can carried out in a timely and effective manner." The analyses were guided by the management options described in the document entitled *Management options for bigeye and yellowfin tuna in the western and central Pacific Ocean* (WCPFC/PrepCon/WP.24).

21. The approach taken by the SCG was to identify the data requirements and likely analyses that could be used to evaluate each management option. The assessment of the feasibility of such analyses was based on the availability of data and the scientific achievability of the analyses. Implementation issues relating to each management option were not considered by the SCG (these will need to be considered by the Commission).

22. Of the 17 management options examined, analyses for nine options were considered to be not feasible given current data availability. However, some options could be analysed by making certain assumptions where data are not available. These analyses maybe more feasible in the long term if the necessary data are collected . A summary of the feasibility of the analyses is given below. The full table of results (including extra comments) is given in Annex IV.

23. SCG highlighted that the following matters need to be considered in conjunction with the advice:

(a) The table describes the data/information and analyses required to quantitatively evaluate the possible effects of various management options described in WCPFC/PrepCon/WP.24. **The operational and implementation aspects of these options were not considered in this paper**.

(b) Many of the analyses require management direction before they can be undertaken. Furthermore, quantitative evaluation of the effectiveness of a given management option will require determination of benchmarks/targets/reference points against which to evaluate the effectiveness of the management option, e.g. future biomass, fishing mortality against some value.

(c) While many analyses are feasible some are not due to data limitations. These could be analysed by making certain assumptions where data are not available, but the outcomes of such analyses could be associated with greater uncertainty. Nevertheless, these analyses maybe feasible in the long term if the necessary data are collected. The following feasibility statements are used in this paper:

1. Analysis is feasible
2. Analysis is feasible contingent on management advice
3. Analysis is not feasible due to data limitations, but maybe feasible in the long term.

(d) Many management options could cause changes in fishing behaviour that may be difficult to predict and therefore quantify.

(e) Analyses should be undertaken using a model-based approach to allow integration of population dynamics into the evaluation of management options. A range of models could be considered, but the analysis of some options will require particular model structures, e.g. spatial stratification or age-structure. A critical assumption for such analyses will be future levels of recruitment; this and other important modelling assumptions are described in the "No controls" section. It should be noted that currently, estimates of stock status for most of the species are obtained from MULTIFAN-CL (MFCL), but while there are obvious benefits in using the same model to evaluate management options, analyses using MULTIFAN-CL can be time consuming.

(f) No distinction is made between purse-seine and longline management options except where such options can only apply to a single fishery. Many of the options could be also applied to other gear types.

(g) Though the management measures are directed at bigeye and yellowfin, analyses may include estimates of the effects of measures on catches of other important species (e.g. skipjack, species of special concern).

(h) Some useful analyses, for example, an analysis of the characteristics (e.g. vessel details, fishing strategies) of top bigeye or yellowfin-catching vessels, could provide information in support of the analysis of a range of management options.

Control Type	Management Option	Feasibility Statement
NO CONTROLS	Status-quo: No attempt is made to control fishing mortality	Analysis is feasible in the immediate term and could represent an analysis against which other analyses are compared.
OUTPUT CONTROLS	Catch limits (a): Competitive overall or regional catch limits.	Analysis is feasible in the immediate term contingent on management advice: overall or regional catch limits.
	Catch limits (b): Allocated overall or regional catch limits.	Analysis is feasible in the immediate term contingent on management advice: overall or regional catch limits.
	Catch limits (c): Vessel Limits	Analysis is feasible in the immediate term contingent on management advice: vessel catch limits.
INPUT CONTROLS	Capacity (a): Limit/restriction on the number of vessels. This could be general reductions or directed at those fleets catching most bigeye and yellowfin.	Analysis is not feasible in the immediate term due to data limitation, but maybe feasible in the long term.
	Capacity (b):	Analysis is not feasible in the immediate term due

	Limit size or power of vessels	to data limitation, but maybe feasible in the long term.
	Capacity (c): Limit size of fish hold.	Analysis is not feasible in the immediate term due to data limitation, but maybe feasible in the long term.
	Total effort limits: Setting overall or regional limits for some measure of effort (e.g. sets, hooks, days fished).	Analysis is feasible in the immediate term contingent on management advice: overall or regional effort limits.
	Area/seasonal closures: Restricting fishing effort in particular area/seasonal strata	Analysis is feasible in the immediate term contingent on management advice: the area/seasonal closures.
TECHNICAL MEASURES	Gear restrictions (a): Restrictions on various gear configurations (e.g. net size/depth, longline length)	Analysis is not feasible in the immediate term due to data limitation, but maybe feasible in the long term.
	Gear restrictions (b): Method restrictions (e.g. time of set, soak time)	Analysis is not feasible in the immediate term due to data limitation, but maybe feasible in the long term.
	Size restrictions: Limits on the sizes of fish that can be retained. Compulsory retention (no discards allowed).	Analysis is feasible in the immediate term contingent on management advice: size limits and species and fleets to which they apply.
	Restrictions on operational efficiency (a): Banning or limiting power of vessel electronics.	Analysis is not feasible in the immediate term due to data limitation, but maybe feasible in the long term.
	Restrictions on operational efficiency (b): Restrictions on auxiliary vessels, e.g. tender vessels or light vessels. Regulations on transhipment.	Analysis is not feasible in the immediate term due to data limitation, but maybe feasible in the long term.
	FAD restrictions (a): Prohibition of FAD sets on a time and/or area basis. Restrictions of the number of sets allowed on FADs.	Analysis is feasible in the immediate term contingent on management advice: areas/seasons where FAD sets will be restricted and the specific FAD types.
	FAD restrictions (b): Limit number of FADs deployed	Analysis is not feasible in the immediate term due to data limitation, but maybe feasible in the long term.
	FAD restrictions (c): Regulations on the design of FADs	Analysis is not feasible in the immediate term due to data limitation, but maybe feasible in the long term.

Agenda item 4. Discussions on a Management Strategy Evaluation Approach using Operational Models

24. The SCG held preliminary discussions on this topic after a brief presentation of an introductory document entitled *A management strategy evaluation approach using operational models* (Annex V).

25. Operational models are models that combine species population dynamics models with fishery models. Management scenario evaluation models (MSEMs) overlay operational models with stock assessment models and management action models. Well-defined management goals are a critical prerequisite for implementation of MSEMs. In practice, establishment of management goals requires a lengthy process of stakeholder consultations, and full implementation of a MSEMs could require an effort extending over a period as long as five years. If MSEMs are to be implemented by the WCPFC, the Commission will need to develop and articulate management goals, possibly including reference points and control rules. The involvement of stakeholders at an early stage of implementation is also important.

26. The SCG recommended that the Commission conduct a review of existing operational and management strategy evaluation models.

Agenda item 5. Advice on ecosystem, bycatch and other scientific issues

Ecosystems and bycatch
27. SCG reviewed the document entitled *Review of Ecosystem and Bycatch Issues for the Western and Central Pacific Region* (WCPFC/PrepCon/WP.9). The document is very comprehensive and provides relevant information on ecosystem and bycatch issues. SCG noted that the report summarizes current thinking on the scientific basis for taking an ecosystem approach to fisheries management with focus on pelagic fisheries in the WCPO.

28. SCG identified the following elements of ecosystem research required for fishery management by the Commission:

4. Impacts of the environment on pelagic fisheries and stocks
    - e.g., large scale work on pelagic ecosystem modelling
    - more local scale ecosystem modelling at national level
5. Impacts of pelagic fisheries on the pelagic ecosystem
    - e.g., SEAOPODYM model, ECOSIM/ECOPATH
    - Noting, these require substantial commitment to collection and analysis of time series data (e.g., stomach contents) on species interactions across WCPO
    - development of new modelling approaches
    - impacts on seamounts
    - marine debris impacts
6. By-catch issues
    - By-catch estimation and fishery impacts relative to other human impacts
    - By-catch mitigation research

29. SCG noted a number of scientific issues related to assessing the effects of the environment on pelagic fish stocks, and the effects of fishing on the environment. SCG advises the Commission to consider specific work plans, and associated costs, to address these issues. In the short-term, the Commission, through its Scientific Committee, should identify data deficiencies that exist to address these issues, and make plans to rectify them. Priorities of ecosystem research need to be reconciled with the need to assess the major tuna stocks.

30. The SCG recognizes the complexity of understanding and modelling the effects of changes in climate and fisheries on pelagic ecosystems, and that the Commission is unlikely to be in position to conduct such research in the near future. The SCG therefore welcomes the new GLOBEC (GLObal OCEan ecosystem Dynamics) initiative in this scientific field, and recommends that the Commission formally express support of this programme (CLIOTOP, e.g. CLimate Impacts on Oceanic TOp Predators).

31. SCG identified the following ecosystem and bycatch related research that is currently underway: Spatial ecosystem and population dynamics modelling (SEAPODYM); tuna meta-population abundance and size structure as indicators of ecosystem impacts of fishing; individual/agent-based modelling of fish, fishers and turtles; regime shifts in the WCPO and its tuna fisheries; fish bycatch in tuna longline fisheries; incidental catch of sharks, seabirds and sea turtles in tuna longline fisheries.

Stock assessment research

32. SCG discussed stock assessment planning for 2005, and noted the desirability for having stock assessment available for all tuna species in 2005. In the event that this is precluded by limited resources, the SCG recommends the following priority for the major tuna assessments 2005: 1. Bigeye – including a Pacific wide assessment in collaboration with IATTC; 2. South Pacific Albacore and/or Yellowfin; and 3. Skipjack.

33. SCG recognizes that biological studies and assessing the status of billfish stocks within the Pacific are important issues for the Commission. Blue marlin is considered as a high priority to be assessed because of concerns about the stock being fully exploited and as it thought to be a single stock in the Pacific. The SCG notes the existence of multiple stocks of some billfish species within the Pacific and regional differences in the priorities among member states makes it difficult to determine a single set of priorities for assessing billfish species at this time. Nevertheless, the SCG encourages member states to cooperate on carrying out billfish assessments.

Agenda 6. Advice on data standards and other data related issues for the Western and Central Pacific region

34. The report of a meeting of the SCTB17 Statistics Working Group to consider anticipated data-related tasks for the Commission's Scientific Committee, and two working papers presented at the meeting, were presented to SCG.

34. SCTB17 WP SWG-8, entitled *Legal aspects governing fisheries data*, describes the international legal obligations in respect of the collection, compilation and dissemination of fisheries data by the Commission. These include the obligation on members of the Commission to collect and provide certain specified data to the Commission, consistent with Annex I of the UN Fish Stocks Agreement and as required by the Commission (under Article 23). The roles of the Commission, the Secretariat and the Scientific Committee in respect of data are discussed. Other considerations include the capacity of small island developing States and territories to meet their obligations and the role of the Commission in respect of this under Article 30(4); the area of application of data standards; and the obligation to cooperate with other organizations.

35. SCTB17 WP SWG-6, entitled *Information regarding anticipated data-related tasks for the WCPFC Scientific Committee*, discusses data standards and other data-related issues. The working paper, which contains seven appendices containing relevant texts and a comprehensive list of references, with web links, is intended to be a reference document for use by the Scientific Committee, based on the experience accumulated by the SCTB over the 17 years of its existence. The list of tasks was developed with the Scientific Committee in mind; however, certain of the tasks could be addressed by the Commission's secretariat or the scientific experts engaged under Article 13, rather than the Scientific Committee. The manner in which the tasks could be addressed, such as by resolutions of the Commission or otherwise, will be determined by the Commission.

36. SCG noted that many of the data-related tasks for the Commission's Scientific Committee are listed in WP SWG-6, specifically:

- Draft the terms of reference of the Statistics Working Group
- Draft a resolution on the scientific data to be provided by members of the Commission under Article 23 of the Convention
- Draft a resolution on the principles and procedures for the dissemination of scientific data by the Commission
- Advise the Commission regarding the contents of an annual report on the status of the collection, compilation and dissemination of data to be provided by the Commission's data managers

- Monitor the status of data collection in the Philippines and the Pacific Ocean waters of Indonesia
- Develop a strategy for improving the capacity of members to meet the data requirements of the Commission
- Establish standards for the collection of scientific data, including operational catch and effort data, port sampling data and observer data
- Advise the Commission regarding the scientific aspects of the regional observer programme to be developed under Article 28 of the Convention
- Establish procedures for evaluating the quality of the scientific data compiled by the Commission
- Harmonies data collection standards for the Western and Central Pacific Ocean and the Eastern Pacific Ocean in collaboration with the Inter-American Tropical Tuna Commission
- Establish an agreement on the exchange of tuna fisheries data between the Inter-American Tropical Tuna Commission and the Commission
- Harmonies the procedures for the compilation and dissemination of data by the Commission and the Interim Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean
- Recommend that the Commission become a member of the Coordinating Working Party on Fishery Statistics
- Recommend that the Commission become a partner in the Fisheries Resources Monitoring System

37. Other major issues raised during the Statistics Working Group discussions concerned:
- The criteria defining public domain data and the confidentiality of data,
- The use of catch verification schemes to check and improve the quality of fisheries data;
- The treatment of joint-venture of charter vessels in regard to the nationality of the catch and obligations for the provision of catch data.

38. The major issues raised during SCG discussions included criteria defining public domain data; confidentiality of data; the geographic area for which data should be compiled by the Commission; the need for the best scientific data; the use of data by the Commission for compliance purposes; and the need to avoid burdening developing states in regard to data.

39. The major issues raised during SCG discussions concerned:
- The criteria defining public domain data and the confidentiality of data;
- The geographic area for which data should be complied by the Commission;
- The need for the best data achieved through improved data management and data collection processes;
- The need to avoid burdening developing states in regard to data requirements;
- The need to improve the status of data collection in the Philippines and Indonesia;

40. The SCG3 recommended that the Commission take into consideration the following when it establishes data-related policies and develops work programmes:
- SCTB17 WP SWG-8 (legal aspects governing fisheries data);
- SCTB17 WP SWG-6 (information regarding anticipated data-related tasks for the WCPFC Scientific Committee);
- The report of the Statistics Working Group meeting to consider anticipated data related tasks for the Commissions Scientific Committee;
- This report of SCG 3.

Agenda item 7. Identification of Specialist Working Groups of the Scientific Committee

41. At PrepCon VI, WG.II noted (WCPFC/PrepCon/38) that the Scientific Committees' Specialist Working Group's are expected to be similar to those of the current SCTB working groups. This issue was discussed by SCTB17 and further reviewed by SCG 3.

42. The SCG agreed that the current structure of WGs used in SCTB17 is very effective and was an improvement over previous structures. To minimize costs and promote effective participation of developing states and territories, meetings of the SWGs should be held in conjunction with SC meetings. SCG also noted that the process works best when the chairs of the WGs work as a team in steering and coordinating their activities during the period between meetings.

43. The SCG recommended that the following SWGs be established as subsidiary bodies of the Scientific Committee. A brief outline of the types of work each group might cover is given below, acknowledging that the SC is responsible for the development of the terms of references of the SWGs.

- Stock assessment - reviews recent developments in fisheries including trends in catch and effort, with emphasis on four major tuna species, including key attributes of the stock, trends in catches, CPUE, fish size, and information on recruitment, biomass, fishing mortality and stock status
- Statistics - to coordinate the collection, compilation and dissemination of fishery data for all major gear types and fleets.
- Methods - reviews statistical, analytical and modelling approaches and seeks to identify ways to improve stock assessments.
- Fishing Technology - reviews developments with respect to fishing vessel, gear and operational procedures in order to characterize changes in fleets and gear and to provide data to inform a range of topics such as the standardization of CPUE, and evaluating changes in fishing efficiency.
- Biology - reviews studies of basic biology (including growth, mortality, etc) of the key stocks of tuna, billfish, other highly migratory species, especially with respect to biological studies supporting stock assessment.
- Ecosystem and Bycatch - includes ecosystem modelling and bycatch research, with particular attention to bycatch mitigation, effects of fishing on species other than the main tuna target species as well as studies of the effect of environment on highly migratory fish stocks.

44. The SCG recognised the important scientific contributions of the SCTB over the past 17 years to the development of an understanding of the fishery resources of the Western and Central Pacific Ocean, and the contribution made by the SCTB to the PrepCon.

45. The delegation of Korea, on behalf of the SCG, thanked the Chairman (Dr. Yuji Uozumi) and Secretariat (Chris O'Brien) for their work in the SCG process. Thanks were also conveyed to the Marshall Islands for their generosity, hospitality and tireless support over the course of the meeting.

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Annex I

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Annex II

AGENDA

1. Introductory remarks
2. Review of the updated stock status statements for the major target species
3. Response to the requests from PrepCon VI.
4. Discussion of the nature and extent of work required to develop management scenario models, for example development of operating models.
5. Provision of advice on ecosystem, bycatch and other scientific issues.
6. Advice on data standards and other data related issues for the Western and Central Pacific Region
7. Identification of Specialist Working Groups of the Scientific Committee.
8. Adoption of the report of SCG 3
9. Adjournment.

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<u>Annex III</u>

SCTB17 STOCK STATUS SUMMARIES

Given the length of the SCTB17 Executive Summary it is not attached to this (SCG 3) report. Readers can obtain a copy of the SCTB17 Executive Summary from http://www.spc.org.nc/oceanfish/Html/SCTB/SCTB17/Execsum.pdf

In the summary, the relevant excerpts are:

Bigeye	14-21
Yellowfin	22-30
Skipjack	31-36
Albacore	37-41

Annex IV

REVIEW OF THE TECHNICAL FEASIBILITY OF PROVIDING ANALYSES OF MANAGEMENT OPTIONS

INTRODUCTION

This paper provides information to be considered by SCG 3 under Agenda item 3 *Response to the requests from PrepCon VI.* Based on the annotated Agenda for SCG 3, the specific task under this agenda item is:

"Advise on the further analyses to support the consideration by PrepCon VII and the first session of the Commission of management options and how these analyses can carried out in a timely and effective manner.

> Following a discussion of the paper entitled Management options for bigeye and yellowfin tuna in the western and central Pacific Ocean (WCPFC/PrepCon/WP.24), PrepCon VI, had decided that further analysis to support consideration by PrepCon VII and the first meeting of the Commission of management options in two broad groups (national capacity, catch and effort limits and a range of technical measures) should be undertaken. Therefore, PrepCon VI requested SCG 3 to provide advice, through the Interim Secretariat, on the analyses that should be undertaken and how these analyses can be carried out in a timely and effective manner [emphasis added]. Based on the updated stock status of these two species which will be obtained thorough SCTB17, SCG 3 will discuss the technical points of the further analyses which will provide information for consideration of management options (see Appendix). *"*

EXPLANATORY NOTES

1 This paper describes the data/information and analyses required to quantitatively evaluate the possible effects of various management options described in WCPFC/PrepCon/WP.24. **The operational feasibility of these options in not considered in this paper.**

2 Many of the analyses require management direction before they can be undertaken. Furthermore, quantitative evaluation of the effectiveness of a given management option will require determination of benchmarks/targets/reference points against which to evaluate the effectiveness of the criteria, e.g. future biomass, fishing mortality against some value.

3 While many analyses are feasible in the immediate term some are not due to data limitations. For those options for which analyses are not immediately feasible, analyses could be undertaken using estimated data, but the reliability of such analyses would be lower. Nevertheless, these analyses maybe feasible in the long term if the necessary data are collected. The following feasibility statements are used in this paper:

- Analysis is feasible in the immediate term
- Analysis is feasible in the immediate term contingent on management advice
- Analysis is not feasible in the immediate term due to data limitations, but maybe feasible in the long term.

4 Many management options could cause changes in fishing behaviour that may be difficult to predict and therefore quantify. Notwithstanding this, analyses should include a scenario reflecting non-compliance.

5 Analyses should be undertaken using a model-based approach to allow integration of population dynamics into the evaluation of management options. A range of models could be considered, but the analysis of some options will require particular model structures, e.g. spatial stratification or age-structure. A critical assumption for such analyses will be future levels of recruitment, this and other important modelling assumptions are described in the "No controls" section. It should be noted that currently, estimates of stock status for most of the species are obtained from MULTIFAN-CL (MFCL), but while there are obvious benefits in using the same model to evaluate management options, analyses using MULTIFAN-CL can be time consuming.

6 No distinction is made between purse-seine and longline management options except where such options can only apply to a single fleet. Many of the options could be also applied to other gear types.

7 Though the management measures are directed at bigeye and yellowfin, analyses may include estimates of the effects of measures on catches of other important species (e.g. skipjack, species of special concern).

8 Some useful analyses, for example, an analysis of the characteristics (e.g. vessel details, fishing strategies) of top bigeye or yellowfin-catching vessels, could provide information in support of the analysis of a range of management options.

9 The definition of FADs is taken from WCPFC/PrepCon/WP.24. "*Unless otherwise indicated a reference to FADs includes all types of floating objects, natural and artificial.*"

NO CONTROLS
No attempt to control fishing mortality

Management option	Data/Information required	Analyses required	Comments
Status-quo: No attempt is made to control fishing mortality **Analysis is feasible and could represent an analysis against which other analyses are compared.**	Recent estimates of catch and effort for each fishery.	The current MFCL assessment can provide projections based on recent catch/effort levels. Other model(s) could be used and not necessarily be restricted to the current fishery definitions in the MFCL assessment	Full catch and effort data can take up to 18 months to be submitted. Complete catch and effort data are currently available up to 2002. MFCL may need to be modified to allow evaluation of catch projections. Important considerations will include: • Will catch/effort remain at recent levels or follow recent trends, • Will future recruitment be at recent, average, or some other level. • Selectivity/catchability assumptions • Biological parameters.

OUTPUT CONTROLS

Output controls aim to control the total catch directly by setting an upper limit on catch.

Management option	Data/Information required	Analyses required	Comments
Catch limits (a): Competitive overall or regional catch limits. **Analysis is feasible in the immediate term contingent on the provision of information on: overall or regional catch limits.**	Distribution of the catches among fisheries, i.e. methods and regions. Definition of regions if necessary, e.g. MFCL region, 10x10° grid etc. Proposed overall or regional catch limits	Undertake projections with MFCL with the revised catch/effort levels. Other models could be used and not necessarily be restricted to the current fishery definitions in the MFCL assessment, but such a model would require spatial stratification to accommodate regional catch limits	The spatial stratification of the MFCL model may need to be revised to reflect regional limits. Modification of the spatial stratification of the MFCL model would require rerunning the model and the stock assessment results (i.e. estimates of stock status) could change. Scenarios should be evaluated against similar spatial stratifications.
Catch limits (b): Allocated overall or regional catch limits. **Analysis is feasible contingent on the provision of information on: overall or regional catch limits.**	As above	As above	As above
Catch limits (c): Trip/Vessel/Country Limits **Analysis is not feasible** but maybe feasible in the long term..	Annual catches by vessel. Proposed catch limits.	Estimate, for a given limit, how catches could be reduced for each fishery, i.e. how much catch was taken historically taken in excess of the annual catch limit. Undertake projections with MFCL with the revised catch/effort levels. Other models could be used and such models could require the specification of fleets and age/size structure.	Data is limited by logsheet return rates and observer coverage. Analyses relating to Trip level limits are described in the section on Fish Hold Limits. Analyses relating to Country Limits are described in the above sections.

INPUT CONTROLS

Input controls directly restrict one or more of the group of inputs (e.g. vessels, gear, fishing time) which, in combination, produce total fishing effort and, ultimately, catch.

Management option	Data/Information required	Analyses required	Comments
Capacity (a): Limit/restriction on the number of vessels. This could be general reductions or directed at those fleets catching most bigeye and yellowfin. **Analysis is feasible contingent on the provision of information on: number and type of vessels**	Estimates of annual catches, effort, and areas fished by each vessel, particularly those vessels that may, as a result of such restrictions, no longer fish in the WCPO. Proposed number of vessels.	Estimate, based on historical data for a relevant period, reductions in catch/effort by the exclusion of a given number of vessels of a given class. Undertake projections with MFCL with the revised catch/effort levels. Other models could be used and such models could require fleet stratification.	Data is available for many vessels from the FFA regional vessel register: • All DWFN purse-seine and longline vessels fishing in FFA member countries waters. • Does not include all domestic longline vessels • Does not include vessels fishing in the waters of non-FFA member countries or the high seas. Domestic vessel registries exist for many Pacific Island Countries and Territories, but the data content is often less than the FFA register.
Capacity (b): Limit size or power of vessels **Analysis is not feasible due to data limitations, but maybe feasible in the long term.**	Estimates of the number of vessels by size/power class. Estimates of CPUE by vessel size/power classes. Proposed vessel classes and limits.	Estimate, based on historical data for a relevant period, the reductions in effective effort that would have occurred based on the exclusion of certain classes of vessels. Undertake projections with MFCL with the revised catch/effort levels. Other models could be used and such models could require fleet stratification.	See above for details of availability of vessel data. CPUE data is limited by logsheet return rates and observer coverage.
Capacity (c): Limit size of fish hold. **Analysis is not feasible due to**	Estimates of the number of vessels by fish hold size class. Estimates of trip-level catches by vessel, in particular comparisons of trip-level	Estimate, for a given limit, how catches could be reduced for each fishery, i.e. how much catch was taken historically taken in excess of the fish hold limit.	Trip-level catch data are limited by logsheet return rates, observer coverage, and port sampling. There is currently limited data for

Management option	Data/Information required	Analyses required	Comments
data limitation, but maybe feasible in the long term.	catches to fish hold size. Proposed fish hold limits	Undertake projections with MFCL with the revised catch/effort levels. Other models could be used and such models could require the specification of fleets and age/size structure.	fish hold capacity. This analysis might consider whether vessels can maintain catches through increasing the number of trips. This analysis of this measure is essentially the same as required to analyse trip limits.
<u>Total effort limits:</u> Setting overall or regional limits for some measure of effort (e.g. sets, hooks, days fished). **Analysis is feasible contingent on the provision of information on: overall or regional effort limits.**	Estimates of the current distribution of effort (in the same units as proposed). Proposed overall or regional effort limits.	Calibration of effort used in the assessment model to units of effort proposed for the limit. Undertake projections with MFCL with the revised catch/effort levels. Other models could be used but would require fleet stratification and spatial stratification to accommodate regional effort limits.	Data is limited by logsheet return rates and observer coverage. Require details of overall or regional effort limits. The spatial stratification of the MFCL model may need to be revised to reflect regional limits.
<u>Area/seasonal closures:</u> Restricting fishing effort in particular area/seasonal strata **Analysis is feasible contingent on the provision of information on: the area/seasonal closures.**	Catch and effort data by area/season strata. Proposed areas/seasons where fishing effort will be restricted.	Calculate the effort that would occur in each area/season strata in the presence of a given closure, e.g. no effort in closed areas and perhaps increased effort in other regions. Exploratory analyses of catch hotspots including the consistency of such regions from year to year, particularly incorporating information on broad-scale environmental effects. Undertake projections with MFCL with the revised effort levels. Other models could be used but would require spatial stratification.	Data is limited by logsheet return rates and observer coverage. The spatial stratification of the MFCL model may need to be revised to reflect area closures. Important considerations will include the reallocation of effort. Options include: • No reallocation of effort, • Effort reallocated to open areas Such an analysis could include other species (e.g. skipjack, species of special concern).

Management option	Data/Information required	Analyses required	Comments
			Details of licence/access agreements could be useful in determining how fleets could reallocate their effort to other regions.

TECHNICAL MEASURES

Technical measures are used to regulate the output that can be obtained from a specific amount of effort. Such measures generally attempt to influence the way fishing is conducted and the efficiency of the fishing gear (FAO 1997) to achieve a specific purpose in a given fishery.

Management option	Data required and availability	Analyses required	Comments
Gear restrictions (a): Restrictions on various gear configurations (e.g. net size/depth, longline length) **Analysis is not feasible due to data limitation, but maybe feasible in the long term.**	Estimates of the proportion of the fleets using various gear configurations. Estimates of the CPUE attained by vessels using various gear configurations. Proposed gear configuration restrictions.	Estimate the proportional reduction in effective effort for various fisheries due to this restriction based on an analysis of historical data for a relevant period. Undertake projections with MFCL with the revised effort levels. Other models could be used but would require fleet stratification.	Data is limited by logsheet return rates and observer coverage. These data are less complete than simple catch and effort data.
Gear restrictions (b): Method restrictions (e.g. time of set, soak time) **Analysis is not feasible due to data limitations, but maybe feasible in the long term.**	Distribution of sets by time of day. Estimates of catch per set for different time periods. Proposed gear configuration restrictions.	Estimate the proportional reduction in catches that would occur by setting at different times based on an analysis of historical data for a relevant period. Convert this catch reduction to an effort reduction. Undertake projections with MFCL with the revised effort levels. Other models could be used but would require fleet stratification.	Data is limited by logsheet return rates and observer coverage. These data are less complete than simple catch and effort data. Data could be uncertain due to alternative interpretations of set time.
Size restrictions: Limits on the sizes of fish that can be retained. Compulsory retention (no discards allowed). **Analysis is feasible contingent**	Estimates of the sizes of fish caught by different fleets. Including the size distribution of fish in individual sets/fishery operations. Estimates of catch rates of all species to which retention could apply.	The selectivity of the fisheries estimated within the model can be modified to reflect the effects of changes in the sizes of fish caught. Undertake projections with MFCL with the revised selectivity curves fixed levels. Other models could be used but would require age/size and fleet stratification.	Data is limited by logsheet return rates, observer coverage, and port sampling. Data are sometimes confounded due to moving of the catch among holds within a trip. This analyses would require the definition of new fisheries in the MFCL assessment.

Management option	Data required and availability	Analyses required	Comments
on the provision of information on: size limits and species and fleets to which they apply.	Estimates of the survival probabilities of fish of different sizes caught by different methods. These estimates are dependent on observer estimates and coverage. Proposed size limits and species and fleets to which they apply.		Compulsory retention could be expected to change behaviour which could be difficult to anticipate and incorporate into an analysis. Though it may be possible to measure. Survival probabilities could be obtained from various sources: observer data, studies reported in the literature, informed guesses.
<u>Restrictions on operational efficiency (a):</u> Banning or limiting power of vessel electronics. **Analysis is not feasible due to data limitation, but maybe feasible in the long term.**	Details of the types of electronics used by individual vessels. Catch and effort data for individual vessels. Database to allow characterisation of the capabilities of different electronics. Proposed restrictions on vessel electronic characteristics.	Estimate the "effect" of various measures on CPUE using historical data for a relevant period – perhaps using GLM approaches. Use the estimated effects to determine the reduction in effective effort. Undertake projections with MFCL with the revised effort levels. Other models could be used but would require fleet stratification.	Some relevant data is available for vessels on the FFA regional vessel register and from observer data. Data is often collected by make/model rather than capability. Would require assumptions about the types of electronics that would be used instead.
<u>Restrictions on operational efficiency (b):</u> Restrictions on auxiliary vessels, e.g. tender vessels or light vessels. Regulations on transhipment. **Analysis is not feasible due to data limitation, but maybe feasible in the long term.**	Details on which vessels use auxiliary vessels and over which periods. Catch and effort data for individual vessels. Proposed restrictions on auxiliary vessels.	Estimate the "effect" of auxiliary vessels on CPUE or catches using historical data for a relevant period. Use this to determine the reduction in effective effort. Undertake projections with MFCL with the revised effort levels. Other models could be used but would require fleet stratification.	Limited information could be obtained from observers. Data availability probably poor.
<u>FAD restrictions (a):</u> Prohibition of FAD sets on a time	Estimates of the number of FAD sets by type and area.	Undertake projections with MFCL with the revised effort levels for the FAD fisheries reflecting these restrictions.	Data is limited by logsheet return rates and observer coverage.

Management option	Data required and availability	Analyses required	Comments
and/or area basis. Restrictions of the number of sets allowed on FADs. **Analysis is feasible contingent on the provision of information on: areas/seasons where FAD sets will be restricted and the specific FAD types.**	Proposed areas/seasons where FAD sets will be restricted and the specific FAD types.	Other models could be used but would require fleet and possibly spatial stratification.	This analysis will be similar to analyses examining general time/area closures. Important considerations will include the reallocation of effort. Options include: • Effort reallocated to open areas • Changes from FAD sets to other set types
FAD restrictions (b) Limit number of FADs deployed **Analysis is not feasible due to data limitation, but maybe feasible in the long term.**	Details of the numbers of and FADs deployed by individual vessels. Catch and effort for individual vessels. Proposed definitions for what constitutes a FAD deployment.	Estimate the "effect" of the number of FADs deployed on CPUE or catches using historical data for a relevant period. Use this to determine the reduction in effective effort. Undertake projections with MFCL with the revised effort levels. Other models could be used but would require fleet stratification.	Data is limited by logsheet return rates and observer coverage. Very little data is available, but some is held by individual countries.
FAD restrictions (c) Regulations on the design of FADs **Analysis is not feasible due to data limitation, but maybe feasible in the long term.**	Details on characteristics of FADs by individual vessels. Catch and effort data for individual vessels. Proposed restrictions on FAD design.	Estimate the "effect" of FAD characteristics on CPUE using historical data for a relevant period – perhaps using GLM approaches. Use this to determine the reduction in effective effort. Undertake projections with MFCL with the revised effort levels. Other models could be used but would require fleet stratification.	Almost no information on the characteristics of FADs used.

Annex V

A MANAGEMENT STRATEGY EVALUATION APPROACH USING OPERATIONAL MODELS

A harvest strategy or management procedure is a set of rules used to determine a management action (Butterworth et al. 1997, Cooke 2003). The set of rules should define the data to be collected from the fishery, how those data are to be analysed, and how the results of the data analyses are to be used to determine actions (Cochrane et al. 1998). Harvest strategies may be very simple (e.g. a constant catch/effort strategy) or extremely complicated (such as the determination of annual *TACs* based on the outcomes of a stock assessment and a set of performance based decision rules).

Before any harvest strategy is adopted it should be evaluated against how well it is able to satisfy the management objectives for the fishery. An approach that has been developed to do this is known as Management Strategy Evaluation (MSE; Smith 1994, Punt et al. 2001). The primary goal of the MSE approach is to identify, in an objective and quantifiable manner, the trade-offs among the management objectives across a range of management actions.

The MSE approach involves the following five basic steps:

1) Identification of the management objectives and representation of these using a set of quantitative performance measures (see note below).

2) Identification of alternative harvest strategies and decision rules.

3) The development and parameterization of a set of alternative operating models which have the following components.
   a. Models that simulate the fish population and fishery dynamics. These models can be used to simulate various hypotheses about the spatial structure, movement dynamics and biology of the resource and, as such, are used to represent the alternative realities in the calculations. A component is also required to determine a range of initial starting values for the operating model that are consistent with the available historical information on the resource. This process is referred to as conditioning.
   b. A sampling model that generates the time series of future data (catch, size, tag returns, etc) which is then used for assessing the status of the resource from the 'true' state of the resource as simulated in the operating model.
   c. An assessment model that uses the data from the sampling model to provide estimates of resource status.
   d. A harvest strategy component that determines management actions (e.g. setting a TAC or TAE) based on the results of the assessment model and the specified decision rules.

4) Simulation of the future using each harvest strategy to manage the system and each set of assumptions about the dynamics of the resource.

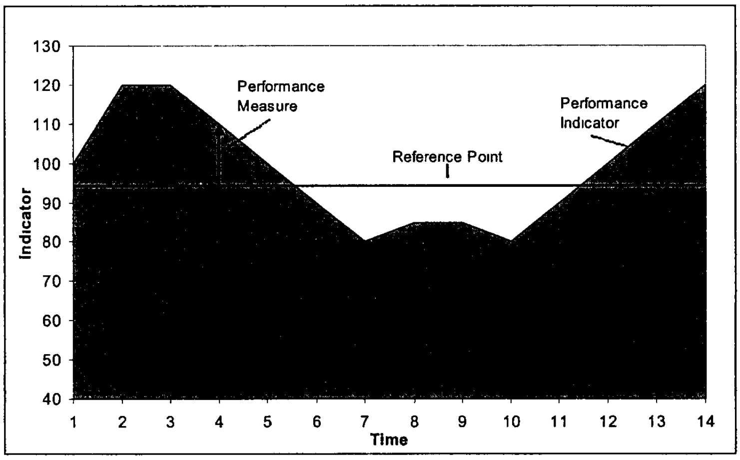
5) The development of summary measures to quantify the performance of each harvest strategy relative to the management objectives of the fishery.

The operating model, which is central to the MSE approach, is a mathematical or statistical representation of the population dynamics of the fishery being studied. The operating model is used to generate observations in the form of pseudo catch, effort and catch-at-size data sets which are then used in the management procedure. Several operating models are usually considered because the true situation for any fishery is never well known, and a broad range of input parameter values thus needs to be examined to ensure the full range of possible resource and fleet dynamics are covered. In this manner, each operating model can be considered as reflecting an alternative (yet plausible) representation of the status and productivity of the resource and the fishing dynamics of the fleets.

Another key feature of the MSE approach is that it can be used to identify robust harvest strategies in light of the uncertainties in the information available for managing fish resources. This is achieved by incorporating into the operational models not only the uncertainty in the underlying dynamics of the resource in response to management actions, but also the uncertainty in the methods and data used to assess the status of the resource, and uncertainty in the ability to implement management actions. As such, the approach is based on recognition that it is the combination of the uncertainties about the dynamics of the system being managed, plus the ability to measure relevant information about the system, that determines the performance and robustness of a management decision-making framework.

Note: Performance Indicators and Measures
A performance indicator conveys information about some aspect of the system under study (e.g. the biomass of the swordfish population in the SW Pacific) while a performance measure conveys information about how well the system is performing relative to some management objective (e.g. it compares the performance indicator with some reference value or benchmark, say 30%B_0). Performance indicators are usually based on quantities estimated during the assessment and are generally useful only if a stock assessment method can estimate them reliably.

Figure 1. *Schematic representation of the relationship between a performance indicator and associated performance measures and reference point.*



References

Butterworth, D.S., Cochrane, K.L. and De Oliveria, J.A.A. 1997. Management procedures: a better way to manage fisheries? The Southe African experience. In Pikitich, E.K., Hippert, D.D. and

Sissenwine, M.P., eds. Global Trends: Fisheries Management (Proceedings of the Symposium held at Seattle Washington, 14-16 June, 1994). Am. Fish. Soc. Symp. 20, 83-90.

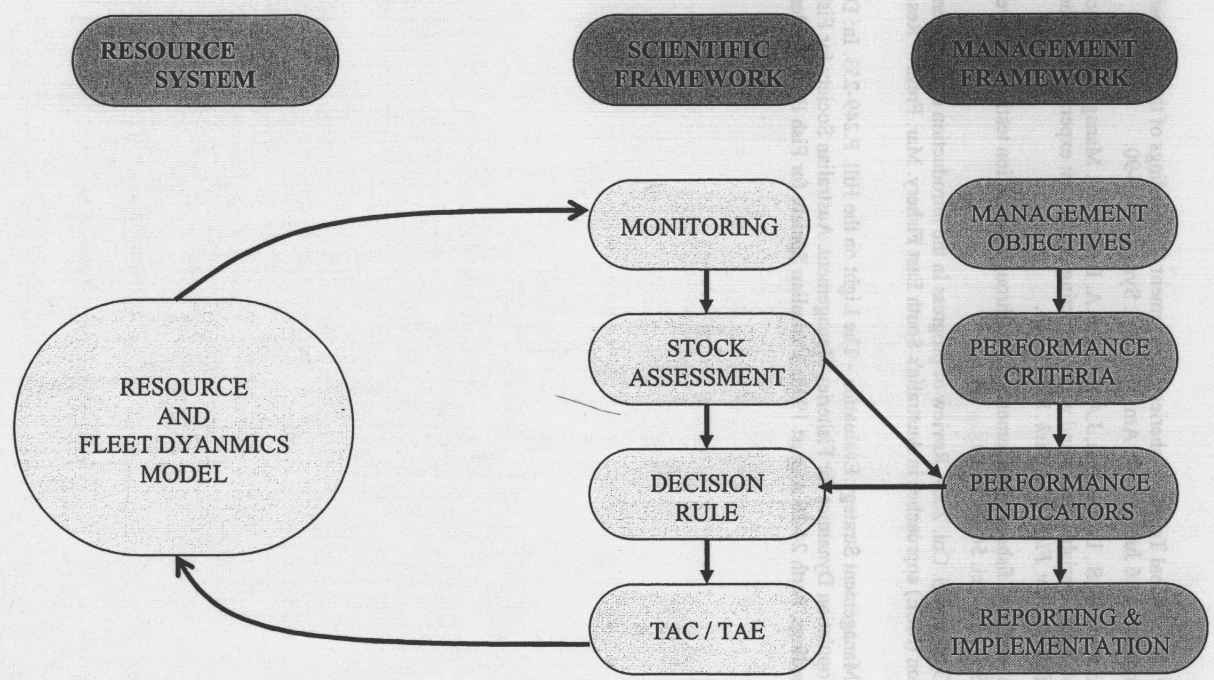
Cochrane, K. L., Butterworth, D.S., De Oliveria, J.A.A. and B.A. Roel. 1998. Management procedures in a fishery based on highly variable stocks and with conflicting objectives: experiences in the South African pelagic fishery. *Rev. Fish. Biol. Fish.* 8, 177-214.

Cooke, J. 2003. Improvement of fishery-management advice through simulation testing of harvest algorithms. ICES J. Mar. Sci. 56: 797-810.

Punt, A.E., Smith, A.D.M. and G. Cui. 2001. Review of progress in the introduction of management strategy evaluation (MSE) approaches in Australia's South East Fishery. Mar. Freshw. Res. 52: 719-726.

Smith, A.D.M. 1994. Management Strategy Evaluation - The Light on the Hill. P.249-253. In: D.A. Hancock [Ed.] Population Dynamics for Fisheries Management. Australian Society for Fish Biology Workshop Proceedings, Perth 24-25 August 1993, Australian Society for Fish Biology, Perth.

MANAGEMENT STRATEGY EVALUATION



Annex VI

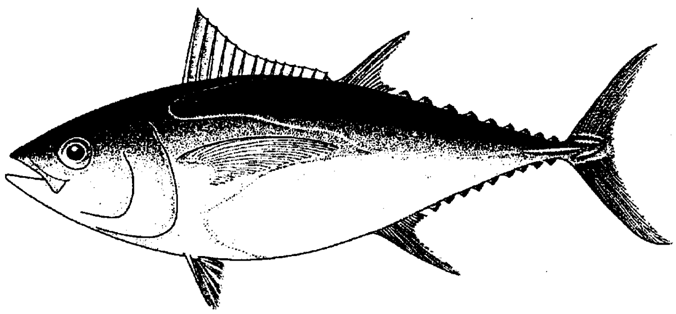
ABBREVIATIONS AND ACRONYMS USED IN THIS REPORT

$B_{current}$	Current biomass
B_{MSY}	Biomass that will support the maximum sustainable yield
CPUE	Catch Per Unit Effort
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
EEZ	Exclusive Economic Zone
FAD	Fish Aggregating Device
$F_{current}$	Current Fishing Mortality
F_{MSY}	Fishing Mortality that will support the maximum sustainable yield
mt	Metric tonnes
OFP	Oceanic Fisheries Programme Fishing Programme (run by SPC)
PrepCon	Preparatory Conference
SCTB	Standing Committee on Tuna and Billfish
SCG	Scientific Coordinating Group
SPC	Secretariat of the Pacific Community
WG	Working Group
WG.II	Working Group II of the PrepCon
WCPFC	Western Central Pacific Fisheries Convention
WCPO	Western Central Pacific Ocean
MSY	Maximum Sustainable Yield
UNFSA	United Nation Fish Stocks Agreement

附件三

Seventeenth Meeting of the
STANDING COMMITTEE ON TUNA AND BILLFISH
Majuro, Republic of the Marshall Islands
9–18 August 2004

EXECUTIVE SUMMARY



August 2004

Seventeenth Meeting of the

STANDING COMMITTEE ON TUNA AND BILLFISH

Majuro, Republic of the Marshall Islands

9–18 August 2004

EXECUTIVE SUMMARY

The seventeenth meeting of the Standing Committee on Tuna and Billfish (SCTB 17) was held on 9-18 August 2004 in Majuro, Republic of the Marshall Islands. SCTB 17 was attended by participants from Australia, Canada, Commonwealth of the Northern Marianas, Cook Islands, European Union, Federated States of Micronesia, Fiji, French Polynesia, Japan, Kiribati, Korea, Marshall Islands, Nauru, New Caledonia, New Zealand, Palau, Papua New Guinea, the Peoples Republic of China, Samoa, Solomon Islands, Taiwan, Tonga, Tuvalu, United States of America and Vanuatu. Participants from various regional and international organizations also attended the meeting. These included the Forum Fisheries Agency (FFA), the Inter-American Tropical Tuna Commission (IATTC), the Secretariat of the Pacific Community (SPC) and the Food and Agricultural Organisation of the United Nations (FAO).

The SCTB provides a forum for scientists and others with an interest in the tuna and billfish stocks of the western and central Pacific Ocean (WCPO) to meet to discuss scientific issues related to data, research, and stock assessment. Its aims are to:

1. coordinate fisheries data collection, compilation and dissemination according to agreed principles and procedures;
2. review research on the biology, ecology, environment and fisheries for tunas and associated species in the WCPO;
3. identify research needs and provide a means of coordination, including the fostering of collaborative research, to most efficiently and effectively meet those needs;
4. review information pertaining to the status of the stocks of tunas and associated species in the WCPO, and to provide statements on stock status where appropriate, and;
5. provide opinions on various scientific issues related to data, research and stock assessment of WCPO tuna fisheries.

The SCTB Chairman and Working Group Coordinators for SCTB 17 were as follows.

SCTB Chairman:	Dr SungKwon Soh
Biology WG:	Dr Talbot Murray
Ecosystem & Bycatch WG:	Mr Paul Dalzell
Fishing Technology WG:	Mr David Itano
Methods WG:	Dr John Sibert
Statistics WG:	Mr Tim Lawson
Stock Assessment WG:	Dr Naozumi Miyabe and Dr Max Stocker

The meeting agenda, working papers presented at the meeting and list of participants are provided in Appendices 1, 2 and 3, respectively. The meeting convened as six working groups: the Statistics Working Group, the Highly Migratory Species (HMS) Biology Working Group, the Ecosystem & Bycatch Working Group, Fishing Technology Working Group, the Methods Working Group and the HMS Stock Assessment Working Group. This 'thematic' working group structure differed from the species-based approach used at previous SCTBs.

The Statistics, Methods and Fishing Technology Working Groups held a series of meeting in the two days prior to the SCTB 17 plenary session. They considered a range of issues relevant to their respective terms of reference. Summaries of these meetings were presented to SCTB 17 and summary statements for each Working Group are provided.

The HMS Biology, HMS Stock Assessment and Ecosystem & Bycatch Working groups were convened during the main SCTB 17 session. Summary reports of these Working Groups are provided. The report of the HMS Stock Assessment Working Group incorporates statements on the status of bigeye, yellowfin, skipjack, and South Pacific albacore tuna.

The initial overview of Western and Central Pacific Ocean (WCPO) tuna fisheries provided details of recent and historical fishery developments. A summary of this information is presented in the report of the HMS Stock Assessment Working Group. Further details of fisheries at the national level were elaborated in a series of National Fisheries Reports presented by national representatives. Reports on relevant activities of other organizations were received from FAO, IATTC and the Pelagic Fisheries Research Program of the University of Hawaii.

SCTB 17 discussed a range of research and fishery statistics needs for the WCPO (Appendix 4). The priority needs identified by SCTB 16 and adopted by the 2nd meeting of the Scientific Coordinating Group were again discussed and progress noted (items 1 to 6 below). Also, SCTB 17 suggested two additional issues (Items 7 and 8 below) that it felt needed to be highlighted.

1. Better estimation of current catch and catch composition from Indonesia, Philippines and Vietnam

A 'Proposal for monitoring the catches of highly migratory species in the Philippines and the Pacific Ocean waters of Indonesia' was presented at PrepCon VI (Bali, April 2004). Under this project, a review of the tuna fisheries and the current statistical system was conducted in the Philippines in July 2004, with funding from Australia. This review highlighted significant problems with the collation of fisheries statistics in the Philippines. One year of port sampling will commence later in 2004, with funding from the United States and another donor. SCTB strongly encouraged potential donors to contribute funds for the balance of the project, i.e. a second year of port sampling in the Philippines and two years of port sampling in Indonesia. There is also a continuing need to compile information on the longline fishery in Vietnam, including estimates of annual catches.

2. Reconstruction of early catch history (catch, effort, size composition) for all fisheries

The incorporation of complete time series of significant industrial fishing into stock assessments generally allows a fuller understanding of population abundance variability over a range of environmental regimes. Significant progress has been made, e.g. the incorporation of pre-1965 Japanese longline size data into bigeye and yellowfin tuna stock assessments. Current work is examining pre-1972 skipjack data for the Japanese pole-and-line fisheries. Further efforts in this area will be important to further reduce uncertainties in the stock assessment.

3. Further development of methods to standardise effort, including the better use of vessel operational details, environmental data and archival tagging data

This work has been ongoing and improvements in effort standardisation for both longline and purse-seine fisheries were presented to SCTB 17. There is a need for finer scale data on the environment and on habitat preferences, as well as information on vessel, gear and operational details, for example, better information to estimate hook depths. Additional variables may be included in the standardisation of effort and more flexible use of standardized effort made in assessment models. There is a forthcoming IATTC meeting on purse seine effort standardization and its deliberations will be considered. The use of 'Longhurst'-type Large Marine Ecosystems as regions for stock assessments will be explored.

4. Ongoing efforts to reduce uncertainty in assessments, through improved data inputs, sensitivity analysis and simulations

There is a need for better species composition data, especially on improved discrimination between small yellowfin and bigeye. Statistical relations among observer, logbook, and port sampling and landing data need to be established. WPFC databases should provide for general biological data, particularly for parameters relevant to stock assessment. Assessment models should refine the parameterization of catchability between regions and explore the estimation of mortality at age. The use of simple production models may also be explored. Bigeye assessments should be compared for the EPO, WCPO, Pacific-wide and with other oceans. Fishing power and effort needs to be characterized and quantified, and there is a broad range of issues related to FADs.

5. Evaluation of possible regime shifts/changes in productivity and development of improved/alternative estimates of recruitment where possible

In response to the SCG 2 recommendations, a project proposal was developed by OFP in collaboration with NRIFSF and NIWA. The project has been funded by the Pelagic Fisheries Research Program of the University of Hawaii and preliminary results were presented at SCTB 17. This work will continue through the collection of empirical data and simulation studies to characterise long-term variability in catch histories and physical/biological time series from the WCPO. Operational metrics to detect changes in productivity and recruitment will be developed. These and other ecosystem indicators may then be used in stock assessments. SCTB17 also recommends the development of empirical recruitment indicators to compare with model estimations.

6. Large-scale tagging experiments for the main target tuna species in the WCPO.

This has been recommended by successive SCTBs as the highest research priority for the region. Such a project will provide better estimates of movement, mortality and other important parameters for stock assessment. Previous work undertaken more than 10 years ago has underpinned stock assessments but there is a need for regular if not continuous tagging studies of all species of interest. This work could be considered analogous to trawl surveys for demersal fisheries as the data provided are quasi-independent of the fisheries themselves. A large-scale tagging experiment would also permit further scientific research relevant to WCPO fisheries, including biology, ecology and oceanography. Various options for conducting tagging of tropical tunas were presented to SCTB 17 and the likely costs of a two-year tag release programme estimated. The meeting agreed to establish a small group to further develop a concept paper that might be made available to the Commission at its December 2004 meeting.

7. Assessing impacts of fishing and the environment on the pelagic ecosystem

The WCPFC Convention (Article 5d) requires members 'to assess the impacts of fishing, other human activities and environmental factors on target stocks, non-target species, and species belonging to the same ecosystem or dependent upon or associated with the target stocks'. This can be achieved through studies of forage species by in situ sampling and/or diet analysis, the continued development of modeling methodologies, the definition and identification of habitats of special concern, and the mitigation of bycatch. Biological/ecological studies should be carried out for species of special concern.

8. Regional Observer Programme

Article 28 of the Convention requires the Commission to 'develop a regional observer programme to collect verified catch data, other scientific data and additional information related to the fishery from the Convention Area and to monitor the implementation of the conservation and management measures adopted by the Commission'. The data needed for scientific purposes includes size and species composition, bycatch and discards. There needs to be coordination with national observer programmes, particularly regarding species of special concern. Additionally, there is a need for sub-regional coordinators for supervision of port samplers and observers. Data collection needs to be expanded to all fleets, in particular distant water longline fleets, and information should be collected on IUU (Illegal, Unregulated, Unreported) fishing activities.

Consideration of issues requested by PrepCon WG-II

PrepCon WG-II recommended several tasks for consideration by SCTB17 and SCG, among them data standards and advice on analyses of management options respectively. SCTB17 considered these issues and reviewed the legal basis for data requirements and standards of the new WCPFC as well as existing standards that could be adopted by that Commission. The meeting also discussed requisites for management options analyses, specifically reference points and decision rules. The meeting concluded that the topic is much too broad to be properly reviewed in the time that was available. It was noted that SCTB11 held a workshop on the precautionary approach that is relevant to these issues. The meeting further concluded that the topic should be reviewed and discussed in the future at a meeting for that purpose and that fishery managers of the new Commission should also be involved. The meeting also considered the working group structure that was used for SCTB17. This new structure generally functioned more smoothly; it is recommended that this or a similar structure be adopted for the Specialist Working Groups of the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC) when it is established.

Closing remarks

At the end of SCTB17, Chairman Sung Kwon Soh (Korea) asked participants to share their personal experiences of the SCTB. Apolosi Turaganivalu (Fiji, on behalf of the Pacific Island countries), John Hampton (OFP), John Sibert (PFRP, USA), Chung-Hai Kwoh (Taiwan), Ziro Suzuki (NRIFSF, Japan), Talbot Murray (New Zealand), Jacek Majkowski (FAO), and Chairman Soh himself all spoke fondly of the achievements of the SCTB throughout the years.

All speakers were in agreement that the SCTB had achieved far more than its original modest goals, that the data collection, compilation and analyses have evolved dramatically, and that the stock assessments are now world class. Notwithstanding the concerns expressed by SCTB17, stock conditions remain healthier in our region than for other oceans and participants expressed the hope that sustainability of the resources would be ensured by quick and wise management.

One of the most important achievements of SCTB has been to bring together representatives of the Distant Water Fishing Nations and the Pacific Island Countries and Territories on an equal footing. Colleagues have become friends and from friendships grew understanding. This has assisted the development of Pacific Island Countries and Territories and of WCPO fisheries. SCTB has provided a unique experience and learning process and participants at SCTB17 hope that the collegiality and cooperative spirit of SCTB will continue through into the SC.

All speakers highlighted the critical role played by the SPC, and in particular the OFP and its present and previous leaders, in providing support for SCTB meetings and technical assistance to SPC members and other parties. Views were expressed that the critical role of the OFP be retained and its capabilities expanded within the context of the new Commission.

Thanks were extended to our Chair, Sung Kwon Soh, to all the Working Group Chairs, to the rapporteurs, and a special thanks to Glen Joseph and all the MIMRA team for hosting this last meeting of SCTB. Glen Joseph thanked the Honourable Minister John M. Silk, all the MIMRA staff, the participants at STCB17, the staff of OFP and the Marshall Island Resort staff.

Our Chair then formally closed the last meeting of SCTB, bidding farewell to SCTB and welcome to the SC.

STATISTICS WORKING GROUP

The objective of the Statistics Working Group is to coordinate the collection, compilation and dissemination of tuna fishery data. The following were the major issues discussed:

Coverage of tuna fisheries in the WCPO by data held by the OFP

The coverage of tuna fisheries in the WCPO during 2002 by operational catch and effort (logsheet) data held by the OFP is 50.5%, the highest level ever achieved. Coverage by port sampling data for 2002 is 11.1% and coverage by observer data is 3.9%. The principal gaps in coverage by operational catch and effort data include the domestic fisheries of the Philippines and Indonesia, the distant-water longline fleets of Korea and Taiwan, and the longline, pole-and-line and purse-seine fleets of Japan on the high seas. Figure 1 illustrates the trends in coverage from 1970 to 2002; the coverage for recent years may increase as more data become available.

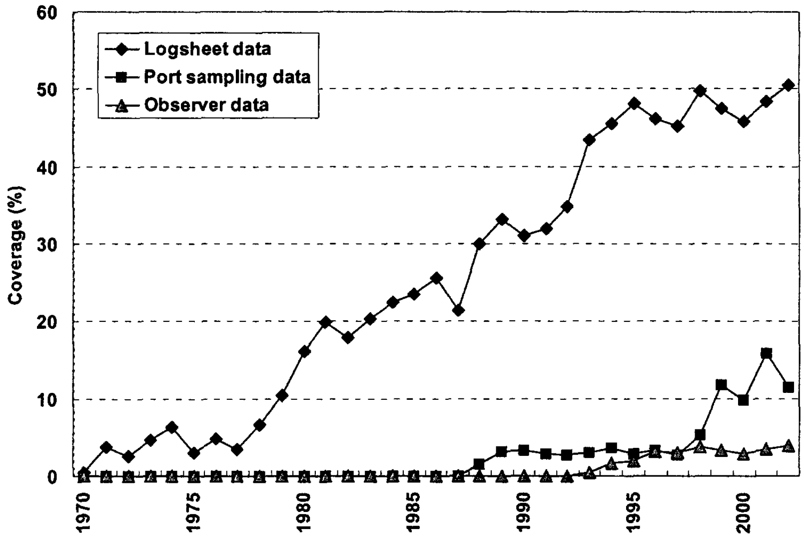


Figure 1. Trends in coverage from 1970 to 2002

Quality of port sampling and observer data

High priority should always be placed on improving the quality of sampling data through improved data management and data collection skills. In this regard, a request for more resources to support the significant increase in regional sampling activity was made. For the Pacific island countries and territories, sub-regional coordinators are desirable to help improve local processes for the control of data-quality. It is essential that the debriefing of observers should continue to be expanded, such that all observers are debriefed by qualified supervisors after each trip.

Availability of observer data for estimating catches of non-target species

The availability of observer data for eight categories of longliners in the WCPO was summarised in WP SWG–5. The observer data covering the distant-water longline fleets are not sufficient for estimating the catches of non-target species in the WCPO and increased observer coverage of these fleets is urgently required.

Proposal for the compilation of annual catch estimates for the Convention Area

The Commission will require annual catch estimates to be compiled for the Convention Area (see Figure 2); however, the western boundary of the Convention Area has not been specified in the text of the Convention. It was therefore proposed that, for statistical purposes, the western boundary of the WCPO Area that was established at SCTB12 be used in this regard, and that estimates of annual catches for both the Convention Area and the WCPO Area be provided. This will allow catches for the WCPO and the EPO to be easily summed to provide the total catch for the Pacific Ocean. The reporting of annual catches for both the Convention Area and the WCPO Area will concern China, French Polynesia, Japan, Korea and Taiwan, and these parties indicated that this was feasible. This will be an interim procedure, until the Commission establishes a policy on the provision of data.

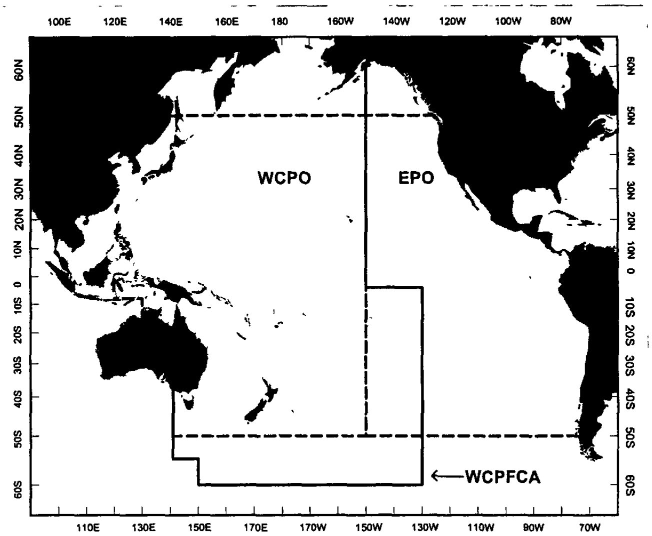


Figure 2. Convention Area (WCPCA), WCPO and EPO

Data collection in the Philippines and the Pacific Ocean waters of Indonesia

A 'Proposal for monitoring the catches of highly migratory species in the Philippines and the Pacific Ocean waters of Indonesia' (Information Paper INF-SWG-3) was developed by the OFP in conjunction with Indonesia and the Philippines and distributed to potential donors in December 2003. For each of the Philippines and Indonesia, there are two components: (a) a review of the tuna fisheries and the current statistical system and (b) port sampling and observer programmes.

Australia agreed to fund the review for the Philippines and is considering funding the review for Indonesia. The budget for port sampling and related activities, for two years in both countries, is USD 292,000. At PrepCon VI (Bali, April 2004), Taiwan and the United States announced contributions of USD 20,000 and USD 60,000 respectively. In order to allocate the available funds and to monitor project developments, the Indonesia and Philippines Data Collection Steering Committee was established by PrepCon. It met during PrepCon VI and allocated the currently available funds to the Philippines to enhance the current port sampling programme, which is operating at a low level of coverage due to lack of funds.

Dr Antony Lewis conducted the review in the Philippines from 8 to 28 July 2004. His report highlighted significant problems in the collection of fisheries statistics. A workshop will be held in Manila in October 2004 — with the Bureau of Fisheries and Aquatic Resources, the Bureau of Agricultural Statistics, industry and SPC — to consider the recommendations from the review and to plan the port sampling, which will commence following the workshop. CSIRO would conduct the review for Indonesia in 2005, subject to funding. The port sampling programme in eastern Indonesia will be established if funding for the two-year project is contributed by the potential donors (European Union, France, Japan, Korea and New Zealand). Observer programmes will be established in the Philippines and the Pacific Ocean waters of Indonesia when funding becomes available. The meeting strongly encouraged the potential donors to contribute the required funds as soon as possible.

Data-related tasks for the WCPFC Scientific Committee

A one-day meeting of the SWG to consider anticipated data-related tasks for the WCPFC Scientific Committee was held immediately prior to SCTB17. Two working papers were presented. WP SWG-8, 'Legal aspects governing fisheries data', describes the international legal obligations in respect of the collection, compilation and dissemination of fisheries data by the Commission. WP SWG–6, 'Information regarding anticipated data-related tasks for the WCPFC Scientific Committee', discusses data standards and other data-related issues. WP SWG–6 contains background information regarding the tasks listed above, much of which is based on the experience accumulated by the Standing Committee on Tuna and Billfish over the 17 years of its existence. The working paper, which contains seven appendices containing relevant texts and a comprehensive list of references, with web links, is intended to be a reference document for use by the Scientific Committee.

Working Papers SWG–6 and SWG–8, and the report of the one-day meeting, will be considered at the third meeting of the PrepCon Scientific Coordinating Group, which immediately follows SCTB17, under SCG3 agenda item 6, 'Advice on data standards and other data related issues for the Western and Central Pacific region'.

METHODS WORKING GROUP

The two primary tasks of the MWG for SCTB 17 were the completion of the extensive simulation analysis begun at SCTB 16 and detailed scrutiny of the 2004 bigeye tuna stock assessment prepared by the SPC Oceanic Fisheries Programme.

The results of the simulation analysis are complex. Absolute estimates of MSY-related reference points were often poor, while relative estimates (e.g. F_t/F_{MSY} or B_t/B_0) were usually better. The MULTIFAN-CL and SCALIA models had serious problems estimating natural mortality-at-age in most cases. Using the correct values of natural mortality substantially improved MULTIFAN-CL performance (particularly MSY-related values) in some cases, but not all. MULTIFAN-CL estimation performance seemed to improve with increasing simulation model complexity. Incorporation of data where CPUE is not an accurate index of abundance decreased the accuracy of most model estimates. The production models (particularly the Fox model using the global nominal CPUE) performed well when non-informative data were excluded from the analysis. The operational model used for the simulation analysis is extremely complex, and the results show that evaluating the performance of one complex model using a second complex model produces complex results that are difficult to interpret. Future simulations should be designed to elucidate specific aspects of assessment models (e.g. estimation of natural mortality).

The bigeye tuna assessment was conducted using a suite of catch per unit effort (CPUE) standardization methods and assumptions about catchability. The analysis using statistical habitat-based effort standardization and constant catchability for the principal longline fleets (LL1-LL5) and estimation of natural mortality at age (SHBS-MEST) produced an adequate fit to the data and the most credible estimates of other parameters. A new prototype method which also estimates trends in catchability for fleets LL1-LL5, the 'SHBS-MEST-LLq' model produced a better fit to the data and more pessimistic assessment results. However, the assumptions about initial catchability used in the current SHBS-MEST-LLq model are inappropriate and should be revised in the future. The long-term correlation between recruitment estimates for MFCL Region 2 and Indonesian catches was noted and investigated. The MWG considered use of likelihood profiles to be a useful means to communicate uncertainties in parameter estimates to fishery managers.

HMS BIOLOGY WORKING GROUP

The Group received 8 presentations on various aspects of the biology of highly migratory species. Subsequent discussion concluded that continued improvements in understanding of the basic biology of the key stocks of tuna, billfish, other highly migratory species caught as bycatch, would be a core requirement of the work of the Western and Central Pacific Fisheries Commission. It was highlighted that for most non-target species even the fundamental biological parameters that constitute the basic inputs required for stock assessment were unknown. The meeting therefore noted that the Commission should, when developing its databases, make provision for incorporating biological data. It was also noted that the Commission's requirements for information on the biology of highly migratory species should be directly related to information supporting the stock assessments and could include such information as maturity ogives, sex ratios, size frequencies, size at age, growth parameters, longevity and natural mortality.

FISHING TECHNOLOGY WORKING GROUP

The work of the Fishing Technology Working Group (FTWG) is highly diverse, ranging from the development of training materials useful to observer and port sampling programs to complex studies on effort standardization and the quantification of harvesting capacity. Central to the Terms of Reference of the FTWG is the principle that advances in fishing technology and vessel efficiency move quickly between ocean basins and must be accounted for as soon as possible to avoid sampling and analytical bias. A large agenda discussed a wide range of studies during a preparatory meeting to SCTB 17 which were summarized and further discussed by the SCTB Plenary. These studies included work related to:

- the application of gear technology to the reduction or mitigation of bycatch and the increased targeting (efficiency) of longline and purse seine fisheries;
- the development of information materials on longline gear technology and fisheries and training materials promoting the proper identification and discrimination of juvenile bigeye in multi-species catches and landings in both fresh and frozen condition;
- the development of different analytical means to examine and estimate vessel efficiency or productivity;
- issues and studies related to the collection, compilation and use of vessel and gear attributes for a variety of research oriented purposes;
- studies related to anchored and drifting FADs used by large-scale fisheries; including a compilation of information on FAD use and design, particularly for purse seine operations, and a study examining differential catch parameters for bigeye tuna taken on natural logs and drifting FADs;
- information papers and studies related to harvesting capacity and the management of fishing effort in the WCP region;
- detailed information on the status of the Palau Arrangement and the FFA initiative to regulate purse seine effort through a vessel day scheme;
- recent developments on a fine scale related to distant-water and domestic tuna fisheries, expansions and contractions of fisheries, licensing and joint-venture arrangements, changes in areas of operation, developments of new fisheries or fishing technologies, the development and status of shore-side infrastructure to fisheries, transhipment, marketing, port sampling and observer programs, information on the use of FADs and any significant changes to national policy related to industrial fisheries.

All of these studies and sources of information are important and relevant to the management of pelagic resources in the WCPO. However, if priorities need to be set, the Terms of Reference to the FTWG clearly state that the group should concentrate on issues of greatest concern to stock condition.

Given these directives, the FTWG recognises the problem of overcapacity and the need to quantify the impact of excessive harvest capacity on fishing mortality of species caught in the WCPO. The FTWG was informed that the FAO Technical Advisory Committee on Management of Fishing Capacity recognised that world tuna fishing capacity is excessive for current resources. The FTWG was also informed that an FAO Technical Consultation expressed concern about recent increases in purse seine fishing capacity in WCPO. Overcapacity in world-wide fisheries has potential ramifications for stock condition, resource sustainability, the economic viability of fleets, and potential ecosystem effects. In addition, studies on the impact of large-scale anchored FAD arrays, the design and efficacy of drifting FADs and the species-specific identification of tunas in the Philippines and Indonesia are of primary concern to the FTWG and the SCTB in general.

The FTWG has spent considerable time examining, identifying and suggesting the types of technical data that would facilitate assessment of changes in fishing operations and efficiency. The FTWG recognises that while there are many data types which have been routinely collected, it is essential that these data types be explicitly linked to a management oriented purpose. The FTWG also recognised that technological innovations are introduced continually and that the best source of current information is through observer reports and maintaining a close dialogue with vessel operators.

The FTWG is of the view that continual monitoring of technological and operational changes in tuna fisheries in the WCPFC area will be necessary and that these requirements fall in three general areas: 1) fishery characterisation, 2) standardisation of fishing effort for stock assessment, and 3) catch targeting or bycatch avoidance, e.g. avoidance of juvenile bigeye catch by purse-seine. The FTWG was of a view that these areas of research should be considered as priority areas of study for the Commission. The meeting clearly recognized that the work that the FTWG conducts would not disappear with the formal dissolution of the SCTB and that a similar group within the Commission structure would be necessary to address these issues into the future.

HMS STOCK ASSESSMENT WORKING GROUP

RECENT DEVELOPMENTS IN THE FISHERIES

Catch

Annual total catches of the four main tuna species (skipjack, yellowfin, bigeye and albacore) in the WCPO increased steadily during the 1980s as the purse seine fleet expanded, remained relatively stable during most of the 1990s, increased sharply in 1998 and have remained at this elevated level since (Figure 3 and 4). The provisional total WCPO catch of tunas during 2003 was estimated at **1,940,546 mt**, the second highest annual catch recorded after 1998 (1,985,110 mt). During 2003, the purse seine fishery accounted for an estimated 1,172,780 mt (60% of the total catch), with pole-and-line taking an estimated 294,752 mt (15%), the longline fishery an estimated 213,259 mt (11%), and the remainder (13%) taken by troll gear and a variety of artisanal gears, mostly in eastern Indonesia and the Philippines.

The WCPO tuna catch (1,940,546 mt) represented 71% of the total estimated Pacific Ocean catch of 2,725,083 mt in 2003, and close to 50% of the global tuna catch (the provisional estimate for 2003 is ~4,000,000 mt). The eastern Pacific Ocean (EPO) catch (~790,000 mt) of the four main tuna species for 2003 was the highest ever.

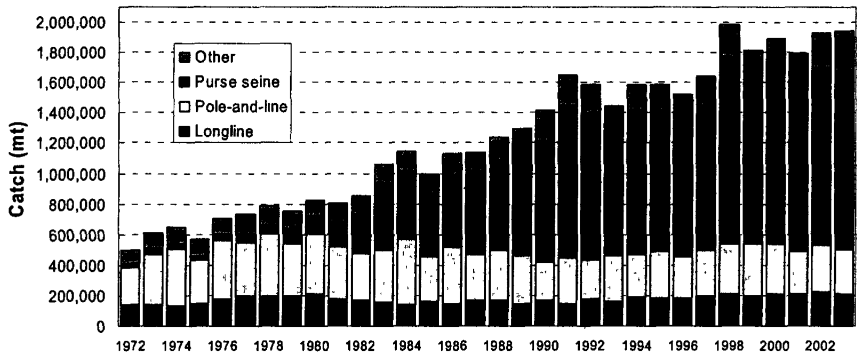


Figure 3. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCPO, by longline, pole-and-line, purse seine and other gear types for the period 1972 to 2003

Since 1972 the WCPO catch by species has been dominated by skipjack (65% in 2003). The 2003 WCPO catch of skipjack (1,252,738 mt) was the third highest ever (the highest recorded skipjack catch was in 1998 – 1,301,054 mt). The WCPO yellowfin catch for 2003 (456,947 mt; 24%) was the highest in five years and only 8,000 mt less than the record catch in 1998 (465,642 mt). The WCPO bigeye catch for 2003 (95,991 mt; 5%) was the lowest for seven years. The WCPO albacore catch (includes catches of North and South Pacific albacore west of 150^0 W, which comprised 86% of the total Pacific Ocean albacore catch of 157,363mt in 2003) was 134,870 mt (7%) and was about 5,000 mt less than the record level in 2002 (139,848 mt).

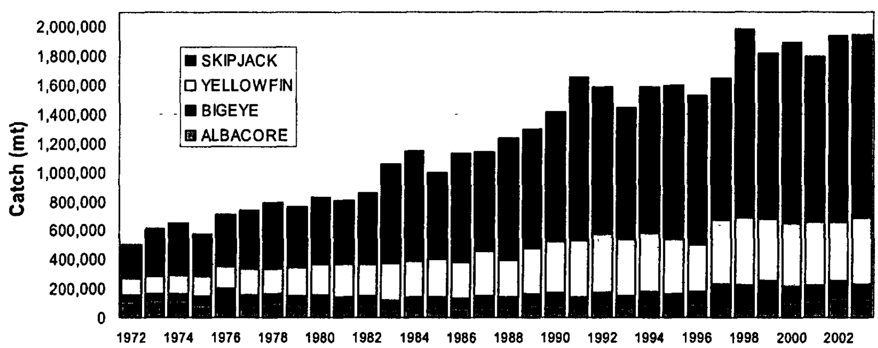


Figure 4. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCPO for the period 1972 to 2003

Fleets

Purse seine fishery

In total, more than 200 purse seiners operated in 2003 in the WCPO. There has been a reduction in the number of US flagged vessels and an increase in the Pacific Islands' flagged vessels (e.g. PNG, Marshall Islands and Vanuatu), which has been expanding in recent years and is at its highest level ever (GEN-2). The catch of the PNG fleet is now nearly equivalent to that of the Japanese tropical fleet. In 2001 New Zealand and China also started fishing in tropical waters. Significant number of Philippine purse seiners are operating both inside its EEZ as well as in PNG waters. Drifting FAD sets have been declining since 1999 in the major purse seine fleets, and the reason for this is not well known and thought to be related to the shift in fishing areas.

Longline fishery

The total number of longline vessels has fluctuated between 4,000 and 5,000 since the mid 1970s, and remained close to 5,000 since 1992. In recent years, there has been a gradual increase in the number of Pacific Islands domestic vessels, such as those from American Samoa, Cook Islands, Samoa, Fiji, French Polynesia, New Caledonia and Solomon Islands. These fleets mainly operate in their respective EEZs, with albacore the main species taken. The entrance into the fishery and subsequent decline of the smaller 'offshore' sashimi longliners of Taiwan and mainland-China, based in Micronesia, during the past decade is also noteworthy. The Korean and Japanese distant water fleets have declined somewhat in the WCPO in recent years. On the other hand, the Taiwan fleet increased substantially and shifted the target to bigeye in the eastern equatorial areas of the WCPO. Distant water longliners from China have recently begun fishing in the eastern portion of the WCPO.

Pole-and-line fishery

Economic factors and technological advances in the purse seine fishery (primarily targeting skipjack) have seen a gradual decline in the number of vessels in the pole-and-line fishery and stabilisation in the annual catch during the past decade. Some Pacific Islands domestic fleets (Palau, PNG and Kiribati) are no longer active, with only one or two vessels operating seasonally in Fiji

BIGEYE TUNA

Key attributes

Bigeye tuna are a relatively slow growing species that matures at approximately three to four years of age. Bigeye are known to grow to about 200 cm and over 180 kg when eight years or older. They have a wide distribution between 40°N and 40°S (Figure 5) and vertically between surface and 500 m deep (occasionally to 1000 m) due to their tolerance of low oxygen levels and low temperatures. These and other characteristics make them less resilient to exploitation than skipjack and yellowfin tunas. The geographical distribution of bigeye is continuous across the Pacific (Figure 5). However, it has been noted that there are areas of lower catch separating the principal fishing areas in the eastern (east of about 165°W-170°W) and the more western regions of the Pacific. It was also noted that though little information is available on mixing rates between these regions, the limited tag returns available suggest low mixing rates between the eastern and western Pacific. On this basis, and considering the existence of two major surface fishing areas in the western and central Pacific and eastern Pacific, stock assessment has been carried out on two different stock hypotheses, i.e. two-stock hypothesis (western and central Pacific and eastern Pacific) and a Pacific-wide stock hypothesis allowing the extent of basin-scale mixing to be estimated. Large fish are caught mainly by longline, and these longline-caught bigeye are the most valuable among the tropical tunas. Juvenile fish tend to form mixed schools with skipjack and yellowfin, which results in catches by the surface fishery, particularly in association with floating objects. Natural mortality is estimated to be relatively low compared with other tropical species.

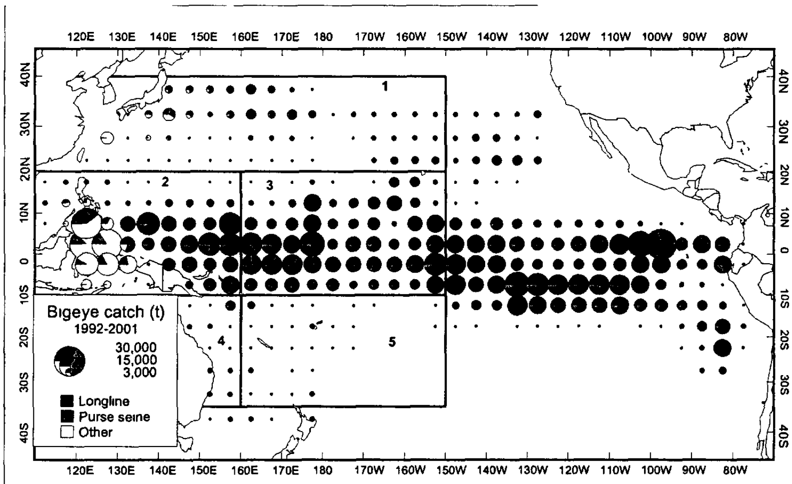


Figure 5. Distribution of bigeye tuna catch, 1992–2001. The spatial stratification used in the WCPO MULTIFAN-CL model is shown

Trends

Catch and CPUE

The total bigeye tuna catch in the WCPO for 2003 was 96,000 mt, the lowest for 7 years. This represents 53% of the total Pacific catch in the same year. Available statistics (Figure 6) indicate that 60% of the WCPO catch was taken by longline, and most of the remainder by purse seine (21%) and by the domestic fisheries of Indonesia and Philippines and others (18%). The total catch of small bigeye tuna by the purse seine fishery is uncertain, as they are not systematically separated from yellowfin at the unloading sites nor recorded separately on fishing logs. Purse seine catch in 2003, estimated through the statistical analysis of sampling data, continued to reduce to 20,300 mt since the 1999 record high of 34,600 mt due to a decreased use of drifting FADs. There is also considerable uncertainty in the estimation of the Indonesian and Philippines catches due to the lack of (or limitations in) systematic sampling programs. Nominal (unadjusted) CPUE for WCPO bigeye tuna derived from longline data indicated a sharp decline during the early stages of the fishery but has been fairly stable over recent years.

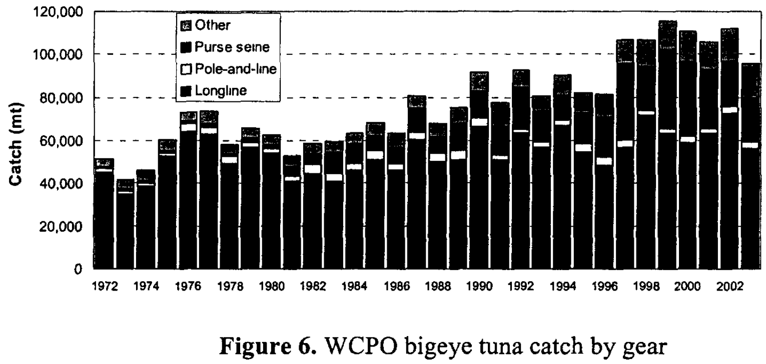


Figure 6. WCPO bigeye tuna catch by gear

Standardized CPUE was estimated by the General Linear Model (GLM), deterministic habitat-based standardization (HBS) and statistical habitat-based standardization (SHBS). However, the HBS estimate was not used in the MFCL model as this effective effort poorly predicted the catch and the trend was similar to that of SHBS. The trends of the remaining models (Figure 7) were generally similar, although CPUEs in Regions 2 and 3, where the most significant fisheries have existed, were somewhat different as they showed some high peaks between 1970s and 2000s, while CPUE in the other regions tended to show steady decline with minor fluctuation after the large decline that occurred at the beginning. The most recent years were the lowest for SHBS CPUE for Regions 1, 3 and 5. The SHBS CPUE for Region 3 indicated the most precipitous and continued decline. However, the GLM index shows increases in recent years in Regions 3 and 5. In summary, there are some regions which indicate some decline of CPUE in recent years, but there appears to be no indication of a significant recent decline in longline exploitable biomass, as has been documented for the EPO, the Atlantic and the Indian Ocean.

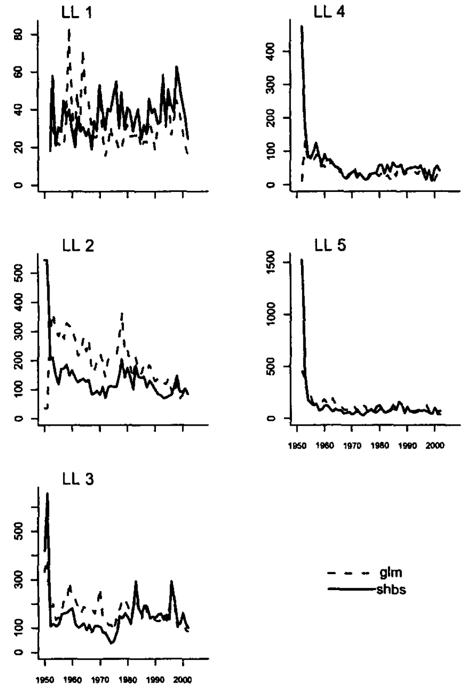


Figure 7. Catch-per-unit-effort (CPUE) for the longline fisheries LL1–LL5 standardised using two different methodologies. glm = general linear model; shbs = statistical habitat-based standardisation

Fish size

Annual and recent quarterly catch-at-size by major fisheries is shown in Figure 8. The surface fisheries of the Philippines and Indonesia take large quantities of small bigeye in the 20-50 cm range. Purse seine sets on floating objects (i.e. associated schools), which are mostly 'mixed' schools of skipjack and yellowfin, generally take smaller fish (40-100 cm) than sets on unassociated or free-swimming schools. Bigeye taken in unassociated purse-seine sets are larger than those caught by associated sets and the amount is much smaller. The longline catch of adult bigeye tuna dominates those of other fisheries. Decadal trends in the length composition of the bigeye longline catch show a considerable decline in the proportion of large (>150 cm) fish in the catch, particularly during the early period of the fishery (ECO-3).

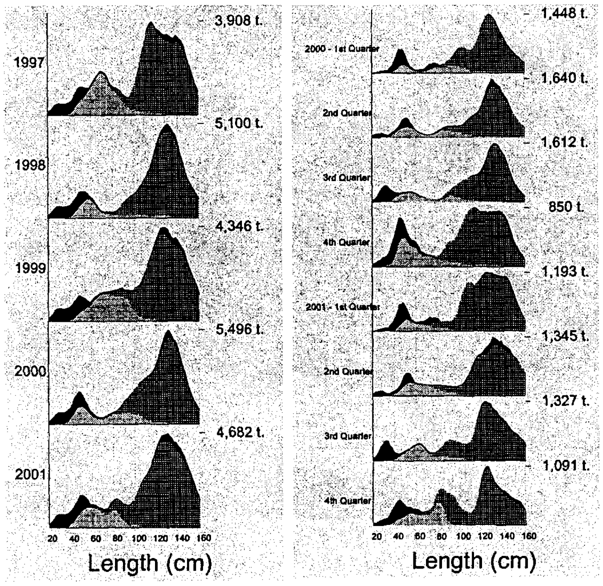


Figure 8. WCPO bigeye catch-at-size, expressed in weight. Black, dot, grey and hatched area indicate Philippine and Indonesian surface catch, associated catch by purse seine gear, unassociated catch by purse seine gear, and longline catch, respectively

Stock Assessment

The stock assessment (SA-2) was conducted using the statistical model 'MULTIFAN–CL' (MFCL) applied to data for the WCPO as has been done in recent years. Years covered were 1950-2007 the final 4-5 years being a projection period. The projection assumed that future fishing effort is constant at the same level of the most recent year for which the fishing effort is available (either 2002 or 2003 depending on fishery). Considerable size data for the Japanese longline fishery before 1965 were included in the analysis for the first time. The methodology of projections was improved and the initial stock condition was assumed to be in equilibrium and to have experienced the average total mortality of the first 20 quarters.

This year's MFCL runs were made using two effort series standardized by the GLM and SHBS methods applied to the Japanese longline fishing effort. Natural mortality rates at age were either estimated (MEST) or fixed (MFIX) and assuming fixed or variable (LLq) catchability for the longline fisheries. The estimated catchability trends for the LLq option often differed substantially among model regions in a manner that did not have an obvious mechanistic explanation. Therefore the LLq option was not considered to be suitable for the interpretation of stock status.

The run for which SHBS effort was used and natural mortality at age was estimated was designated as the base case analysis (SHBS-MEST). The results, shown below, were mostly taken from this base case, although results of other runs were also referred to as sensitivity runs where necessary.

Recruitment

The estimated recruitment (Figure 9) for all runs indicated an increasing trend with large interannual variability since the 1980s and reached the highest level in 1999, which is about 2.0-2.5 times higher than the 1980s. This increasing trend was first observed in the 2003 assessment. Once again, the possibility that increasing recruitment was simply a model response to increasing juvenile catch in the Indonesian and Philippines fisheries was raised. This was investigated by conducting a model run in which the Indonesian and Philippines catches were reduced by a factor of 100. Under these circumstances, average recruitment was slightly reduced and the increasing trend in Region 2 (where the Indonesian and Philippines fisheries occur) was not as strong. However, an increasing trend in recruitment still remained and this was thought to be related to the increase in longline CPUE in Region 2. However, it was concluded that increasing juvenile catches did seem to be having some effect on the recruitment estimates, and further research was required to develop an appropriate modelling response to this artefact.

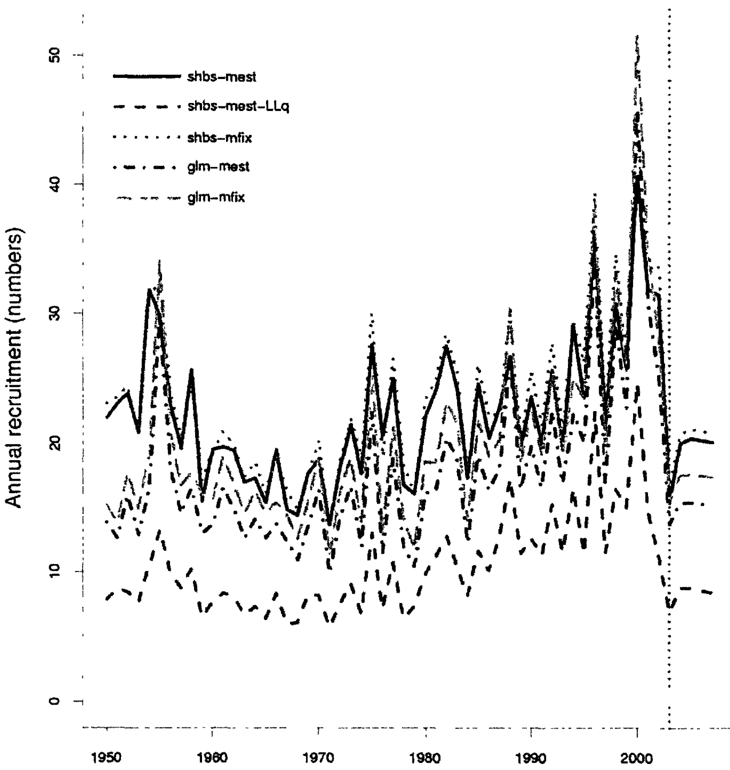


Figure 9. Estimated annual recruitment for the WCPO obtained from the separate analyses using different model options. The vertical dotted line indicates the point at which population projections are made with assumed levels of effort

Biomass

Total estimated annual average biomass of bigeye tuna in the WCPO indicated a similar declining pattern among different runs, although the absolute level was different (Figure 10). The largest decline was observed in the runs using GLM effort. In all runs, the largest decline occurred during the late 1950s and the early 1960s, and it has been fairly stable thereafter. The impact on the results of using estimated or fixed natural mortality at age was negligible.

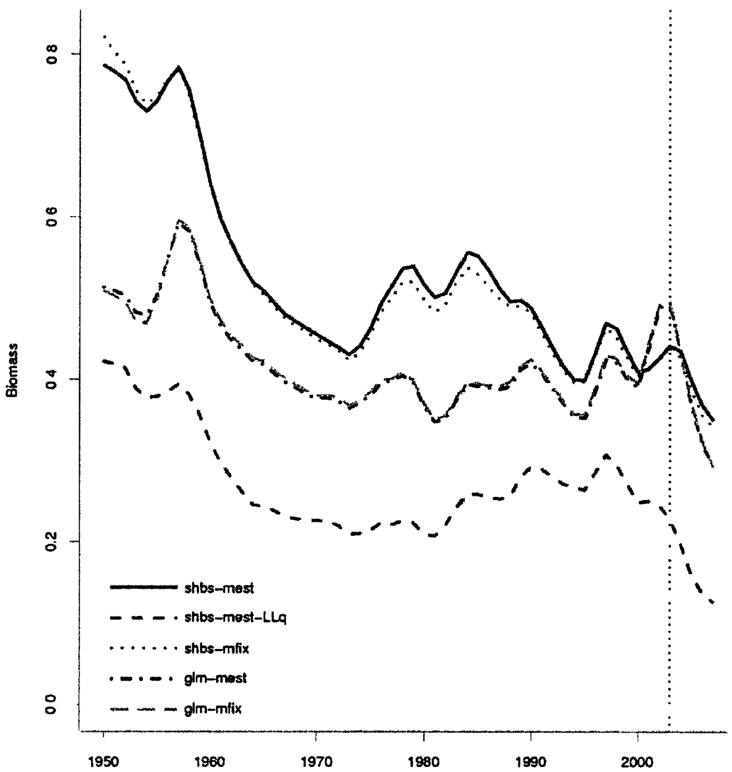


Figure 10. Estimated annual average total biomass (million t) for the WCPO obtained from the separate analyses using different model options. The vertical dotted line indicates the point at which population projections are made with assumed levels of effort

Fishing mortality

Average fishing mortality rates for juvenile and adult age classes increased continuously throughout the time series in a similar fashion for all runs (Figure 11). The juvenile fishing mortality in the most recent year is still lower than the adult fishing mortality in all runs. Fishery impact analysis shows that the highest impacts on the bigeye stock occur in the tropical regions (Regions 2 and 3 – Figure 12). The longline fishery has the highest overall impact on the stock; however, the surface fisheries catching juvenile bigeye have high impact in the tropical regions.

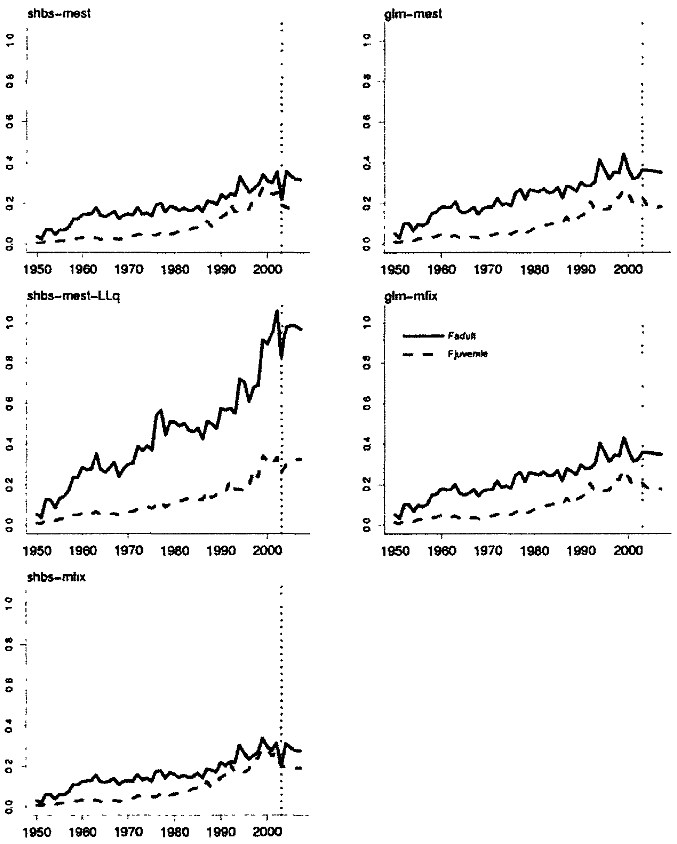


Figure 11. Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the separate analyses using different model options

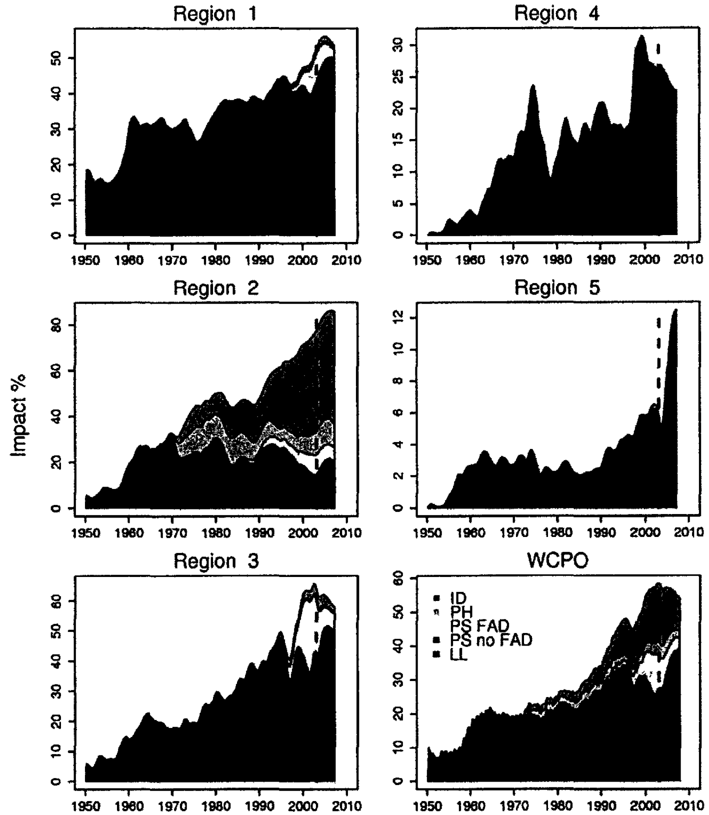


Figure 12. Estimates of reduction in total biomass due to fishing by region and for the WCPO attributed to various fishery groups. LL = all longline fisheries; ID = Indonesian domestic fishery; PH = Philippines domestic fisheries; PS FAD = purse seine FAD sets; PS non-FAD = purse seine log and school sets

Stock status

The 2004 assessment results were reviewed and confirmed as consistent with the 2003 assessment, although the point estimates of some reference points were slightly more optimistic in this assessment (Table 1, Figure 13). The current fishing mortality (i.e. the average for 1999-2001) is estimated to be close to MSY level ($F_{current}=F_{MSY}$) and the current biomass to be above the MSY level ($B_{current}>B_{MSY}$, not in an overfished state). This result is common for all runs. Probability distributions for $F_{current}/F_{MSY}$ and $B_{current}/B_{MSY}$ were developed by the likelihood profile method. These distributions (Figure 14) indicate that the current levels of fishing mortality carry high risks of overfishing but the probability that the stock is in an overfished state is close to zero.

The future stock status of WCPO bigeye will depend both on future fishing mortality and future recruitment. Recent recruitment has been estimated to be well above average, and if it falls to the long term average or lower, current catch levels would result in stock reductions to near and possibly below MSY-based reference points. Lower future recruitment is a possibility if the recruitment trends for bigeye in the EPO are mirrored in the WCPO, and if the hypothesis concerning the impact of large-scale ocean climate on tropical tuna recruitment, which was suggested in the paper presented to SCTB17 (ECO-5), proves to be correct.

According to the information provided by the IATTC, the spawning stock biomass of bigeye tuna in the eastern Pacific Ocean (EPO) has now declined below the MSY level. The stock will likely remain in an overfished condition for some time because of high fishing mortality and low recent recruitment. The annual meeting of the IATTC adopted several management measures aimed at preventing further decline and promoting recovery of the stock. It was noted that the longline fishery operates continuously across the tropical Pacific (Figure 5) and that collaborative research with the IATTC on Pacific-wide bigeye assessment should continue.

Taking all above information into consideration, it is recommended that, as a minimum measure, there be no further increase in the fishing mortality rate for bigeye tuna from $F_{current}$. If future evidence supports a shift to a lower productivity regime, a decrease in total catch would be anticipated in order to maintain the stock at sustainable levels. The SCTB participants recognize there are still large uncertainties associated with the stock assessment of this species and recommend that the stock assessment be conducted again next year.

Table 1. Estimates of management measures based on the 2003 - 2004 stock assessments

Management Quantity	2004 Assessment	2003 Assessment
Most Recent Catch	96,000 MT (2003)	115,000 MT (2002)
Effort	Base case and others	All
MSY	56,000 ~ 62,000 MT	40,000~80,000 MT
$Y_{Fcurrent}$ / MSY	1.00	0.82-0.99[1]
$B_{current}$ / $B_{current,F=0}$	0.41~0.43	0.27 ~ 0.34
$F_{current}$ / F_{MSY}	0.89~1.02	1.11~2.00
$B_{current}$ / B_{MSY}	1.75~2.28	1.35~1.76

[1] These are the correct numbers - those given in the Executive Summary of SCTB16 were incorrect

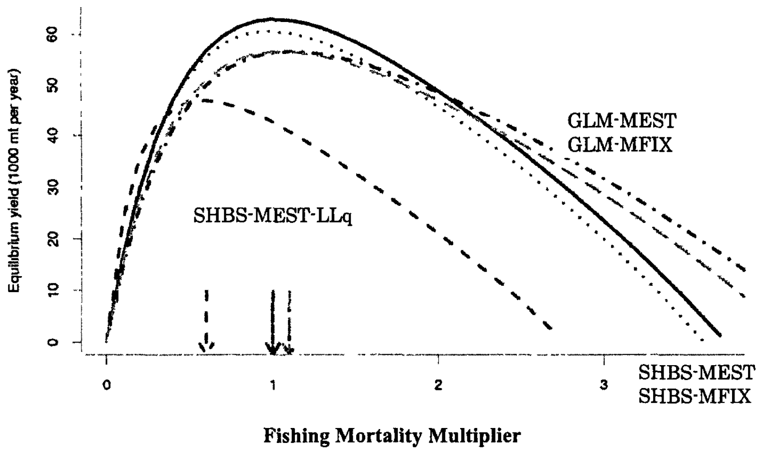


Figure 13. Yield curves estimated from the separate analyses using different model options. Arrows indicate corresponding F_{MSY} relative to the current fishing mortality multiplier

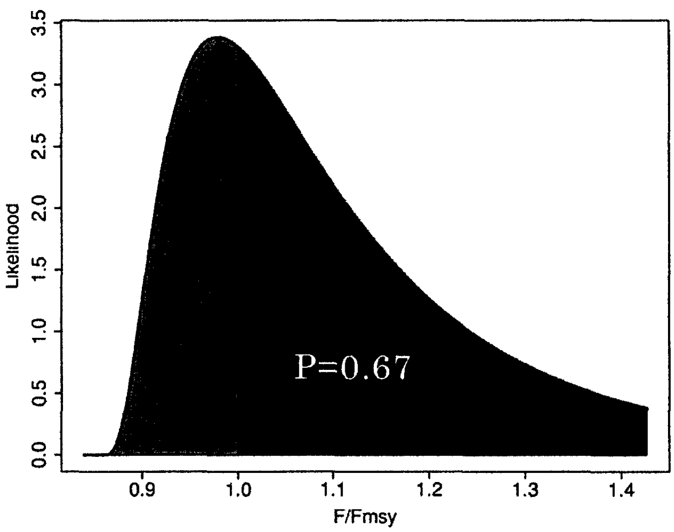


Figure 14. Probability distribution of $F_{current}$ / F_{MSY} based on the likelihood profile method (base case with steepness of mode = 0.9 and sd = 0.1)

YELLOWFIN TUNA

Key attributes

Yellowfin tuna are fast growing, mature at about two years of age and are highly fecund. Yellowfin can grow to 180 cm in length and weigh over 100 kg when they are about six years of age or older. The majority of the catch is taken from the equatorial region where they are harvested with a range of gear types, predominantly purse seine and longline. Catches of yellowfin tuna represent the second largest component (21–27% since 1990) of the total annual catch of the four main target tuna species in the WCPO. For stock assessment purposes, yellowfin tuna are believed to constitute a single stock in the WCPO.

Trends

Catch and effort

Since 1990, there have been large increases in the total catch of yellowfin with the development of the purse seine fishery. This has included a considerable catch of juvenile yellowfin associated with the FAD fishery. In recent years catches in the purse seine fishery overall have declined from the record catch taken in 1998. The catches of juvenile yellowfin in the Philippine and Indonesian domestic fisheries have also increased significantly since 1990, with these increases continuing to 2003, although the magnitude of these catches is not well determined.

Longline fisheries developed in the early 1950s with yellowfin tuna being the principal target species, though a major change took place after the mid-1970s with the increased targeting of bigeye tuna. Large-scale industrial purse seine fisheries developed in the early 1980s, principally targeting skipjack tuna but also taking large catches of yellowfin tuna. This development, together with increased catches by Indonesia and the Philippines, resulted in the yellowfin catches in the WCPO doubling from 200,000 to 400,000 mt between 1980 and 1990. Over the past decade, 40-60% of the total yellowfin catch each year has come from the purse seine fishery.

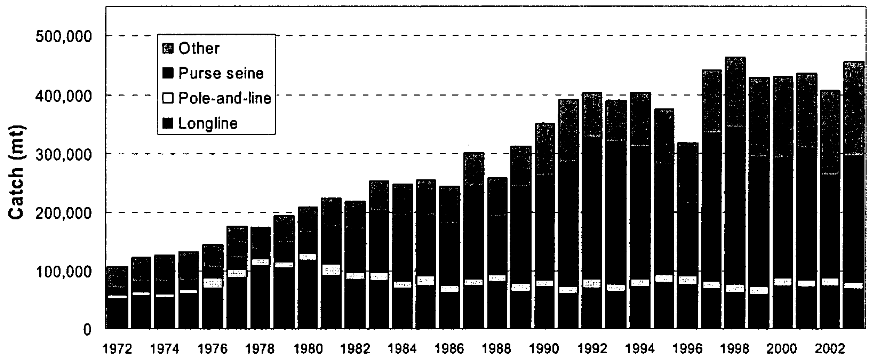


Figure 15. Annual WCPO yellowfin catch (mt) by gear

The 2003 catch of yellowfin tuna in the WCPO (Figures 15 and 16) was estimated at 456,947 mt. This level of catch represents the second highest catch on record, and is mainly due to an increase in the Philippines domestic purse seine and handline catches (Figure 15). Relatively high catches of yellowfin by all gears have also been reported for the EPO which contributed to a record high Pacific wide catch of yellowfin by all gears of 873,794 mt.

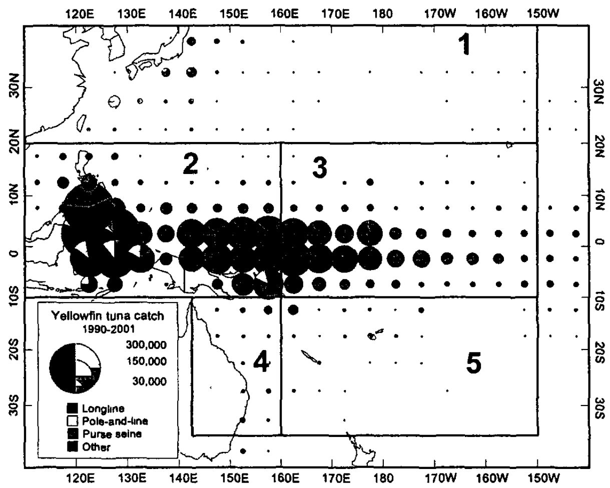


Figure 16. Distribution of yellowfin tuna catch, 1990-2001.
The five-region spatial stratification used in stock assessment is shown

In 2003 the purse seine catch (Figure 16) was estimated at 214,535 mt or 47% of the total WCPO yellowfin catch. The longline catches since 1990 (60,000–80,000 mt) have been well below catches taken in the late 1970s to early 1980s (87,000-117,000 mt). The 2003 longline catch is estimated to be 67,490 mt, or 15% of the total yellowfin catch. During 2003, the pole-and-line fisheries took 14,357 mt (3% of the total) while 'other' fisheries (largely taken by fisheries in the Philippines and Indonesia) accounted for 160,565 mt (35% of the total).

Time-series of nominal catch rates for the Japanese longline fleet display high inter-annual variability and regional differences, with an overall decline since the early 1950s in the equatorial WCPO but little or no overall trend in more temperate regions. Time-series of standardised catch rates for this fleet also display regional differences, with large differences also seen between the different indices within several regions. The GLM based index displays similar (if sometimes smaller) trends to the nominal catch rates, while the statistical habitat based method (SHBS) predicted a considerable decline in effective effort and an increase in standardized CPUE from the late 1970s to the 1990s.

Size of Fish Caught

The annual catch-at-size by principal fisheries are shown in Figure 17 while recent trends in quarterly catch-at-size are shown in Figure 18. These figures are from the Executive Summary for SCTB16. The domestic surface fisheries of the Philippines and Indonesia take large quantities of small yellowfin in the range 20–50 cm. Purse seine sets on floating objects (i.e. associated schools) generally take smaller fish than sets on unassociated or free-swimming schools, which are often 'pure' schools of large yellowfin. However, the size ranges of the yellowfin taken in associated and unassociated purse seine sets vary from year to year. Yellowfin taken in unassociated purse-seine sets are of a similar size range to fish taken in the longline fishery and the handline fishery in the Philippines (both gears target adults in the range 80–160 cm). The purse-seine catch of adult yellowfin tuna is in fact higher than the longline catch in most years. There was a relative absence of medium-sized (60–100cm) yellowfin in the catches from both the longline and purse seine fisheries during most quarters of 2000 and 2001, although a 'pulse' in this size range appears by the 4^{th} quarter 2001.

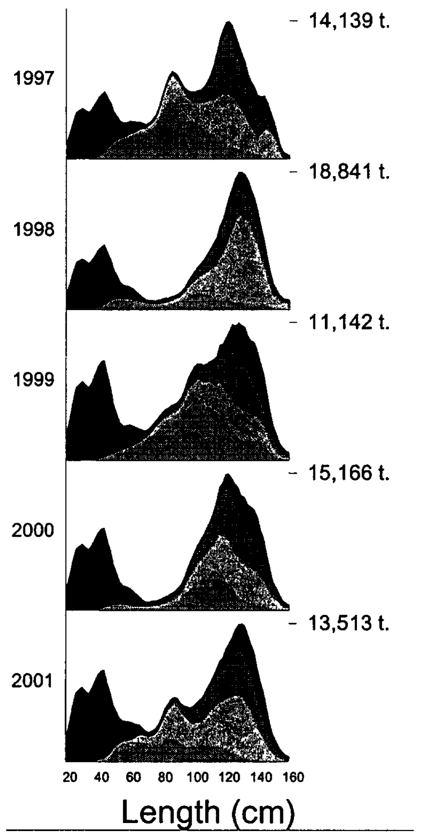


Figure 17. Annual Yellowfin tuna catch-at-size in the WCPO, 1997–2001.
The catch is broken down into the Indonesian / Philippines domestic fisheries component (black), the longline fishery component (hatched), unassociated-set catch from the purse-seine fishery (grey) and associated-set catch from purse-seine fishery (dotted). The y-axis scale is in weight – the figures on the right indicate the catch weight in a 2-cm size class.

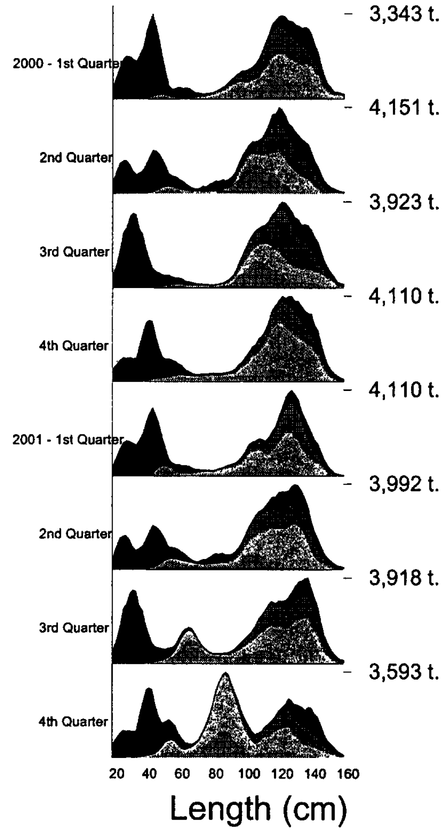


Figure 18. Quarterly Yellowfin tuna catch-at-size in the WCPO, 2000–2001.
The catch is broken down into the Indonesian / Philippines domestic fisheries component (black), the longline fishery component (hatched), unassociated-set catch from the purse-seine fishery (grey) and associated-set catch from purse-seine fishery (dotted). The y-axis scale is in weight – the figures on the right indicate the catch weight in a 2-cm size class.

Stock Assessment

The stock assessment was conducted using the statistical model 'MULTIFAN-CL' applied to the yellowfin data for the WCPO as has been done in recent years. This year's MFCL runs were made using two effort series standardized by the GLM and SHBS methods applied to the Japanese longline fishing effort. Natural mortality rates at age were either estimated (MEST) or fixed (MFIX) and assuming fixed or variable (LLq) catchability for the longline fisheries. The estimated catchability trends for the LLq option often differed substantially among model regions in a manner that did not have an obvious mechanistic explanation. Therefore the LLq option was not considered to be suitable for the interpretation of stock status.

Recruitment

Estimated recruitment numbers are sensitive to the standardised effort indices used in the assessment model, and assumptions made regarding natural mortality at age (Figure 19). In general, estimates of recruitment were higher for model options using an assumption of fixed natural mortality compared to options where natural mortality at age was estimated. However, all analyses revealed a strong temporal trend in recruitment. Initial recruitment was relatively high declining to a lower level during the 1960s and early 1970s. Recruitment subsequently increased to higher levels beginning in the late 1970s. Recruitment remained relatively high during the 1980s and 1990s. The recruitment indices also indicated that recruitment variability may have increased in recent years. Whether this change in the productivity of the stock reflects a change (or a 'regime shift') in oceanographic conditions or is an artefact of the increased catch of juvenile fish taken in the surface fisheries over this period remains unclear.

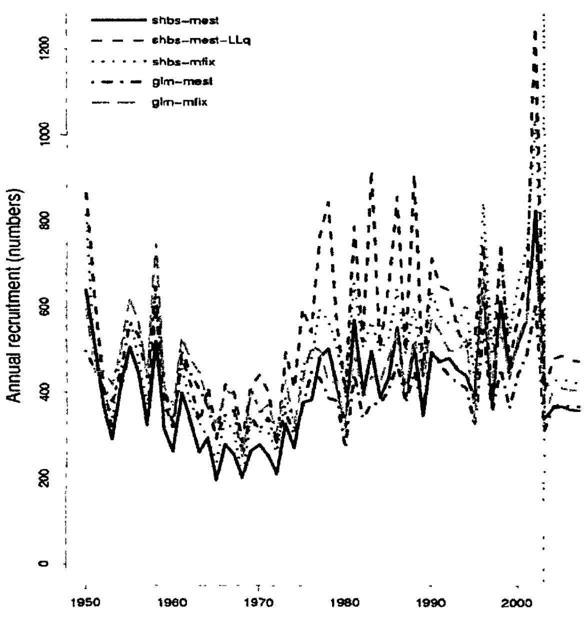


Figure 19. Estimated annual recruitment for the WCPO obtained from the five different model options. The vertical dotted line indicates the point at which population projections are made with assumed levels of effort

Biomass
The general trends in overall annual average biomass were comparable between the five model options, although there was considerable difference in the biomass estimates (Figure 20). The overall level of biomass for the two GLM models (GLM-MEST and GLM-MFIX) and the SHBS-MFIX models was lower than the base-case (SHBS-MEST) and the two GLM models revealed a considerable reduction (about 40%) in total biomass over the entire model period. Estimates of the current level of depletion of yellowfin in the WCPO indicate that the current biomass is 20-35% less than the level that would have occurred in the absence of fishing. Depletion is greater for some regions, notably the equatorial regions where recent depletion levels are near 50%. However, high levels of unfished biomass in some regions (e.g. Region 5) may be a model artefact and require further investigation.

Fishing mortality
Trends in estimated fishing mortality rates are shown in Figure 21. Fishing mortality for both juveniles and adults is estimated to have increased continuously since the beginning of industrial tuna fishing, with significantly more rapid increases since the early 1990s. These increases are attributable to increased catches in purse seine fisheries and catches of juveniles in particular in the domestic Indonesian and Philippine fisheries, together with the declines in overall biomass over the past decade. Fishery impact analysis shows that the highest impacts on the yellowfin stock occur in the tropical regions (Regions 2 and 3 – Figure 22). The longline fishery has relatively low impact on the stock, but the surface fisheries, particularly the Indonesian fishery, have high impact.

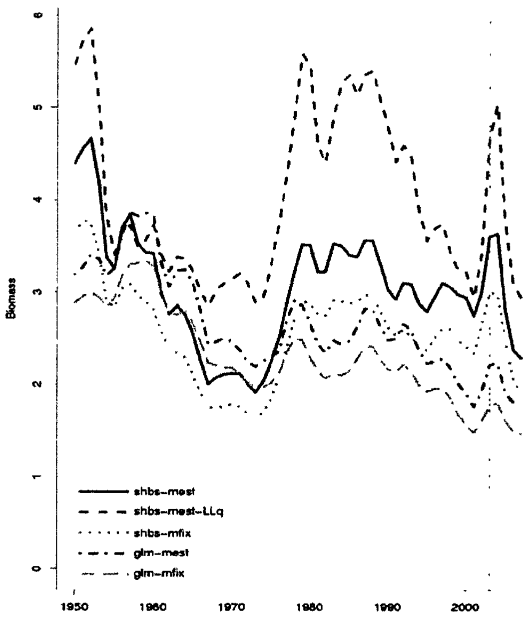


Figure 20. Estimated annual average total biomass (million t) for the WCPO obtained from the five different model options. The vertical dotted line indicates the point at which population projections are made with assumed levels of effort

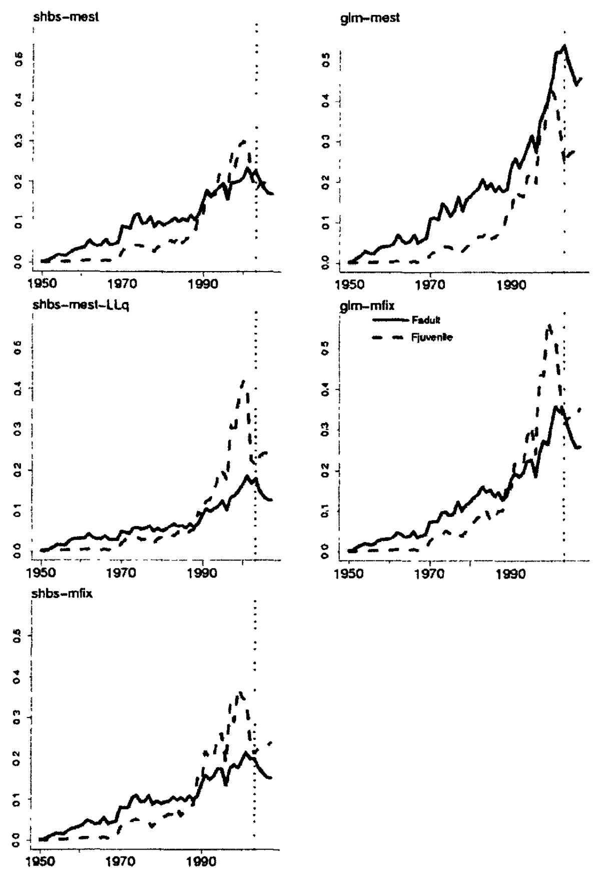


Figure 21. Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the five separate model options

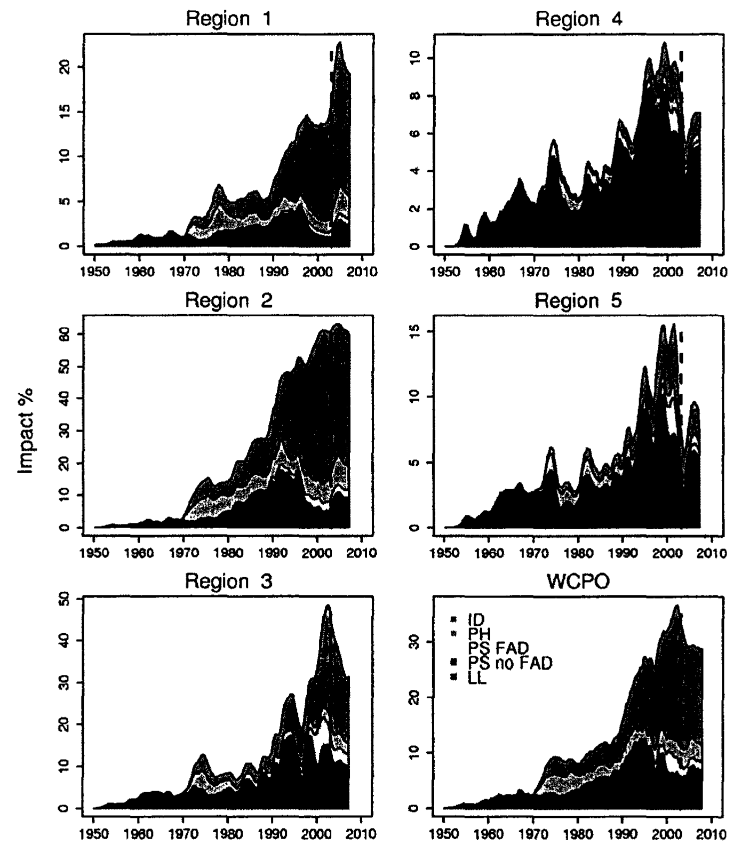


Figure 22. Estimates of reduction in total biomass due to fishing (fishery impact = $1\text{-}B_t/B_{0,t}$) by region and for the WCPO attributed to various fishery groups. LL = all longline fisheries; ID = Indonesian domestic fishery; PH = Philippines domestic fisheries; PS FAD = purse seine FAD sets; PS non-FAD = purse seine log and school sets

Stock status

The assessment (SA-1) reviewed by SCTB17 reaffirms the result of the previous assessment that the yellowfin stock in the WCPO is probably not being overfished ($F_t/F_{MSY} < 1$) and that it is not in an overfished state ($B_t/B_{MSY} > 1$). However, the stock is likely to be nearing full exploitation and any future increases in fishing mortality would not result in any long-term increase in yield and may move the yellowfin stock to an overfished state. While biomass-based reference points (Table 2) indicate that the long-term average biomass should remain above that capable of producing *MSY* if present catches are maintained, yield estimates (Figure 23) indicate that there may be limited potential to expand long-term catches from the fishery at the current pattern of age-specific selectivity. The assessment also indicates that the equatorial regions are likely to be fully exploited, while the temperate regions are likely to be lightly exploited. Furthermore, the attribution of depletion to various fisheries or groups of fisheries indicates that the Indonesian fishery has the greatest impact, particularly in its home region, but is also impacting other regions, as the assessment model indicates that Region 2 is a source of recruits for other regions. The purse seine fishery also has moderate impact, particularly in the equatorial regions.

It is important to note that the key reference points are sensitive to initial assumptions regarding the nature of the stock-recruitment relationship (Figure 24). The assumed prior distribution for the steepness parameter is highly influential and a relaxation of this assumption results in a more pessimistic assessment despite the lack of any evidence of a strong relationship between spawning stock biomass and recruitment (steepness is a parameter that describes the slope of the ascending limb of the relationship between spawning biomass and recruitment). For future assessments, a comprehensive review of appropriate values of SRR steepness for yellowfin is required to determine appropriate values for inclusion in a range of sensitivity analyses. The other main source of uncertainty is the historical and current levels of catch from the Indonesian fishery.

While recognizing continuing uncertainties associated with the present stock assessment, the SCTB reiterates the previous recommendation that there be no further increases in fishing mortality (particularly on juvenile yellowfin) in the WCPO. If future evidence supports a shift to a lower productivity regime, a decrease in total catch would be anticipated in order to maintain the stock at sustainable levels.

Table 2. Estimates of management measures based on the 2003 - 2004 stock assessments

Management Quantity	2004 Assessment	2003 Assessment
Most Recent Catch	456,947 mt (2003)	437,984 mt (2002)
Effort	Base case and others	GLM
MSY	248,000~310,000	381,000~554,000
$Y_{Fcurrent}$ / MSY	0.90~1.00	0.91
$B_{current}$ / $B_{current,F=0}$	0.51~0.67	0.65
$F_{current}$ / F_{MSY}	0.63~1.11	0.61
$B_{current}$ / B_{MSY}	1.75~2.46	1.59

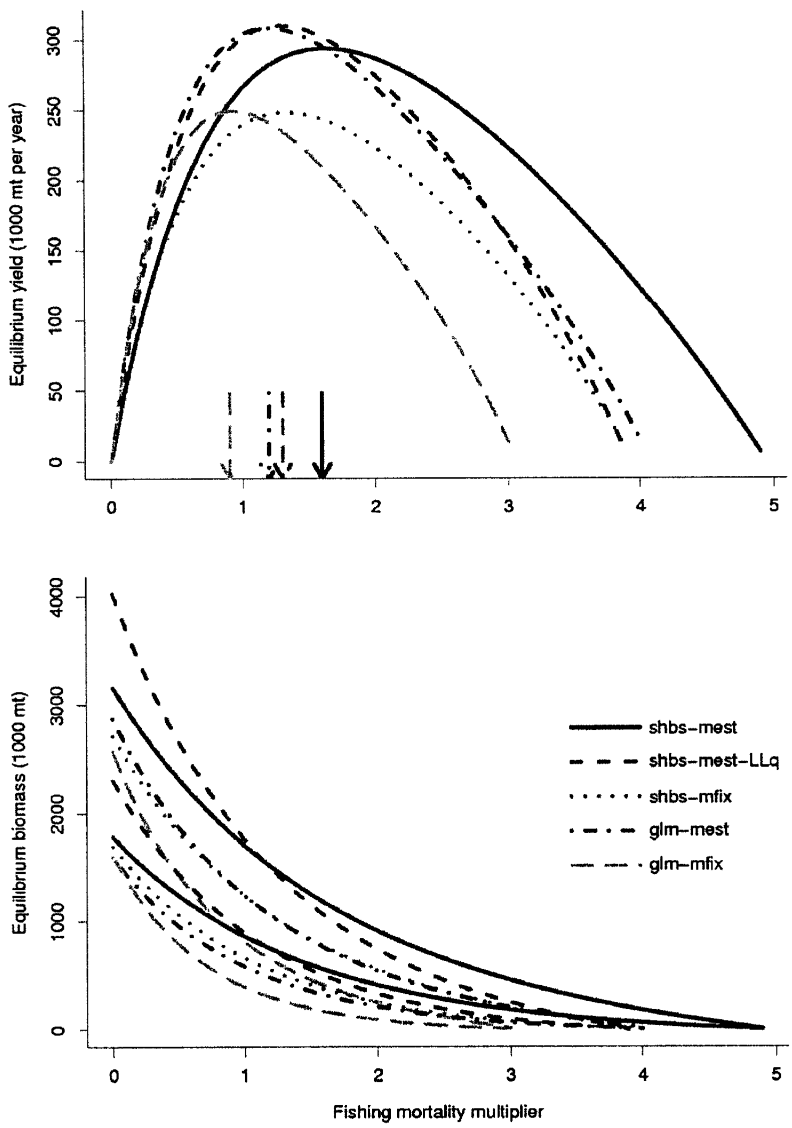


Figure 23. Yield, equilibrium biomass and equilibrium spawning biomass as a function of fishing mortality multiplier obtained from the five separate model options. In the upper panel, the arrows indicate the value of the fishing mortality multiplier at maximum yield

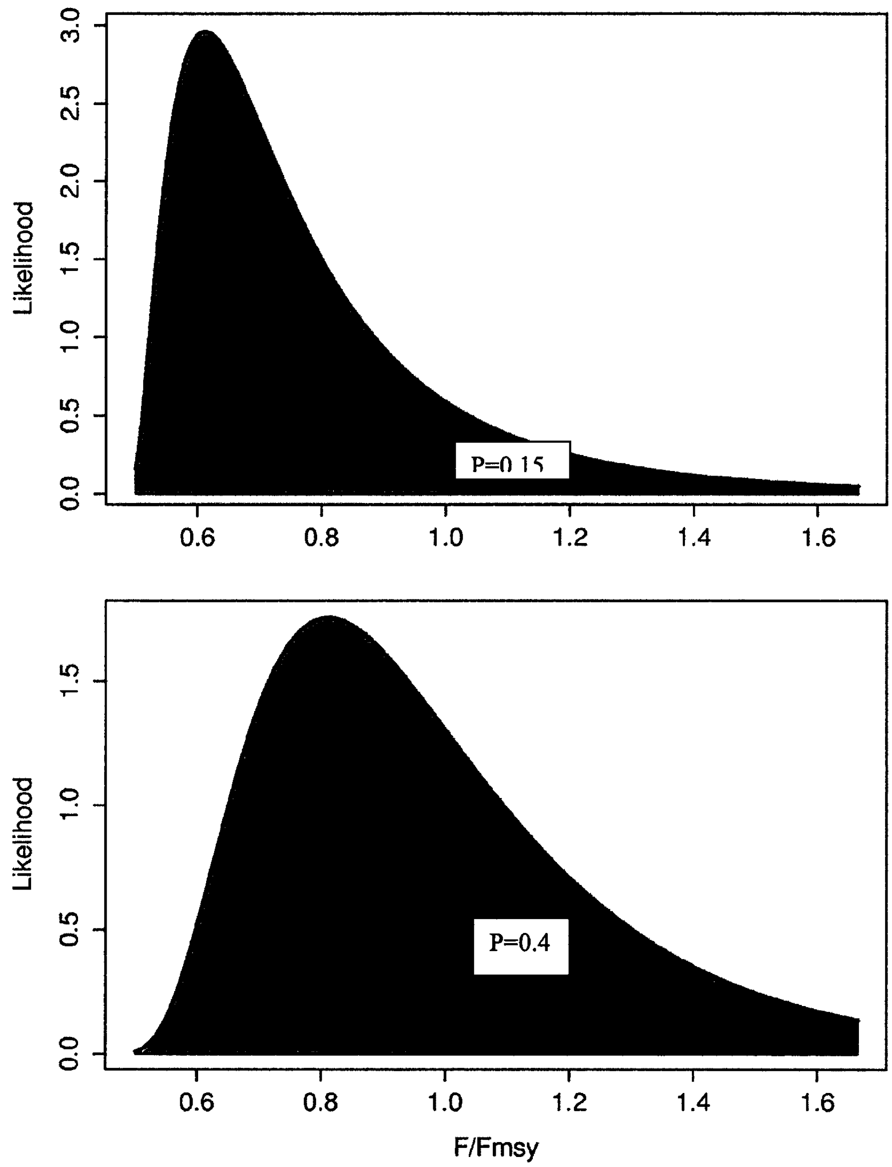


Figure 24. Probability distribution of $F_{current}$ / F_{MSY} based on the likelihood profile method with steepness priors of mode = 0.9 and sd = 0.1 (upper panel) and mode = 0.75 and sd = 0.1 (lower panel)

SKIPJACK TUNA

There was no formal assessment presented for skipjack in 2004 therefore the summary statement that follows is largely a repeat of that prepared at SCTB16.

Key attributes

Skipjack tuna is found year-round concentrated in the tropical waters of the WCPO. Its distribution expands seasonally into subtropical waters to the north and south. It is a species characterized by large stock size, fast growth, early maturation, high fecundity, year-round spawning over a wide area, relatively short life span (maximum age of 4 or 5 years old) and variable recruitment. It is assumed that skipjack in the WCPO constitute a separate population (for stock assessment and management purposes) to those in the EPO. The distribution of skipjack tuna catch, 1990–2003 is given in Figure 25.

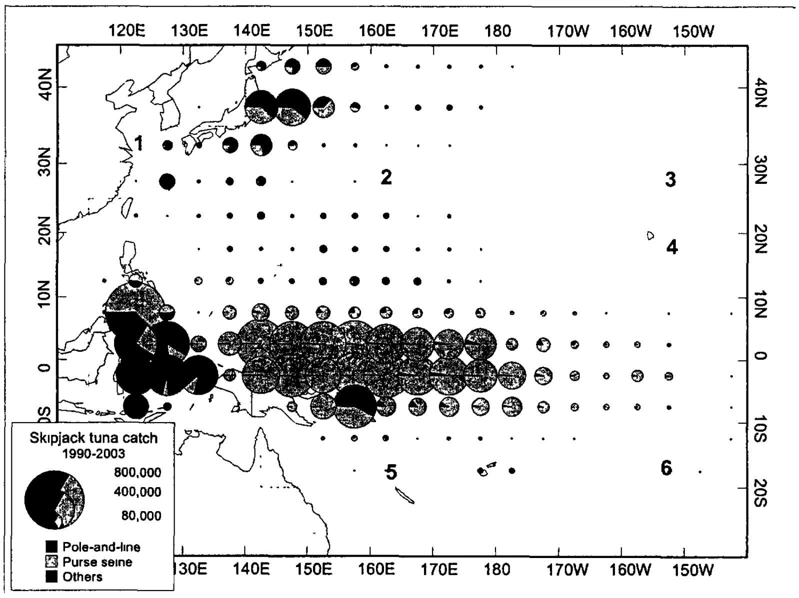


Figure 25. Distribution of skipjack tuna catch, 1990–2003

Trends

Catch and CPUE

The catch in 2003 was estimated to be 1,250,000 mt, a slight decrease on the 2002 catch; 75 % (940,000 mt) was taken by purse seine gear, 19% (242,000 mt) by pole-and-line gear and 6% (approximately 70,000 mt) by other gears. Nominal CPUE for major purse seine fleets, except the U.S. fleet, continues to be at high level, slightly decreased from 2002 level, being more than 20 mt/day fished in 2003 (Figures 26 and 27). This decline reflects the relatively poor catch (experienced by all fleets) in the second half of 2003. The fishing ground of the US fleet in 2002 was distributed in the eastern portion of the WCPO and differed from those of Japan, Korea, and Taiwan fleets; however, the area fished in 2003 was similar to that of other fleets.

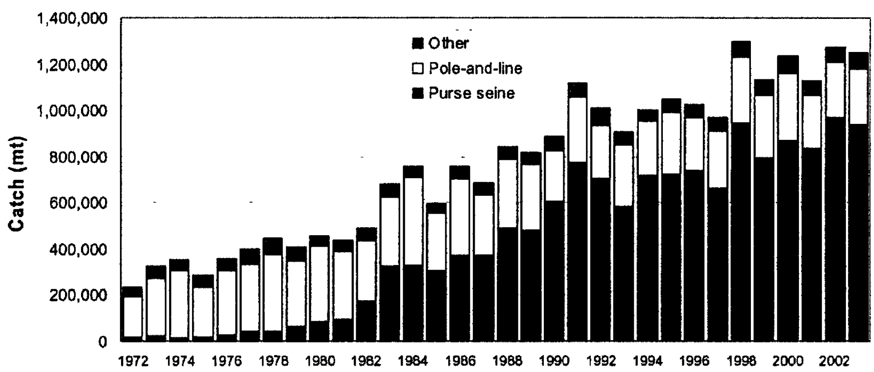


Figure 26. WCPO skipjack catch (mt) by gear for the period 1972 to 2003

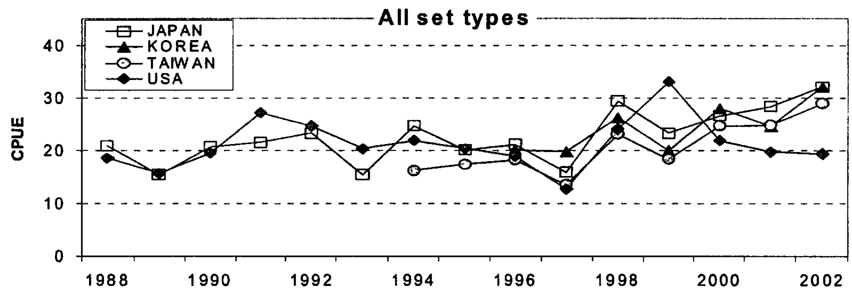


Figure 27. Nominal skipjack CPUE (mt per fishing days) for Japanese, Korean, Taiwanese and US purse seine fleets

Sizes of Fish Caught

Sizes of fish in the catch (based on weight) has largely been constant with a dominant mode at about 50-60 cm FL and a significantly smaller mode at about 30 cm FL (Figure 28). The larger mode consists of fish mainly caught by purse seine and pole-and-line gears and the smaller mode, by various gears of the domestic fisheries of the Philippines and Indonesia.

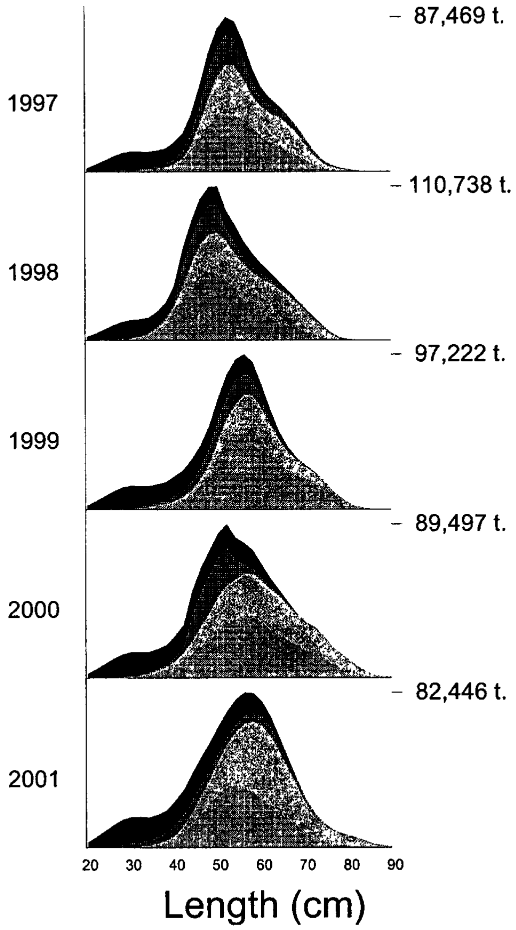


Figure 28. Annual Skipjack tuna catch-at-size in the WCPO, 1997–2001. The catch is broken down into the Indonesian/Philippines domestic fisheries (black), the pole-and-line fishery (hatched), unassociated-set catch from the purse-seine fishery (grey) and associated-set catch from purse-seine fishery (dotted). The y-axis scale is in weight; the figures on the right indicate the catch weight in a 2-cm size class

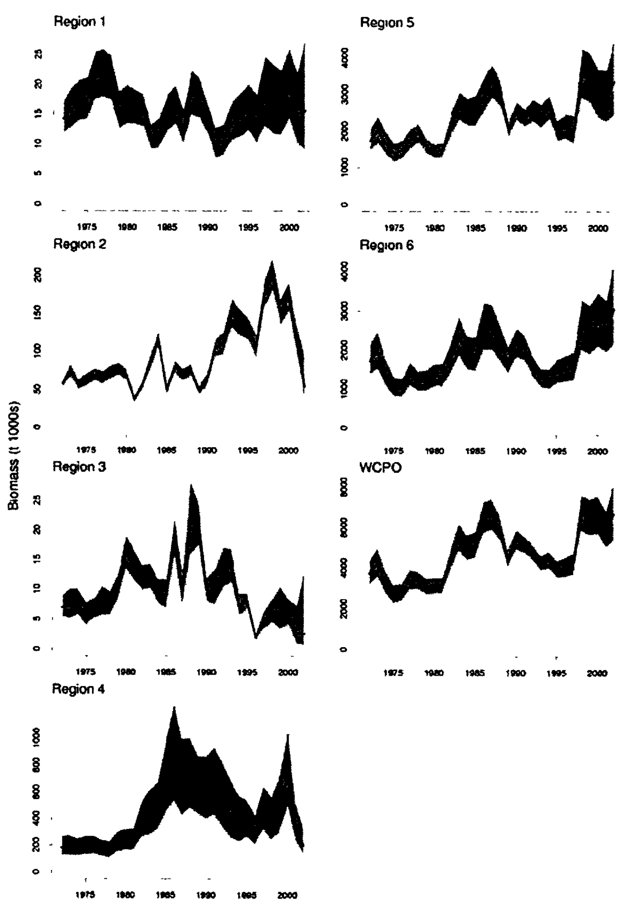


Figure 29. Estimated annual recruitment (millions) by region for the WCPO for the base-case analysis. The shaded area for the WCPO indicates the approximate 95% confidence intervals

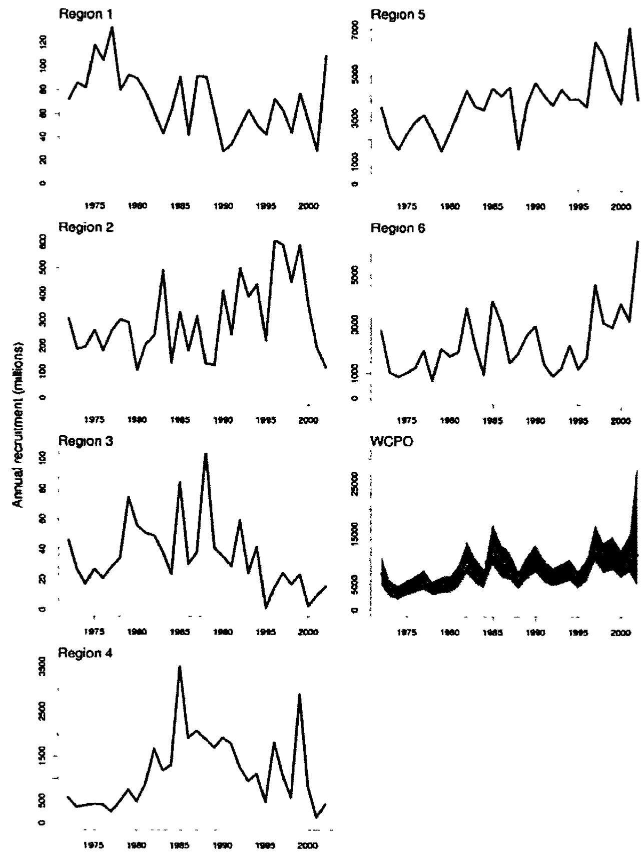


Figure 30. Estimated annual average total biomass (thousand t) by region and for the WCPO for the base-case analysis. The shaded areas indicate the approximate 95% confidence intervals.

Stock Assessment

Previous skipjack stock assessments have been undertaken with the MULTIFAN-CL model. No stock assessment of skipjack was undertaken in 2004 and the information presented below reiterate the results of the 2003 assessment.

Recruitment

Estimated recruitment has varied about three fold since 1972 and the trend has been upward. Estimated current recruitment, although less precise than estimates for earlier year classes, is among the highest in the time series (Figure 29). This high recruitment appears to be related to the El Nino phase of ENSO events.

Biomass

The level of biomass of skipjack tuna is largely dictated by the level of incoming recruitment to the population. Since 1972, the trend in estimated biomass has been upwards, following an apparent step-wise increase in recruitment (Figure 30). Current biomass is well above the biomass that would produce MSY.

Fishing mortality

The trend in estimated fishing mortality rate has been upwards since 1972, with the current overall fishing mortality rate (F) at a modest level of approximately 0.20-0.25 per year (Figure 31).

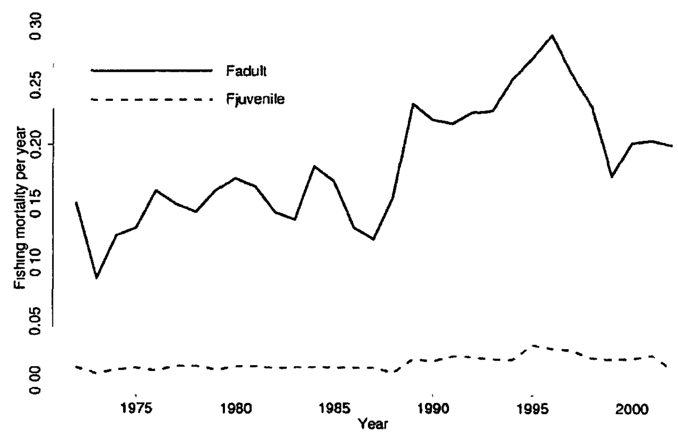


Figure 31. Estimated annual average fishing mortality rates for juvenile (age classes 1 and 2) and adult age-classes from the base-case assessment

Stock status

No formal stock assessment of skipjack was conducted this year and there was no additional information relating to fisheries indicators that could be used to update last year's stock assessment. Estimated biological reference points, particularly $B_{current}/B_{MSY}$ and $F_{current}/F_{MSY}$, indicate that the skipjack tuna stock of the WCPO is not overfished owing to recent high levels of recruitment and a modest level of exploitation relative to the stock's biological potential (Figure 32). Continued catches at the 1.2 million mt level are sustainable with continued high levels of recruitment (Figure 33), which are believed to be determined by principally environmental factors and not owing to a strong spawner-recruit relationship.

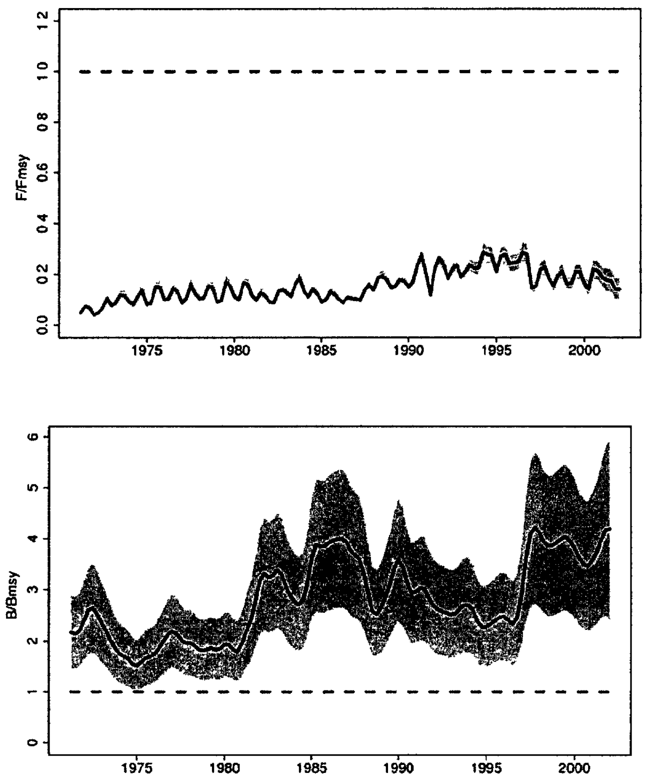


Figure 32. Ratios of F_t/F_{MSY} (top) and $B_t^{adult}/B_{MSY}^{adult}$ (bottom) with 95% confidence intervals. The horizontal lines at 1.0 in each case indicate the overfishing (a) and overfished state (b) reference points

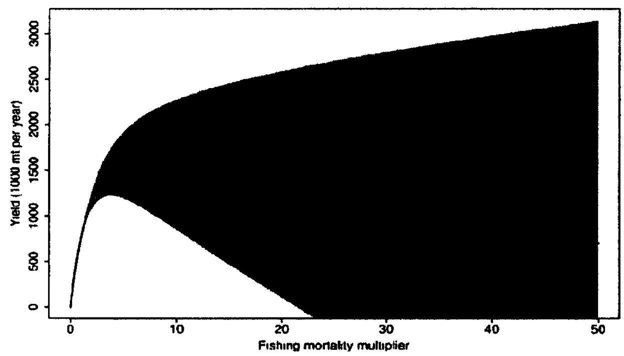


Figure 33. Predicted equilibrium yield and 95% confidence intervals as a function of fishing mortality (relative to the average fishing mortality-at-age during 1997-2001)

SOUTH PACIFIC ALBACORE TUNA

There was no formal assessment presented for albacore tuna in 2004. Therefore, the summary statement that follows is largely a repeat of that prepared at SCTB 16.

Key attributes

Albacore tuna comprise a discrete stock in the South Pacific Ocean. Mature albacore (age at first maturity, 4 – 5 yr; ~ 90 cm FL) spawn in tropical and sub-tropical waters between about 10°S and 25°S during the austral summer, with juveniles recruiting to surface fisheries in New Zealand coastal waters and in the vicinity of the sub-tropical convergence zone (STCZ – about 40°S) in the central Pacific about two years later, at a size of 45–50 cm in fork length. From this region, albacore appear to gradually disperse to the north, but may make seasonal migrations between tropical and sub-tropical waters. Albacore are relatively slow growing, and have a maximum fork length of about 120 cm. Natural mortality is low compared to tropical tunas, with significant numbers of fish reaching an age of 10 years or more.

Trends

Catch and effort

Catch in 2003 reached 55,371 mt, which is the second highest in the post-drift net period (Figure 34). Since drift netting ceased in 1992, catches have predominantly come from troll fleets of New Zealand and the US south of 30°S, and by longliners which fish mainly between 10°S and 50°S (Figure 35).

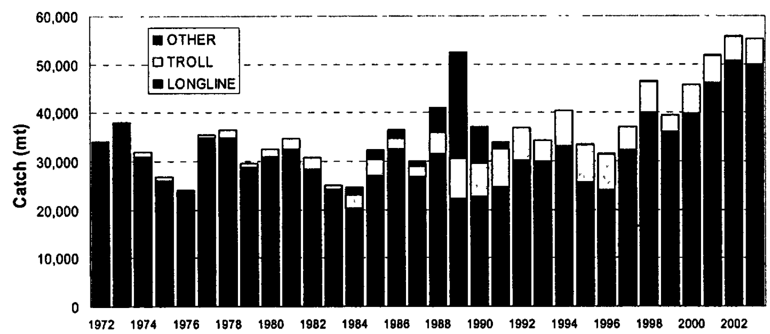


Figure 34. South Pacific albacore catch by gear type
'Other' is primarily catch by the driftnet fishery

Catches from the Pacific Island Country (PIC) longline fleets have increased in recent years. In 2002 these fleets accounted for 50% of the total longline catch. The Taiwanese fleet, which has traditionally targeted albacore and has accounted for the majority of the historical longline catch, recently moved some of its activities to target seasonally albacore in northern temperate waters or bigeye in the tropical waters of the WCPO. The catch of albacore by this fleet has therefore fallen in recent years.

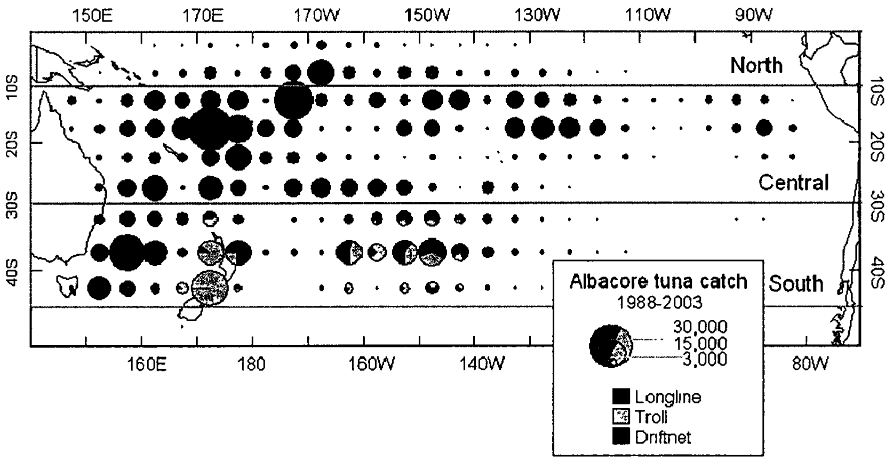


Figure 35. Distribution of South Pacific albacore tuna catch, 1988–2003

CPUE has been fairly stable in the central zone (10°–30°S), where catch rates from the PIC fleets have tended to converge in recent years. The current CPUE in several PIC longline fleets is significantly less than the levels attained in the early years of these fisheries. In some cases, high CPUE has been maintained by expanding the area of fishing to the extremes of the EEZs and beyond. There has been a gradual decline in the catch rates in a number of fisheries. This decline has been gradual in some fisheries and stronger in other areas, particularly Samoa and American Samoa. However, the CPUE for the Samoan and American Samoan fleets remains higher than other fleets despite these declines. Some degree of convergence in CPUE is also noted for the New Zealand and the US troll fleets, although CPUE for the US vessels has generally been higher and more variable.

Size of fish caught

Longliners catch larger albacore, with the size distribution typically comprising a single multi-age-class mode with a modal length of 90–100 cm (Figure 36). Troll catches are of smaller albacore, typically 50–85 cm in length. Size composition varies from year to year, but no trends are evident over the past five years.

Recruitment

Recent application of a high resolution environmental and population dynamics simulation model (SEPODYM) to South Pacific albacore has provided some preliminary results on the possible mechanisms for recruitment variability. Recruitment as estimated by MULTIFAN-CL (see stock status below) appears to be negatively correlated with El Nino events, which may explain low recruitment rates in the 1980s and 90s (Figure 37).

Biomass

Biomass levels have largely reflected the variation in estimated recruitment, peaking in the late 1950s and late 1970's (Figure 38). Current biomass is estimated to be about half of the maximum estimated levels and about 60 % of the estimated biomass in the early 1950s. Biomass is concentrated in the area south of 10°S.

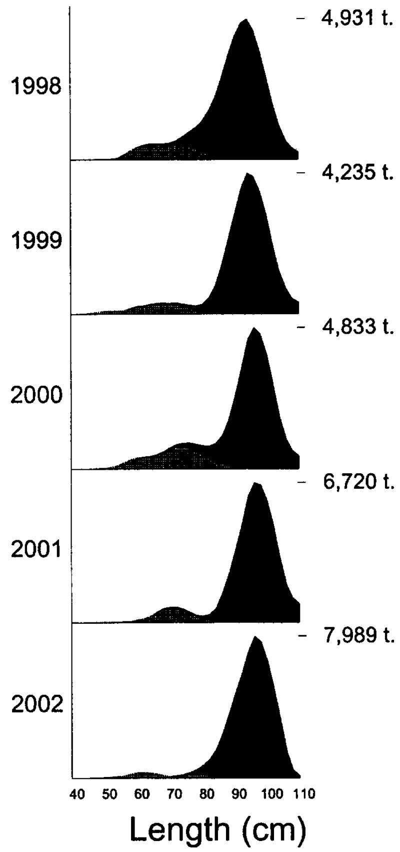


Figure 36. Annual albacore tuna catch-at-size in the south Pacific, 1998–2002. Longline = black; troll = hatched. The y-axis scale is in weight - the figures on the right indicate the catch weight in a 2-cm size class

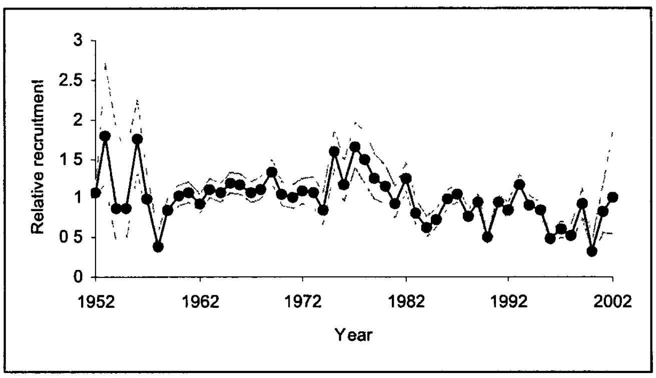


Figure 37. Estimated annual recruitment, with 95% confidence intervals, scaled to the average of the points estimates

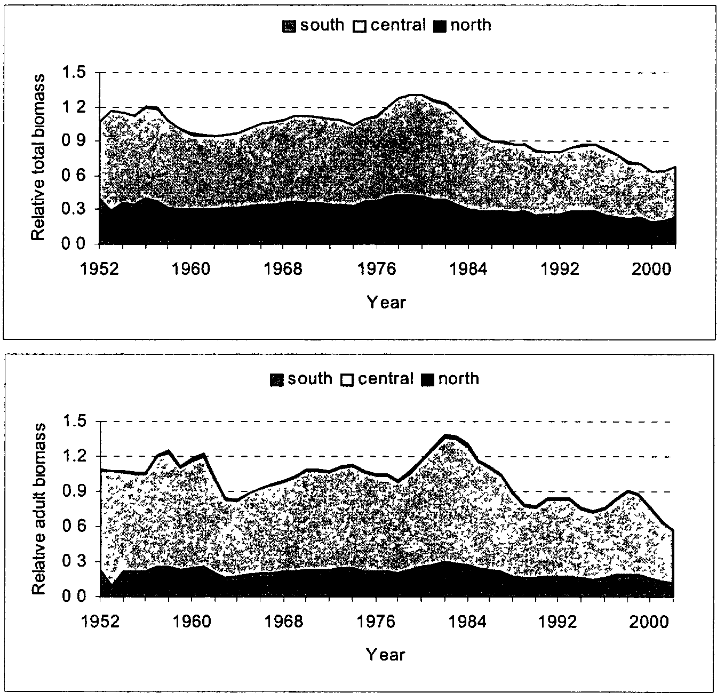


Figure 38. Estimates of relative total and adult biomass, by region

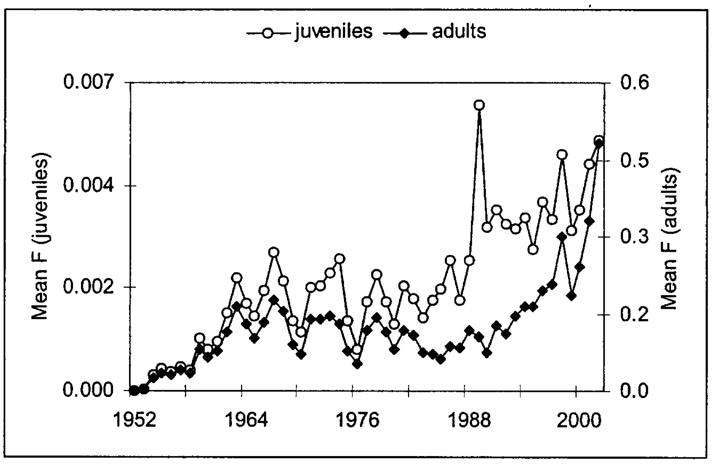


Figure 39. Estimated average annual fishing mortality rates for juveniles (ages 1-5) and adult (ages 6-12) albacore in the South Pacific

Fishing mortality

Fishing mortality is higher for adult albacore than for juveniles, reflecting the predominantly longline exploitation (Figure 39). Total fishing mortality appears to be considerably lower than natural mortality. The impact of the fisheries on total biomass is estimated to have increased over time, but is likely to be low to moderate across a plausible range of model assumptions.

Stock status

No formal stock assessment of South Pacific albacore was conducted this year and there was no additional information relating to fisheries indicators that could be used to update last year's stock assessment. The meeting therefore had no basis for altering the main features of last year's assessment, namely that it is unlikely that the South Pacific albacore stock is being overfished or that it is in an overfished state. The meeting did, however, consider further analyses of the declines in CPUE in some Pacific Island states in 2003. Results indicated that much of this decline is a consequence of changed oceanographic conditions, though high levels of localised effort may also be impacting on CPUE in these fisheries. Catch rates for most fleets have recovered over the last 12 months.

The current (2003) stock assessment was conducted with MULTIFAN–CL. The fishery for albacore is unique in that it has exhibited no significant trend in catches over the period of 1960 – 1995. Due to the problems faced by all assessments conducted with limited data on stocks, which have been apparently exploited at only low exploitation rates over the period of the fishery, the results obtained provide little information on the biomass of the stock. Improved results from this model would be expected if there were better return rates of tags placed on albacore.

The 2003 assessment gave similar results to the 2002 assessment, with a low impact of fishing on biomass, and indicated that the current biomass is at about 60% of unfished levels. It is therefore unlikely that the stock is being overfished or is in an overfished state.

ECOSYSTEM & BYCATCH WORKING GROUP

The Ecosystem & Bycatch Working Group (EBWG) heard seven presentations divided between ecosystem modeling and bycatch research.

There were five presentations under the ecosystem modeling part of the agenda. The first two papers concerned the application of SEAPODYM (Spatial Ecosystem And Populations Dynamics Model) to forage population and to the top-predator species. These preliminary results suggest that the El Nino phase of ENSO results in better recruitment for skipjack. An integrated analysis of tuna abundance and size structure as indicators of ecosystem impacts of fishing was presented. This study showed the changes estimated from the model for both the exploited and unexploited populations of skipjack, bigeye, yellowfin and albacore tunas. The use of individual/agent-based modeling was presented with examples of application to studies on turtle distributions and information sharing by fishing fleets. A paper on regime shifts in the WCPO and its tuna fisheries was presented. The paper described the Pacific Decadal Oscillation (PDO) and how the recruitment of WCPO skipjack, bigeye, yellowfin and albacore appeared to track changes in the PDO. This paper generated considerable discussion on how much weight could be put on these preliminary results, given the potential downturn in recruitment for skipjack, bigeye and yellowfin tuna.

A comprehensive account of fish and seabird bycatch in New Zealand tuna longline fisheries indicated that blue shark, albacore and Ray's bream comprised the dominant bycatch. The study demonstrated the importance of observer data in detecting the impacts of fishing on non-target species.

A review was presented of of shark, seabird and sea turtle bycatch in Japanese tuna longline fisheries. Over the time period studied, some shark CPUEs, such as blue shark, were stable in all oceans, while others, such as shortfin makos showed declining trends in the North Pacific and Atlantic Oceans. Results from the Japanese study on the southern bluefin tuna fishery showed the efficacy of the combination of tori line and blue dyed bait for reducing seabird bycatch. Research on turtle mitigation showed that there was no difference between turtle takes for J-hooks and circle hooks, although the Japanese J-hooks are not exactly the same as the J-hooks used elsewhere, being slightly circular, and the size of the circle hooks is not the same in all studies. However, this study clearly showed that turtles caught on circle hooks were hooked predominantly in the mouth. Experiments were being conducted with longline gear to identify methods to ensure that hooks were consistently set deep to avoid hooking turtles.

The future of the EBWG was discussed. It was noted that there had been some degree of overlap between the EBWG and the Fishery Technology Working Group, particularly in terms of issues related to reducing bycatch (non-target, associated and dependent species). Although there was some concern about the grouping of ecosystem modeling with bycatch, there was a consensus that the two topic areas be maintained in a single working group, incorporating bycatch issues formerly handled by the FTWG. Standing Committee was asked to review the previous recommendations generated from the Billfish and Bycatch Research Group (BBRG), and recommendations for future ecosystem research.