出國報告（出國類別：其他）

參加「經濟合作發展組織（OECD）第 109 屆漁業委員會（COFI）」報告

服務機關：行政院農業委員會漁業署
姓名職稱：曾綺停技士
派赴國家：法國（巴黎）
出國期間：101 年 4 月 21 日至 4 月 27 日
報告日期：101 年 5 月 30 日

參加「經濟合作發展組織（OECD）第 109 屆漁業委員會（COFI）」報告

摘要

一、經濟合作發展組織（OECD）第 108 屆漁業委員會（COFI）會議於本（2012）年 4 月 23 日至 25 日在法國巴黎 OECD 總部舉行，與會者計有德國、比利時、土耳其、加拿大、智利、韓國、丹麥、西班牙、愛沙尼亞、美國、法國、匈牙利、愛爾蘭、冰島、義大利、日本、墨西哥、挪威、紐西蘭、澳洲、荷蘭、波蘭、葡萄牙、斯洛伐克、捷克、英國、瑞典、俄羅斯，及我國、阿根廷、泰國、聯合國糧農組織（FAO）等觀察員，主席由德國籍 Mr. Philippe FERLIN 擔任。我代表團成員包括漁業署遠洋漁業組曾綺停技士、中華民國對外漁業合作發展協會張正昇組長及我駐巴黎辦事處徐炳勳秘書。

二、本（109）屆會議主要討論漁業委員會秘書處針對綠色成長(Green Growth)、OECD 之發展策略(Development Strategy)及 FAO/OECD 之農業展望(Agriculture Outlook)等所涉議題之研究報告，主要包括「捕撈漁業及養殖漁業之能源使用」、「捕撈漁業與養殖漁業廢棄物與再利用」、「養殖漁業」、「漁業治理」之綠色成長議題，及漁業委員會秘書處預定於 2012 年完成之工作，暨 2013-2014 年工作計畫及預算等。

三、漁業委員會〈COFI, committee for fisheries〉匯集跨領域、跨地域專家學者意見，研議當前國際全方位漁業政策改革，其會員多爲歐美先進國家，尤其以歐盟國家作爲主體，各國參加人員亦參與聯合國糧農組織（FAO）及世界貿易組織（WTO）、區域性漁業組織等國際組織進行漁業管理相關議題溝通協商，建立各方聯繫管道，並蒐集當前國際全方位漁業政策，給與政策執行者制定之參考依據，爰我國宜持續參與 OECD COFI 相關會議，俟機經驗分享與交換國際漁業知識，有助於強化我國國際競爭力，更能爲全球永續漁業發展之願景貢獻心力。

參加「經濟合作發展組織（OECD）第109屆漁業委員會（COFI）」報告

目　　次

附件目次

壹、 目的

一、經濟合作暨發展組織（Organization for Economic Co-operation and Development, 簡稱 OECD）成立於 1961 年，總部設於法國巴黎，目前有 34 個會員國，主要是以工業先進國家爲主，由各會員國及歐洲執委會（European commission）各推派一位代表組成理事會（Council）是最高權力機構，另設立各種不同之專門委員會（Committee）、工作小組（Working Party）及專家小組（Expert Group），針對實質經濟與社會問題進行討論與研究，相關成果則做成報告或建議案提報理事會裁決，OECD 之秘書處則負責協調及行政後勤工作，討論與研究成果則做成報告或建議提報理事會裁決。目前「漁業」、「鋼鐵」及「競爭」是我國三個得以「一般觀察員」身分參與 OECD 年會的部門。

二、漁業委員會〈COFI, committee for fisheries〉以責任制、永續性、全球化及生態和諧等思維爲基礎，匯集跨領域、跨地域專家學者意見，研議當前國際全方位漁業政策改革，進而影響聯合國糧農組織（FAO）及世界貿易組織（WTO）、區域性漁業組織等國際相關組織的政策方針，受到許多國家之關注與討論。漁業委員會代表團多爲各國參與國際組織之代表性人物，建立各方聯繫管道，有利於未來國際漁業合作及交流，爰我國宜持續與 OECD 漁業小組保持密切聯繫，我國倘有機會在專案計畫合作進行研究，或合辦相關研討會，以共同關切議題活絡關係，促進與相關國家的互動，營造有利於參與國際社會的條件，以增加參與程度。

三、我國歷年積極參與 OECD COFI 年會各項議題，並針對秘書處所需填報統計數據、問卷與國家報告，與會中可能分享經驗及表達看法，以促進國際漁業交流。秘書處所蒐集之相關統計資訊爲研究漁業發展之依據，其內容涵蓋全球漁業現況暨發展趨勢，該結果可作爲我國漁業政策研擬及產業輔導之參考方向。

四、有鑑於 OECD COFI 各國代表團多爲參與國際組織之代表性人物，出席者均爲政府官員、國際組織代表及學者專家，故參與會議能建立各方聯繫管道，有助於促進未來國際漁業合作及交流，並能適時瞭解我國漁業定位與發展，有助於強化國際競爭力，更能爲全球永續漁業發展之願景貢獻心力。除了 COFI 正式議題外，利用會議之空檔與其他國家代表作非正式溝通及意見交換，對熱絡與相關組織及國家的聯繫管道具有相當助益。

貳、 會議過程

一、經濟合作及發展組織（OECD）漁業委員會（COFI）於本（2012）年 4 月 23 日至 25 日在法國巴黎 OECD 總部召開第 109 屆委員會議，我方在我國駐巴黎辦事處徐炳勳一等秘書陪同下，由本署遠洋漁業組曾綺停技士及中華民國對外漁業合作發展協會張正昇組長以「一般觀察員（Regular observer）」身份出席。

二、本次會議時程安排原則自上午 9 時 30 分起至下午 6 時止，包含中午休息 2 小時，出席者有有德國、比利時、土耳其、加拿大、智利、韓國、丹麥、西班牙、愛沙尼亞、美國、法國、匈牙利、愛爾蘭、冰島、義大利、日本、墨西哥、挪威、紐西蘭、澳洲、荷蘭、波蘭、葡萄牙、斯洛伐克、捷克、英國、瑞典等會員國代表，及我國、阿根廷、泰國、聯合國糧農組織（FAO）等觀察員代表，會議主席由法籍 Mr. Philippe Ferlin 擔任。

三、會議係以專家論壇的模式進行，原則上先由委員會研擬報告之大綱及方針，委請專家學者草擬報告草案，於一定時間提供各會員國審查研究後，召開委員會供各會員國據實務經驗及施政觀點闡述修正意見，最後由秘書處整合各方意見統一修正後，公佈各國施政及研究參考。

四、本次會議主要係討論 OECD 之綠色成長(Green Growth)、OECD 之發展策略(Development Strategy)及 FAO/OECD 之農業展望(Agriculture Outlook)等所涉議題，及漁業委員會秘書處預定於 2012 年完成之工作，暨 2013-2014 年工作計畫及預算等。

伍、本次我方出國開會行程如次：

4 月 21、22 日（星期六、日）搭機經阿姆斯特丹轉機赴法國巴黎

4 月 23 日（星期一）參加 OECD 的 COFI 第一日會議

4 月 24 日（星期二）參加 OECD 的 COFI 第二日會議

4 月 25 日（星期三）參加 OECD 的 COFI 第三日會議

4 月 26 日（星期四）返程，由法國巴黎經阿姆斯特丹

4 月 27 日（星期五）返回國門

參、 會議紀要

本（109）屆會議主要討論漁業委員會秘書處針對綠色成長(Green Growth)、OECD 之發展策略(Development Strategy)及 FAO/OECD 之農業展望(Agriculture Outlook)等所涉議題之研究報告，主要包括「捕撈漁業及養殖漁業之能源使用」、「捕撈漁業與養殖漁業廢棄物與再利用」、「養殖漁業」、「漁業治理」之綠色成長議題，及漁業委員會秘書處預定於 2012 年完成之工作，暨 2013-2014 年工作計畫及預算等。會議主要議題及會議文件內容，茲按日分述如下：

4 月 23 日：第一日除工作報告及業務檢討外，並探討綠色成長之漁業和養殖之能源使用（A Green Growth Perspective on Energy Use in Fisheries and Aquaculture）、漁業與養殖資源之廢棄物與再利用（A Green Growth Perspective on Waste and Improved Use of Fisheries and Aquaculture Resources）、檢視養殖漁業管理(A Green Growth Perspective on Aquaculture)、檢視漁業管理（A Green Growth Perspective on Fisheries Governance）等議題進行討論及審查及修訂 2012 年漁業指南之指導方針說明。

一、議程草案（議程一）：FERLIN 主席宣布會議開始。對於貿易及農業處長議程草案部分，本應由貿易及農業處長 Mr. Ken ASN 報告議題二，由於 ASN 未出席本會議，主席請漁業委員會(COFI)秘書長 Carl SCHMIDT 說明 OECD 發展狀況，並說明本屆會議倘有部分時程調整，亦請各與會人員包容。

二、貿易及農業處長報告 COFI 近況（議程二）：2011 年 OECD 部長理事會通過綠色成長策略(Fisheries and Green Growth)，所謂綠色成長係指成長，亦最近 OECD 重點工作項目，建立在永續發展才是成長策略，故 COFI 選擇 4 個研究方向做爲本次議程。

三、漁業綠色成長進度報告（議程三）：

（一）漁業和養殖之能源使用：

1.由 Mr. Roger MARTINI 發表，強調能源使用分爲三個面向：漁船效率與船隻及動力機械的特性(技術改善)、漁民之漁業行爲(習慣)、管理制度對漁業燃料之影響(管理制度)均有關，由文獻蒐集發現技術改善不如船長習慣及管理制度，希望在 2012 年 10 月第 110 屆會議能提供出草稿，並提供出使用能源更具效率的方法。

2.紐西蘭表示，該文章重點爲強調捕撈方式，並無強調節約能源使用方向，

法國表示漁撈技術宜顧慮漁具改善方面，才能有效率節省能源。

3.經多方討論後，主席裁示在資料蒐集條件允許下，由採捕的能源使用方式擴充到漁產品經濟化過程(如：加工、流通、行銷)，多方考量經濟、社會因素。

4.大家對此議題內容及未來發展，均表贊同。

（二）漁業與養殖資源之廢棄物與再利用：

1.由 Dag Erling STAI 說明內容，強調廢棄物之處理將涉及糧食安全議題，妥善運用將有易於糧食安全及有助於永續發展。針對漁業食物鏈中不同形式之損失進行研究，並加入對政策之研析以提供提升效率之建議，未來可對該部門增加盈利能力及永續能力且增進糧食安全。

2.本次報告爲第一次初稿，希望在明年有第二版更新資訊。

3.加拿大、歐盟、冰島、紐西蘭及美國等強調文件研究範圍應擴大至捕撈量與丟棄量之間關係；惟紐西蘭、日本、美國等經濟體均強調這爲全球性問題，不應拘泥於 OECD 會員國，研究範圍應大。（三）針對各國回應，秘書處表示因資料不足，目前研究方向與重點是基本資料之蒐集及初步分析，倘有足夠資料，未來再進行經濟模型的評估分析，以現有可取得之資料，無法進行建立經濟分析模型的工作。最後在與會者同意於本年 11 月 18 日前補交資料，秘書處同意草擬之研究報告可納入評估移除燃油稅捐減免之衝擊，報告初稿並將於 2012 年 4 月第 109 屆 COFI 會議討論。

4.主席請作者表達對上述意見，歸納出因目前 OECD 資料完備，故以該資料作爲主體研究，未來倘他國有類似資料亦可納入，另由於丟棄資料較完備，後端延伸至產銷方面資料不足，未來倘資料足夠支持該研究，亦可將研究擴至生產過程。

（三）檢視養殖漁業管理：

1.由 Mr. Dongsik WOO 報告，內容以分析成功養殖案例，透過跨國經驗交流分享，分析可幫助發展的意見，做爲未來納入綠色成長之政策，並歸納以往綠色成長成功因素，試著提出養殖綠色成長如何因應之道。

2.本議題預計在 2012 年 10 月要提出第一版文件，2013 年第 110 屆會議舉辦研討會，2014 年 4 月要完成該文件。

3.歐盟強調現行工作內容應不宜與 FAO 工作重複，芬蘭、荷蘭強調不應侷限海上養殖，陸上養殖亦須納入考量，智利強調使用空間衝突狀況，也

應納入成爲評估指標。

4.日本提出捕撈做爲養殖漁業飼料，也應成爲指標，況有些養殖來源取自野生稚魚(如鰻魚)，因此養殖對野生漁業產生衝擊也應考量。

5.紐西蘭認爲該工作對 COFI 有助益，目前討論結果尚無方向，無法支持未來召開工作小組會議。

6.Dong 回復文中指標應爲參考，不僅只文章內之指標，會員提出資訊亦會一併納入，秘書處 Carl 回稱，了解紐西蘭想法，會在 110 屆會議中提出更具體資料給會員國參考。主席裁示，各會員高度關切此議題，請秘書處考量各會員國意見，進一步規劃研究方向。

（四）檢視漁業管理：

1.漁業部門中綠色成長與管理之聯繫極爲密切，而目的爲推動經濟成長、帶入環境關切議題，同時運用生態系統的觀點作爲切入的方向。此份研究首要綱要並分析綠色成長觀點在漁業管理的重要性—主要爲管理架構，其可帶來經濟成長而同時將環境生態系統的觀點納入考量(其與現行的「褐色成長」無法帶來永續經營的結果完全不同)，不同的管理機制與漁業管理制度導向不同的社經環境結果，最重要的是，增進漁業中「綠色成長」與「管理」的相互作用。

2.強調各國皆有針對漁業管理之政策，不管目標爲何，請各會員提供資料來評估政策有效性。

3.歐盟、智利、瑞典均認爲內容方向語意不清，希望秘書處加以說明所需資料。

4.加拿大認爲每一政策均有明確目標，但不知是否達到，是否有指標來評估自己國內政策是否有達成綠色成長指標，美國對此表達支持之意。

5.美國主張援用先前重建漁業經濟支架構，由各會員國組成，提供評估指標，以協助秘書處，瑞典亦表贊同。

6.日本提出，已發表相關研究案例可作爲良好漁業治理方向，並已發表在 FAO 之 605 技術文件。

7.紐西蘭、冰島對組成工作小組提供秘書處之提議，因每一個國家漁業政策均因背景不同，倘一併討論，恐對國內漁業有危害，主席對此裁示明天後再談。

四、審查及修訂 2012 年漁業指南（議程四）：

（一）指導方針(Guidelines for Country Notes)：請會員提供 2010-2011 年資料，希望在 2012 年 7 月 31 日前交出，約 10 至 15 頁，填寫內容與以往差異不大，Carl 認爲娛樂漁業可增填在管理方面，有關該金額計算，採國內貨幣，不需轉換爲美元或歐元。。

（二）建立 2013 年統計模板(Template for Fisheries Statistics (2010-11) 2013 edition)：希望提供 2009-2011 漁業統計資料，並於 2012 年 8 月 31 日前繳交，請各會員國留意時效。主席裁示本日會議時間已結束，明（24）日繼續討論。2.韓國表示設計及擬定漁業重建經濟計畫要考慮各國漁業發展的差異性。

4 月 24 日：本日繼續討論制訂漁業管理手冊（議程五）、OECD/FAO 於 2012 年 2 月 3 日會議報告及 2021 展望更新口頭報告（議程六）及審議 2013 至 2014 及以後之工作計畫（議程七）及漁業燃油稅的優惠分析替代方法評價（議題三），與會者未變。謹將本日會議重點扼陳如次：

一、制訂漁業管理手冊（議程五）：

（一）由 Mr. Roger MARYINI 進行報告，該內容包含 OECD 漁業委員會相關漁業及養殖政策，將以往 OECD 曾製作有關漁業管理文獻重新編彙，並配合現今資料加以修訂，提請會員國共同討論，以期提供漁業及水產養殖決策管理人員參考。該文件預計在 2012 年 10 月於 110 屆提出第一次初稿，本份文件共計 10 章。

（二）日本、韓國均認爲該篇立意良好，不應僅限會員參考，應於網上開放給各界參考使用，歐盟、冰島亦表認同，另表示該彙整資料過於老舊，漁業管理發展快速，重點工作應以蒐集現有資料並增列目前國際間正在浮現議題之可能政策方向；智利、挪威、加拿大則建議應將養殖漁業管理獨立撰寫一章於該手冊中。

（三）美國認爲我們應思考未來手冊會朝向「手冊」還是「指南」方向發展，Roger 回復未來將以「手冊」方式呈現。

（四）Roger 瞭解該文件資料老舊，此點會加以改進，並盡量勾畫出目前浮現於業議題之可能政策方向與取向，並以專章方式討論養殖漁業管理，亦將漁業認證一併納入第四章漁業管理議題工具之選項之一。

二、有關「OECD/FAO 於 2012 年 2 月 3 日會議報告及 2021 展望更新口頭報告」（議程六）：本議題首先由 FAO 漁業統計人員 Ms. Stefania VANNUCCINI 說明，FAO 與 OECD 於 2010 年開始進行共同研究，針對未來 10 年漁產品發展狀況提出以「全球漁業發展」、「OECD 會員國漁業發展」爲研究主體

之預測，將於本(2012)年 6 月出版之 2012 至 2021 年漁產品價格與生產預測報告，其表示該篇主要內容以「供應」、「消費」、「需求」、「貿易等面向」探討包含養殖、捕撈、魚粉之漁業，藉以了解未來全球漁業供應量。

（一）以全球漁業發展：於 2021 年全球漁業產量將會比 2009 至 2012 該三年之平均(ave.3)增加 15%，養殖將增加 32%，捕撈將增加 3%，魚粉將增加 15%。2021 年養殖漁業將佔全球漁業產量之 46%。另以全魚製作之魚粉產量僅占 60%，無用之魚類廢棄物製成魚粉將高達 40%，另，2018 年養殖食用魚將超過捕撈食用魚量。

（二）以 OECD 會國漁業發展：於 2021 年 OECD 會員國養殖漁業產量占全球 8%，捕撈漁業占全球 25%。

（三）OECD 農業貿易處副處長 Mr. Read ASFADI 說明 Agriculture outlook 爲 OECD 與 FAO 之共同研究，將於每年 2 月與 FAO 共同研議以期達成採何種模型來預測及設定前提條件。今年 4 月產出第一次草稿，提供各會員國交換意見，該文件將於 6 月出版。

三、審議 2012 至 2013 及以後之工作計畫（議程七）：

（一）由秘書長 Carl 說明，今年工作項目有政策管理與評估方面，其中有數項優先處理議題，經會員國確認優先次序如下：

1.第一優先順序：製作各國漁業檢視資料(政策管理方面)，重點有兩項，一爲漁業檢視資料(同指導方針)須於 7 月 31 日前繳交，另一爲漁業統計資料(同建立 2013 年統計模板)需於 8 月 31 日前繳交。

2.第二優先順序：製作綠色成長進度報告，包含「漁業和養殖之能源使用」、「漁業燃油稅的優惠分析替代方法評價」、「漁業和水產養殖資源之廢棄物與再利用內容」、「漁業管理」。

3.第三優先順序：OECD 在 2010 年通過加強發展中國家對話、和其他捐助機關合作，讓資源更有效運用。預計在 2014 年與 FAO、World bank、OECD 共同召開部門工作小組會議，針對如何讓資源更有效利用、協助發展中國家如何減貧、增加糧食安全等議題研議。2013 至 2014 之間 OECD COFI 亦會成立進行內部績效評估，該評估主要參考 COFI 每年工作計畫內容，以工作計畫執行程度做爲評估指標。

（二）日本、紐西蘭、美國均認爲應以漁業制度爲第一優先考量，歐盟各會員國則以能源議題爲優先考量。

（三）韓國在會中表明，將在 2012 年 12 月底舉辦養殖漁業永續發展研討會。另對昨日在檢視漁業管理議題成立工作小組，紐西蘭則不再反對。

四、漁業燃油稅的優惠分析替代方法評價（議題三）：

（一）本文件先由 Roger 說明內容，由於該資料完整性較低，需資料補充才可進行，其中以「利用分析模型去調查分析燃料價格改變對消費者、漁民、燃料供應商之影響」、「ENV-Linkages 模型提供了最完整的方法來評估漁業政策改變對社會經濟的影響」方向進行。

（二）歐盟大部分國家均支持該作法，日本則以該研究政策不能被其他國際組織參考而以該研究內作爲審視各國用油可行性依據。主席對此表示瞭解。

（三）本日會議到此結束。

4 月 25 日：開始主席即宣布由於時間安排之不便利性，將議程十與議程九相對調，今日議程包括：昨日未討論完成之漁業燃油稅的優惠分析替代方法評價(議題三)、其他活動(議程八)、其他業務(議題九)、審議俄羅斯加入 OECD(議程十)(觀察員無法參加)及通過漁業委員會第 109 屆會議的簡要記錄(議程十一)。當日會議進行情形如次：

一、漁業燃油稅的優惠分析替代方法評價(議題三)：

（一）歐盟、瑞典主張對該議題要先收集資料，建立使用 OECD 現有模式來評估漁業燃油稅的優惠分析替代方法，日本對此表示贊同，惟不涉及政策意涵僅技術分析問題則可接受該研究繼續進行。

（二）主席裁示，照秘書處可行模式現有資料評估，在 2012 年 10 月針對秘書處所做之可行性報告再來討論其可行性。主席另宣布，經秘書處諮商結果顯示，有關「漁業 handbook」及「漁業及水產養殖資源之廢棄物再利用」研究，預計在今年 10 月經 COED COFI 第 110 屆會議後定稿。

二、其他漁業相關活動報告（Other activities）文件（議程八）：

（一）有關其他 OECD 部門漁業相關活動報告主要有 3 份報告，(1) OECD 稅務政策中心 Mr. Brian 說明在挪威政府資助下，該中心已成立工作小組，研究利用稅務工具以增加成本及避免不當獲利，以打擊 IUU 漁業；(2)OECD 環境組 Ms. Nathalie 則說明簡介 OECD 參與今年 6 月將召開 Rio Plus 20 會議之情形，內容包括參與宣言草案之草擬工作及與各國政府商討綠色成長相關議題；(3) Carl 秘書長簡介永續養殖系統合作發展計劃，該計畫主要爲提供有關漁業與養殖漁業經費財務資助，倘各會員國有意可在 OECD 網上取得更進一步資料。

（二）此外，由於秘書處所提出報告中提及完成檢視印尼漁業政策報告及建議案。職向秘書長探詢得知印尼正爭取加入觀察員，秘書長並表示會後將

與印尼代表團商討成爲觀察員乙節。

三、審議俄羅斯加入 OECD（議程十）：有關俄羅斯加入成爲 OECD COFI 會員乙節，因該會議依 OECD 議事規則規定，觀察員須迴避，我國無法參加。

四、其他業務(議題九)：秘書長說明，由於經列入 Council 理事會建議案，照 OECD 規定，各會員國每 3 年須針對理事會建議案之議題內容以問卷方式反映其執行狀況，會後各會員國會收到該部門問卷調查內容，今年題目爲「會員國在過去 3 年有無執行減船政策 commision scheme」。

五、通過漁業委員會第 109 屆會議的簡要記錄(議程十一)：

最後各會員國亦針對會議紀錄內容進行廣泛性討論，並於本日下午 6 時確認會議紀錄內容，結束本次會議。

肆、 心得與建議

一、本次會議之主要成果係討論綠色成長之發展策略，透過秘書處將 OECD 曾製作有關漁業管理文獻重新編彙，並配合現今資料加以修訂，以期提供漁業及水產養殖決策管理人員參考及後續制定政策之依據。本會議顯示 OECD 會員國對綠色成長之永續概念之重視，並預計於 2014 年底前完成「捕撈漁業及養殖漁業之能源使用」、「捕撈漁業與養殖漁業廢棄物與再利用」、「養殖漁業」、「漁業治理」等 4 篇報告作爲 COFI 綠色成長之產出。

二、因應漁業資源日益減少及氣候變遷之衝擊下，對於有效漁業再利用逐漸受全球重視，未來全世界勢必會對資源之利用及控管更加嚴格，亦將有更多國家加入聲援，爰我方應積極把握出席參與相關國際會議之機會，以掌握國際新規範及趨勢，並將相關資訊提供給各界參考，以期提早輔導產業轉型以達符合國際標準，並提升國際競爭力。

三、OECD 所出版的報告，雖不似聯合國研訂之規則具國際法之效力，惟所探討的議題通常較爲前瞻，議題成果容易被其他管理組織做爲參考依據，以近年會議討論重點爲例，研析綠色成長的理念，探討在追求經濟成長的同時，應如何維護生態環境之和諧，並兼顧各利害關係者之權利，達到永續經營之漁業發展；且因報告文件是經跨領域學者專家研商整合而成，其研究層面廣泛豐富，已受多國肯定與依循，故持續瞭解報告內容、參與會議、分享實務經驗，將有助於提昇我國對產業永續經營之重視。倘有機會在專案計畫合作進行研究，或合辦相關研討會，以共同關切議題活絡關係，可促進與相關國家的互動，營造有利於參與國際社會的條件。

四、本次會議針對漁業和養殖之能源使用議題，我方於會議中說明我國對於省能成效，如運用於養殖漁業之節能水車，太陽能發電節電設備等，顯示目前之漁業及養殖業省能源相關研究與應用是與全球趨勢接軌。

五、有關綠色成長策略部份，會員國多對此議題表達支持與認同。惟優惠燃油稅分析所需資料取得不易且分析模式之發展亦尚未成熟，特別是在取得會員國資料部分較具爭議，故未來之發展仍受限。此外，有關目前 OECD 所作之漁業燃油稅的優惠分析，應不能被其他國際組織作爲審議各國用油可行性依據，故未來就此議題應審慎處理。

六、漁業委員會代表團多爲各國參與國際組織之代表性人物，建立各方聯繫管道，有利於未來國際漁業合作及交流，爰我國宜持續與 OECD 漁業小組保持密切聯繫，積極派員參與年會與相關國際會議，儘可能分享經驗及表達看法，或俟機發表論文，以增加參與程度。

伍、 附件：

1.會議議程：TAD/FI/A(2012)1。

2.漁業綠色成長進度報告：

2-1. 綠色成長觀點：漁業和水產養殖之能源使用：TAD/FI(2012)2。

2-1.2 漁業燃油稅的優惠分析替代方法評價：TAD/FI(2012)1。

2-2. 綠色成長透視：漁業和水產養殖資源之廢棄物與再利用：TAD/FI(2012)3。

2-3. 綠色成長透視：漁業管理：TAD/FI(2012)4。

2-4. 綠色成長透視：養殖：TAD/FI(2011)8/PART4/REV。

3. 2012 年漁業指南(審查及修訂)：

3-1. 指導方針：TAD/FI(2012)5。

3-2. 2013 年漁業統計模板：TAD/FI(2012)6。

4.漁業管理手冊初稿：TAD/FI(2012)7。

5. 審議 2013 至 2014 及以後之工作計畫：TAD/FI(2012)9、TAD/FI(2012)9/ANN。

5.會議紀錄暨與會者名單：TAD/FI/M(2012)1。

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Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **10-Apr-2012**

English - Or. English

TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

Cancels & replaces the same document of 02 March 2012

DRAFT AGENDA OF THE 109TH SESSION OF THE COMMITTEE FOR FISHERIES

Paris, 23-25 April 2012

This Cancel and Replace Draft Agenda has been slightly modified with changes to Items 7 and 10.

The meeting will start at 09:30 on 23 April 2012 and will be held at:

Organisation for Economic Co-operation and Development (OECD)
Conference Centre, Room CC6
2, rue André Pascal
75016 Paris

For further information, please contact:
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JT03319453

English - Or. English

COMMITTEE FOR FISHERIES

DRAFT AGENDA of the 109th SESSION

OECD Conference Centre, Room CC6
2, rue André Pascal, Paris 75016

23-25 April 2012
9:30 – 18:00

Monday, 23 April *(morning)*		
1.	**Adoption of the Draft Agenda for the 109th Session**	TAD/FI/A(2012)1 ***Action required***: Approval
2.	**Statement by Mr. Ken Ash, Director of Trade and Agriculture Directorate**	Information
3.	**Fisheries and Green Growth: Progress reports**	***Action required***: Discussion and guidance
	i) A Green Growth Perspective on Energy Use in Fisheries and Aquaculture; and An Evaluation of Alternative Methods for Analysis of Fuel Tax Concessions in Fisheries	TAD/FI(2012)2 TAD/FI(2012)1
	ii) A Green Growth Perspective on Waste and Improved Use of Fisheries and Aquaculture Resources	TAD/FI(2012)3
Monday, 23 April *(afternoon)*		
3. **(cont'd)**	***iii)*** A Green Growth Perspective on Fisheries Governance	TAD/FI(2012)4
	iv) A Green Growth Perspective on Aquaculture	TAD/FI(2011)8/PART4/REV
4.	**Review of Fisheries 2012: Guidelines and templates for country notes, discussion of content of Review and deadlines**	***Action required:*** Information and discussion
	i) Guidelines for Country Notes; and	TAD/FI(2012)5
	ii) Template for Fisheries Statistics (2010-11) 2013 edition	TAD/FI(2012)6

Tuesday, 24 April *(morning)*		
5.	**Fisheries Managers Handbook: Presentation of draft, discussion and further steps** This is a first draft of the Fisheries Managers Handbook; the Committee's guidance on its further development is being sought.	***Action required*:** Discussion and guidance TAD/FI(2012)7
6.	**OECD/FAO Agriculture Outlook: Status of 2022 Outlook and report from the February 2012 Expert Meeting** An oral report of the meeting which took place 3 February 2012 and an update on the 2022 Outlook, will be given by the Secretariat.	Information
Tuesday, 24 April *(afternoon)*		
7.	**Programme of Work 2013-14: Further discussion of deliverables in 2013 and 2014, adoption of template** In response to comments received on the document TAD/FI(2011)12 circulated on 16 December 2011, document TAD/FI(2012)9 is submitted for discussion and approval. The document also contains, for approval, a PoW template which is the COFI's submission to the Budget Committee. The Annex TAD/FI(2012)9/ANN contains the Guidance from the Secretary-General to Directors and Heads of Programmes concerning the preparations for the PWB 2013-14, as well as the Informal Convergence Paper derived from the meeting of Heads of Delegations (HODs) on 9 February 2012.	***Action required:*** Discussion and approval TAD/FI(2012)9 TAD/FI(2012)9/ANN

Wednesday, 25 April *(morning)*		
8.	**Other activities**	
	i) Report on other OECD activities related to Fisheries	Information
	As has been established practice, the Secretariat will inform delegates about projects in other parts of the Organisation that have relevance to the work of the Fisheries Committee.	
	Representatives from other directorates of the OECD will provide the Committee with an update of their work.	
	ii) Report on activities of the Fisheries Secretariat	Information
	The Secretariat will report on past and planned activities of the Secretariat, including attendance at meetings.	
	iii) Reports from member countries on activities of relevance to the COFI	Oral report
	Oral reports from Delegations are welcome.	Information
	iv) Reports from Observers	Oral report
	Oral reports are expected from observers of the FAO, Council of Europe, World Bank and UNEP.	Information
9.	**Other business**	***Action required***: Discussion
10.	**Consideration of COFI's formal opinion on the Russian Federation's accession to the OECD** ***[Observers are kindly asked not to be present in the meeting room]*** The Committee will consider and agree to a formal opinion which will be transmitted to the Council as part of the overall documentation on the Russian Federation's accession to the OECD.	**CONFIDENTIAL Item** TAD/FI/ACS(2012)1 ***Action required:*** Discussion and approval
Wednesday, 25 April *(afternoon)*		
11.	**Adoption of the Summary Record of the 109th Session of the Fisheries Committee**	TAD/FI/M(2012)1

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Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **09-Mar-2012**

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TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

TAD/FI(2012)1
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EVALUATION OF ALTERNATIVE METHODS FOR ANALYSIS OF FUEL TAX CONCESSIONS IN FISHERIES

23-25 April 2012

This document is presented for DISCUSSION and DECISION to the 109th meeting of the Committee for Fisheries.

For further information contact Roger MARTINI (roger.martini@oecd.org)

JT03317440

Complete document available on OLIS in its original format

English - Or. English

TABLE OF CONTENTS

Tables

Figures

EVALUATION OF ALTERNATIVE METHODS FOR ANALYSIS OF FUEL TAX CONCESSIONS IN FISHERIES

1. Fuel tax concessions (FTCs) are a significant part of overall support to fisheries in many OECD countries [TAD/FI(2010)/8/REV4]. Understanding the impact of this support on fishers and other sector participants up and down the chain contributes to the evaluation of the benefits and costs of this form of tax expenditure policy. This has gained in importance with the introduction of climate change objectives and targets and the increasing fiscal pressures faced by many countries.

2. Policy analysts have recourse to a number of different tools to evaluate the impacts of policies, many of which may be applied to the question of FTC impacts. An important family of policy tools is modelling analysis, a heterogeneous group of mathematically-based approaches that relate different elements of a studied system. This document considers the different categories of models and evaluates their potential for use in OECD analysis of FTCs. This evaluation considers as well specific models that are currently in use for policy analysis in fisheries and enumerates their strengths and weaknesses. This evaluation responds to the request by the COFI for an evaluation of options concerning future quantitative work on illustrating the effects (on catches, stocks, income, profitability, employment and competition) of phasing out fossil fuel subsidies.

Why use economic models?

3. Models are a means of providing a simplified representation of a real system in order to investigate those elements that are of interest to the researcher. Economic models are an abstracted and simplified representation of reality. This simplification offers a number of advantages:

- Direct observation of reality is often unhelpful because complexity and lack of experimental controls prevent the testing of hypotheses.

- Implementation of models are limited by computing power, availability of data and other practical limitations that render models infeasible beyond a certain level of complexity.

4. Reducing a real system to a simplified set of elements is a central characteristic of models. This involves holding variables not of interest to the researcher *exogenous* while specifying rules that define the behaviour of *endogenous* variables of interest. This central characteristic is also a key limitation: models cannot consider impacts of variables outside the scope of their design. Moreover, even when a variable is endogenous to the model, if it is not part of the main focus of the model its behaviour may be treated in a very simplistic manner that is not useful for its direct study. It is for this reason that models are usually designed and used for a specific research task, rather than being developed as a general purpose tool that is applied to a number of different research questions. A notable exception is the Global Trade Analysis Project (GTAP) model and database that provides a general framework for computable general equilibrium (CGE) modelling (though most serious users significantly customise the model to tailor it for specific applications). Applying an existing model to a new problem for which it was not designed is possible in some cases, but requires careful consideration of its appropriateness to the task and limitations.

Prediction vs. pedagogy

5. Models can be used to provide *predictions* - forecasts of future developments, quantification of the impact of reforms or evaluating the value of market or non-market goods. This use of a model is primarily output-centric; it is concerned with the results the model produces. Alternatively, models can

serve a *pedagogical* role - illustrating the implications of certain economic assumptions or parameter values such as prices or elasticities. Using a model to provide insight into how a system works and thereby deriving recommendations or conclusions is a more fundamentally structure-centric approach. In this case, the numerical results of the model are less important than how they are obtained.

Typology of models

6. "Models" as a concept covers a broad variety of approaches. While they all share a mathematical basis, they may be applied in many different ways for fisheries analysis purposes. Models may be economic, biological, spatial, or any combination of these or other domains[1]. Lane (1989) identified five major areas of fisheries systems modelling: (1) descriptive mathematical modelling; (2) mathematical programming and optimisation; (3) statistical analysis and estimation procedure; (4) computer simulation; and (5) decision theory. This classification of approaches to modelling remains relevant today despite the large advances in numerical techniques since that time. In this report, the following types of models will be considered:

- *Analytical Models*. These models are typically composed of a system of equations that is solved for an equal number of endogenous variables representing the factors of interest to the modeller, such as prices or quantities produced or traded. More generally, these may be any mathematical system that may be manipulated to produce useful economic insights. Analytical modelling in this general sense is the foundation of modern economics. The strength of analytical modelling is its clarity and rigour, combined with allowing better understanding of the implications of the underlying assumptions. These models can be limited in scale for reasons of tractability and often produce results that are more directed at academic users than policy makers.

- *Econometric Models*. These models apply data to a functional form to derive estimates of parameter values. Econometric models can be viewed as elements of an analytical model to which data is applied. The parameter estimates produced may be subsequently used to for forecasting or the other forms of output described earlier. Econometric models may be composed of one or many equations, and may stand alone, operate within a larger model, or supply data to a separate model. The strength of econometric modelling is a sound empirical basis, but their relatively poor job at forecasting makes the results of econometric analysis often more important as inputs into other forms of modelling.

- *Simulation Models*. When completed with data for exogenous elements such as initial conditions or parameters (that define how the endogenous variables relate to each other), an analytical model becomes a numerical or simulation model. Using numerical approaches to solve a model enables a larger number of equations and variables to tractably included, allowing for greater model complexity and richness. As well, such models may be used to produce numerical estimates or predictions that are useful to policy makers. Simulation models can take a *comparative static* or *dynamic* approach. Static simulation models solve for the difference between an initial situation and some alternative situation in a future period (days or years ahead). Static models do not consider the process of adjustment between those two time periods or stock-flow relationships, except in a reduced form, but allow for comparison between two equilibria. Dynamic models can use several different mathematical approaches, and are designed to reflect the evolution of the modelled system over a number of time steps. Dynamic models are less focused on establishing an economic equilibrium than evaluating stock-flow relationships over time. Simulation models have become widespread as computer power has increased and

1. In this section, models are considered through the lens of the proposed work on investigating the impacts of FTCs, so the discussion is not intended as a general or treatment of models as a class of analytical tools.

have become a standard tool of analysis in many places. Their ability to provide concrete predictions must be weighed against the risk of their becoming a "black box", where the limitations of the underlying data and model structure are ignored or poorly understood by consumers of the model results.

- *Optimisation Models*. While simulation models define an economic system and investigate changes or shocks to it, optimisation models explicitly maximise an objective function subject to constraints. Typically this is profit maximisation of a firm or set of firms in a defined area. Optimisation models are usually designed for micro-level analysis, whereas simulation models can be at any level of aggregation. Optimisation models use linear and nonlinear programming techniques that excel at explicitly modelling complex structure and cost of firms through a set of constraint equations that accompany the objective function. While they can be structurally very rich, they tend to do a poor job of prediction and their small scale can limit the generality of the results. Using linear programming in fisheries analysis has two disadvantages: the first is the frequently made assumption of constant per-unit price and cost; and the second is the difficulty in incorporating harvest-effort-stock relationships (Önal *et al.* 1991).

Choice Criteria

7. According to Padilla and Charles (1994) "the value of bioeconomic modelling can be judged both by its generation of useful 'theoretical' insights into the operation of fisheries systems, and by its application to real-world fisheries". Also, "to be truly useful, a bioeconomic model must be 'accessible' in that (a) its use must be less demanding of detailed knowledge than its original creation, and (b) it should be directly usable (or easily adapted) to analyse fisheries that differ in their characteristics and their information availability from those for which the model was developed".

8. In order to choose the best approach to investigating the effect of FTCs on fisheries, a set of decision criteria can allow the relative strengths and weaknesses of each to be evaluated. Any decision will involve trade-offs between desirable characteristics of different options, and institutional limitations may play a role. While it is unlikely that a single best option for all purposes can be found, understanding the strengths and weaknesses of a particular choice will help ensure a cost-effective analysis that produces results that are both useful and interesting.

9. Options will be evaluated according to the three following criteria:

1. ***Practicality***: Evaluating the probability of success in carrying out the work. This is determined by, *inter alia*:

   - *Resources required*. Models are preferred that require less secretariat time and lower consultant expenses. Relatively few of the options considered here can be done purely in-house by Secretariat staff, for a number of reasons. Therefore, availability and cost of potential consultants is a main factor. Several of the models reviewed do not see routine use, so finding a competent consultant can be challenging.

   - *Timeliness*. Models are preferred that can produce results in a shorter time-frame. This is also significantly a function of the availability of consultants.

   - *Feasibility*. Models are preferred that are able to be directly applied to the problem without modification or additional development. There will always be a trade-off between applying a model "as-is" and accepting any limitations with respect to FTC analysis or modifying a model to be more able to directly address issues of interest.

2. ***Applicability***: Evaluating the appropriateness of the model for the objectives of the study. This is determined by, *inter alia*:

   - *Specificity to fisheries*. Models that are explicitly developed for fisheries and that contain relevant elements, such as a bionomic model and representation of the management regime, or more specifically species and gear types. In general, this attribute will be in tension with the generality of the model, discussed below.

   - *Inclusion of fuel cost*. The price of fuel is the key element influenced by FTCs, and a representation of the cost of fuel or energy in the model is a key factor in its applicability to the problem of evaluating impacts of FTCs.

   - *Inclusion of outcomes of interest*. Models are preferred that can shed light on the impacts of FTCs of interest to the COFI. It is unlikely that a single model can provide indicators in all relevant areas, so some trade-offs are likely here. A number of socio-economic indicators have been identified as being of interest to the COFI, spanning stock, sector and regional impacts. The only models that can encompass wider economic impacts are general equilibrium (GE) models that represent the whole economy. However, it is generally the case that the wider the scope of the model, the less detail is present in the representation of specific sectors.

3. ***Informativeness***: Evaluating the utility of the results for drawing policy conclusions. This is determined by, *inter alia*:

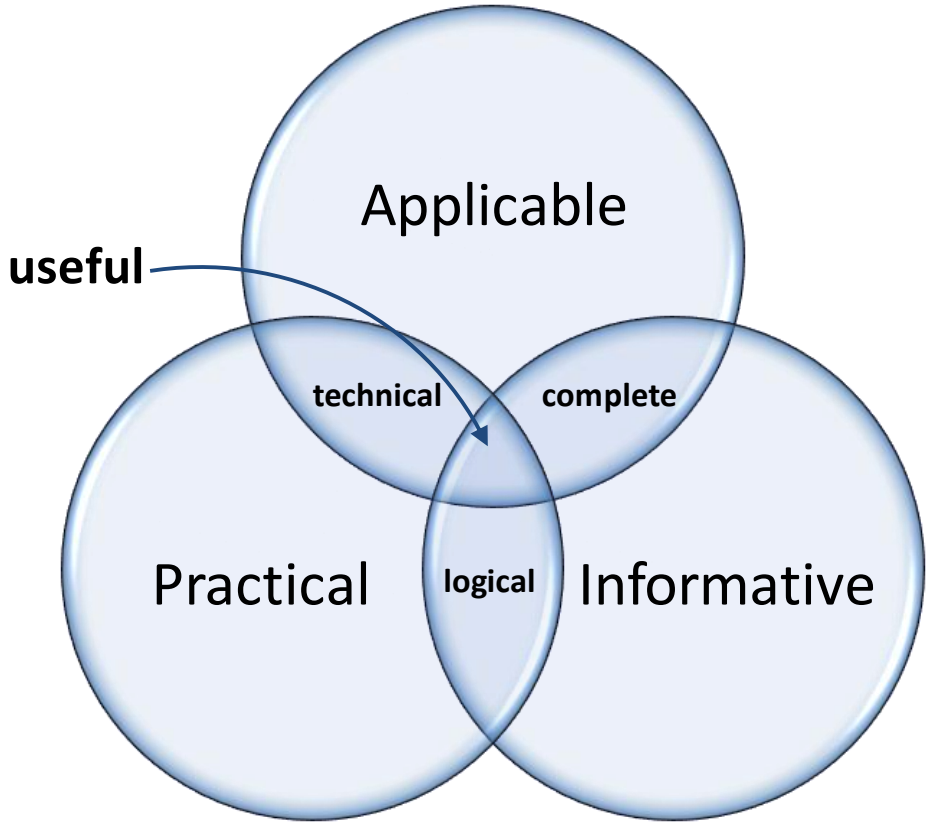
   - *Generality*. Models are preferred that are relevant to a broader scope of situations, either by virtue of the nature of the approach or by incorporating multiple scenarios or situations. Fishery models are often very specific to a localised fishery in order to reflect important details of biology and fishing techniques. This makes generalisation difficult in many cases.

   - *Accuracy*. Models are preferred that can produce results with a good track-record of reliability, or with a means to evaluate their accuracy, such as through sensitivity analysis. Whether for forecasting or counterfactual analysis, model results often compare poorly to ex post observed outcomes. This is due to the *ceteris paribus* nature of modelling; forces outside the scope of the model can dominate real outcomes. That said, few models are intended to be purely predictive, intending rather to shed light on the interactions of factors that influence the outcome of policy changes.

   - *Theoretical relevance*. Models are preferred that elaborate upon established theory and whose results can be explained in terms of the theoretical structures that underpin them. Many of the simulation models reviewed here focus strongly on the biological component of the model and are intended for stock forecasting. While useful for that purpose, they are less adapted to evaluating policy options when multiple criteria are relevant.

   - *Applicability to Green Growth and Development themes*. Models are preferred that can more directly support OECD policy priorities.

Figure 1. Choice Criteria for models



10. Looking at the interactions between these criteria, a model that is both practical and applicable but not very informative could be characterised as a *technical* model (Figure 1). An example would be a simple single-species single-year fishery model. This is straightforward to implement and has clear application to the problem at hand, but would not be expected to yield results that would be novel or interesting. Models that are both applicable and informative but not very practical could be characterised as *complete* models that have the full suite of theoretical content and specific application to fisheries, but would pose too many data or implementation challenges or be too expensive to use for the proposed work. The highly-detailed Atlantis model could be an example: There are relatively few current users, and development time for a representation of a new fishery can be up to two years. Models that are practical and informative, but not applicable to fisheries could be called *logical* models. Such models would explore the theoretical problem in a satisfactory manner and could produce useful conclusions, but would not be specific to fisheries. The large global trade model GTAP could be an example; it is very fully developed and well-understood but with little in the way of specific detail of importance to fisheries.

Review of models

11. There are a very large number of fisheries models existing in the literature. Bjorndal *et al.* (2004) describe some 35 examples spanning different approaches, while Prezello *et al.* (2009) consider 14 simulation models of different EU fisheries. Modelling is a fundamental approach to economic analysis, and so there are hundreds of publications using what could be termed mathematical models to support their analysis. This evaluation narrows the focus to examples that have potential to be of practical use in a study of the impacts of FTCs, though as will be seen, not all of the examples presented will be satisfactory and there is no ideal approach.

Analytical Models

12. Analytical models have been a standard part of natural resource economics at least since Schaefer (1954). Schaefer defined the following model:

$$\dot{X} = rX\left(1 - \frac{X}{K}\right) - Y = 0$$

$$Y = qEX$$

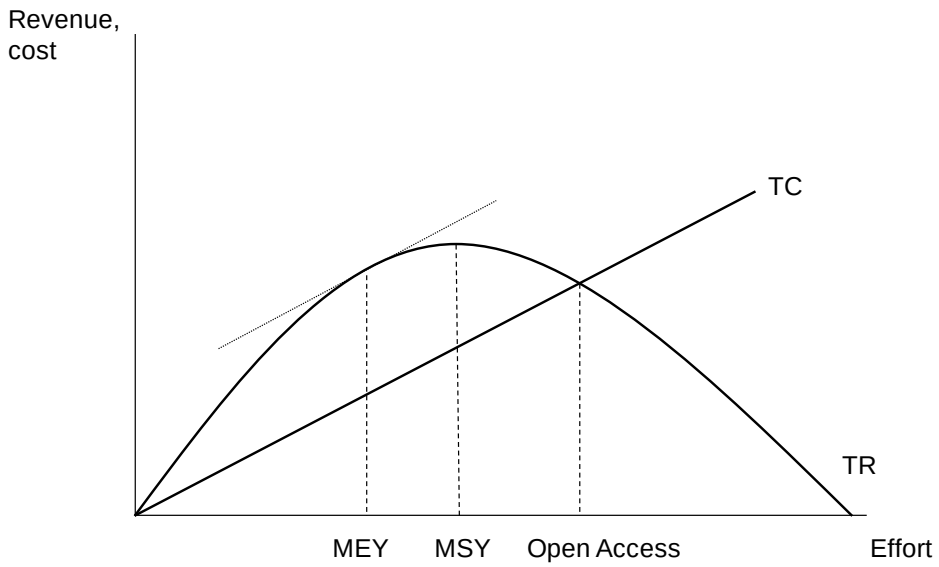
Where X is the stock, r is the intrinsic growth rate, K is the carrying capacity, Y is harvest, q is the catchability coefficient and E is effort. This can be solved for the steady-state values of X and Y as follows:

$$X = K\left(1 - \frac{qE}{r}\right)$$

$$Y = qKE\left(1 - \frac{qE}{R}\right)$$

13. This model can be used in both dynamic and static contexts. The most famous static version is the Gordon-Schaefer model identifying open access equilibrium and MSY in a fishery (Figure 2). The model as expressed here is very simple, but even relatively complicated simulation models can incorporate elements of this approach. For example, the BEMMFISH model incorporates a harvest function Y=qE as part of its economic module, abstracting away even from stock effects (Guillen *et al.* 2004).

Figure 2. Gordon Schaefer Static Model of a Fishery



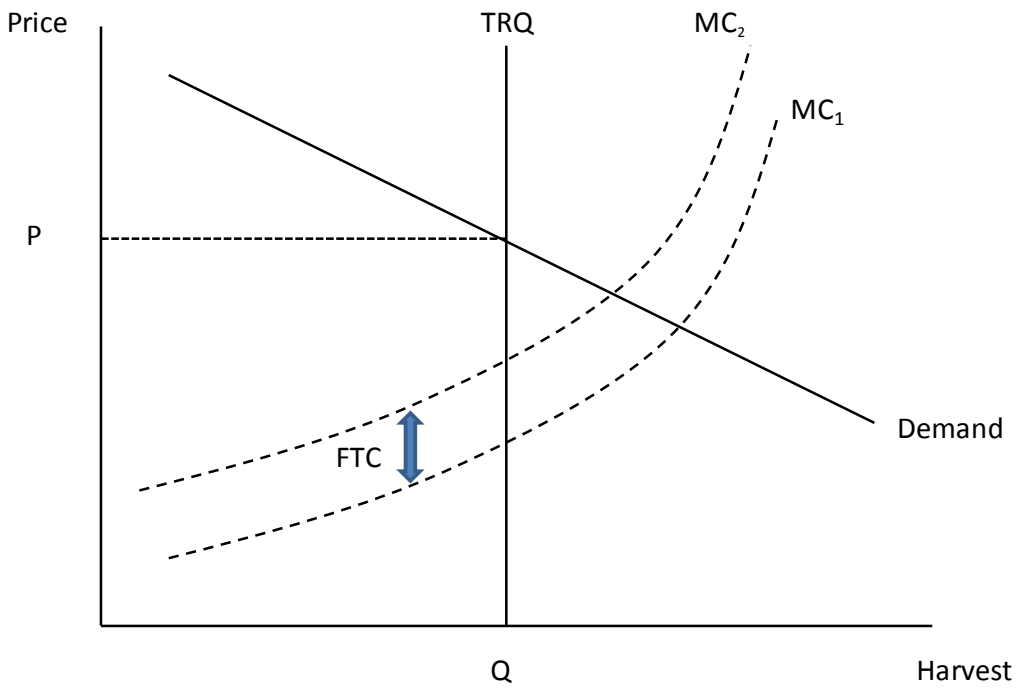
14. There are innumerable variations of this model[2]. Some notable versions are the Beverton-Holt (1957) version incorporating different age cohorts, the Goodwin (1967) model including predator-prey relationships between species and the effect of stochastic risk (Reed 1979). Given the broad application of this approach, it is not helpful to pick out particular examples to review in this evaluation, but rather to

2. A search of "Bioeconomic Model Fishery" in Google Scholar yields 10,000 results.

point out that a version incorporating fuel cost as a variable in the harvest equation, replacing the catchability coefficient *q* with the a functional form based on a more general approach Y=H(E(C),X).

15. Bioeconomic models of fisheries often have only very rudimentary treatment of the production costs of fishers. This is not just because the typical focus is on stocks and harvest, but also because treating the management system in a model often renders the cost element redundant. That is, if an output quota or effort restriction is binding, harvest and price are constant for a broad range of costs (and by implication, FTCs) (Figure 3). This is a general problem of over-specification that is not limited to analytical models. In these cases, the role of costs in the model will be for indicators other than price and harvest - profits or fleet structure, for example.

Figure 3. Cost in a model including TRQ



16. This approach would yield an analysis of the impacts of FTC expenditures that is theoretically sound and useful for policy analysis. It is practical, as there are a large number of potential consultants who could carry out the work; indeed Secretariat staff could undertake this analysis up to a certain scale. Adding complexity, such as endogenous demand would allow for investigation of some socio-economic impacts of interest. The model could be elaborated with explicit parameters using data representative of a specific fishery or type of fishery. This would allow for some estimation of quantitative impacts of FTC policies. Comparative static analysis based on equilibrium conditions is a useful basis for policy analysis; it is both applicable (specific to fisheries) and informative (yields useful general results).

Programming models

Önal et al. LP model

17. Önal *et al.* (1991) provide a model of the Texas shrimp fishery using an linear programming (LP) approach that includes an approximation of the effort-stock relationship as well as the economic factors commonly treated by LP models. Their program maximises the value of the fishery taking into account different size classes and monthly harvest levels, endogenous demand, stock effects and cold storage

capacity. Nonlinear relationships are approximated with linear equations and an approximation variable using grid linearisation. Observable economic data is supplemented with biological data for the fishery are derived from the GBFSM simulation model (Griffin *et al.* 1988) to complete the model.

18. The model is able to obtain an optimal harvest pattern over the year and by size class, and can be used to calculate producer and consumer surplus as well as overall social welfare gain. It includes a cost variable for fishing, but no disaggregation of costs into fuel and other variable costs. Optimal harvest is derived without reference to management regime, so the model results indicate the parameters of an optimal management system in terms of overall TAC and effort.

19. The advantages of this model are the endogenous demand and stock-effort relationship. Improved biological representation makes the model more "appropriate" as a fishery model, and the demand function allows for some estimation of welfare impacts. On the other hand, both of these elements are represented in a limited and stylised manner. Combined with data that is now rather out of date and biological information that is only estimated, the accuracy of the model may be called into question for purposes of FTC analysis.

Kirkley et al. I/O-LP model

20. While most LP models are very micro-scale, Kirkley *et al.* (2011) connect an LP model with a general equilibrium system using an input-output (I/O) table for the regional New England economy incorporating 20 non-fishing sectors and two fishing sectors. They use a general-purpose I/O software platform called IMPLAN. The modified New England model is:

$$\max_{Q} TV = \sum_{i=1}^{22} Q_i$$

subject to:

$$Q_i = P_i X_i,$$

$$\sum_{i=1}^{22} A_{ij} Q_i \leq \mathrm{FD}_j,$$

$$C_s \geq \sum_{s=1}^{4} D_s B_s,$$

$$X_h + C_s \leq 0.5\ \mathrm{HB},$$

where Q_i is the 2006 dollar value of output of each sector, P_i the price of goods produced by each sector i, X_i the total output from sector i, h denotes herring, A_{ij} the input coefficients for sectors i and j, FD_j the final demand for output from sector j, C_s the quantity of herring consumed by predator species s, D_s the dietary requirements in terms of pounds of herring per unit biomass for predator species s, HB the herring biomass, and B_s the biomass of predator species s.

21. This model is optimising the value of the economy, subject to overall constraints that production and consumption (including as factors of production) must balance. This is a standard GE condition in modelling. As can be seen, the main difference between this and a standard LP approach is the multiple sectors in the objective function, and the I/O relationships contained in the matrix A. What is sacrificed is the level of detail for the fishery, which beyond the I/O component has a very simple representation of

harvest requiring that survival after harvest and predation be one-half of stock size. The model is static, meaning that it compares an initial situation with a final situation after a shock and adjustment to equilibrium.

22. This model, while limited in some aspects, has certain advantages. It can calculate economic multipliers from the fishery into the local economy, including changes in employment, so scores well on applicability, a fact which must be moderated by its relative lack of detail for the fishery itself. While the authors have not considered a production cost shock in the fishery, the model is able to carry out this type of scenario which is of interest in the context of FTC analysis. The model also does well in terms of its theoretical content, as it relies on a profit-maximising framework as well as I/O data in the form of a social accounting matrix (SAM), which offers a structured and consistent approach.

Kompas et. al Dynamic delay-difference model

23. Kompas et. al (2010) develop a model of the Australian Northern Prawn fishery using a dynamic delay-difference model combined with an economic optimisation model that maximises the value of the fishery over a 7-year study period. In that sense, the model represents something of a hybrid of LP and other approaches. The objective function of maximising profit is defined with respect to stocks, prices, effort, and costs and the net present value of profits for a seven year period is obtained by an optimal program of harvest taking stock recruitment dynamics into account. The terminal condition at the end of the 7 year period is that the MEY equilibrium is obtained. Cost is differentiated by those proportional to harvest (labour, other) and effort (fuel, repairs). The objective function is therefore

$$\sum_{t>y_{\text{cur}}} \pi_y = \beta_y \sum_w \left\{ \sum_s \left[v^s_{y,w} H^s_{y,w} - \left(c_L v^s_{y,w} H^s_{y,w} + c_M H^s_{y,w} \right) \right] - \sum_f \left[c_K E^f_{y,w} + c_F E^f_{y,w} \right] \right\}$$

The variables E and H denoting effort and harvest are a function of the stock and act to incorporate the dynamic biological system.

24. This model incorporates several useful features. It projects a 7-year period based on price and cost assumptions that may be varied as alternative scenarios, making it potentially useful to FTC analysis. It has a complex representation of cost that also supports FTC analysis. It is theoretically sound, an unusual feature for dynamic models which are usually based on iteration according to a flow-chart and decision rules. It is applicable to fisheries, though the generality of the results for policy analysis depends on the extent to which the results are conditioned on the rather specific recruitment function of the prawn fishery.

Simulation Models

Aglink Model

25. Aglink is a dynamic commodity forecasting model developed by the OECD and now co-developed by the OECD and the FAO. It is designed to provide a ten-year outlook on commodity production and prices for major traded agricultural commodities. A version of the model treating fisheries and aquaculture has recently been developed, though this component is not integrated with the rest of the Aglink model, so no market interactions between fisheries and other commodities are treated.

26. Aglink uses a set of commodity supply and demand functions using data provided through an annual survey or participating countries. In many cases, this data is taken from national models. The model is then calibrated to create a stable equilibrium defining a ten year "baseline". Simulations are produced that are reported as deviations from this set of baseline trends.

27. The model does not include any input markets or production technology; this is implicit in the supply function, which can be taken as a reduced form representation. There is no explicit representation of the fisheries management system. Fishing is assumed to be constrained by a binding TAC such that the supply function for the capture fisheries component is essentially a vertical line. Aquaculture production can respond to changes in the price of fish, which is treated in a highly aggregate manner with no explicit prices for separate species of fish. Demand is projected according to population and GDP trends over the ten-year study period.

28. Aglink is a large and complicated model overall, and much of its detail is given over to commodity market dynamics. The lack of connection to this in the case of the fishery model, combined with the absence of a biological model, a fisheries model, or a management model, make the model of limited use for an investigation of FTCs. It therefore rates poorly in terms of applicability and informativeness. On the other hand, as an in-house model it would be easy to implement for this study and could produce results in a timely manner.

AHF model

29. The AHF model was developed by the Danish Institute of Food and Resource Economics (FOI) to evaluate the trade-offs between different management control schemes and management objectives. It is a dynamic recursive model of a multi-age multi-species fishery. It is comprised of two separate models, one simulating a quota (TAC) and the other simulating effort (days at sea), switching between the two depending on which situation is the effective constraint on fishers in the year simulated. It contains a representation of a harvest function as a function of stock, a production function for a fishery based on the Cobb-Douglas function, and evaluative indicators of days-at-sea and profits. In each time step of the model, a level of fleet investment is chosen that determines effort. Quotas are represented as a limit on total landings for each fleet segment with discards making up the difference between amount harvested and amount landed. The quota level is chosen recursively to maintain the stock at a specified level. The model can be run for a number of simulated years and the trends in stock, harvest, and profits observed.

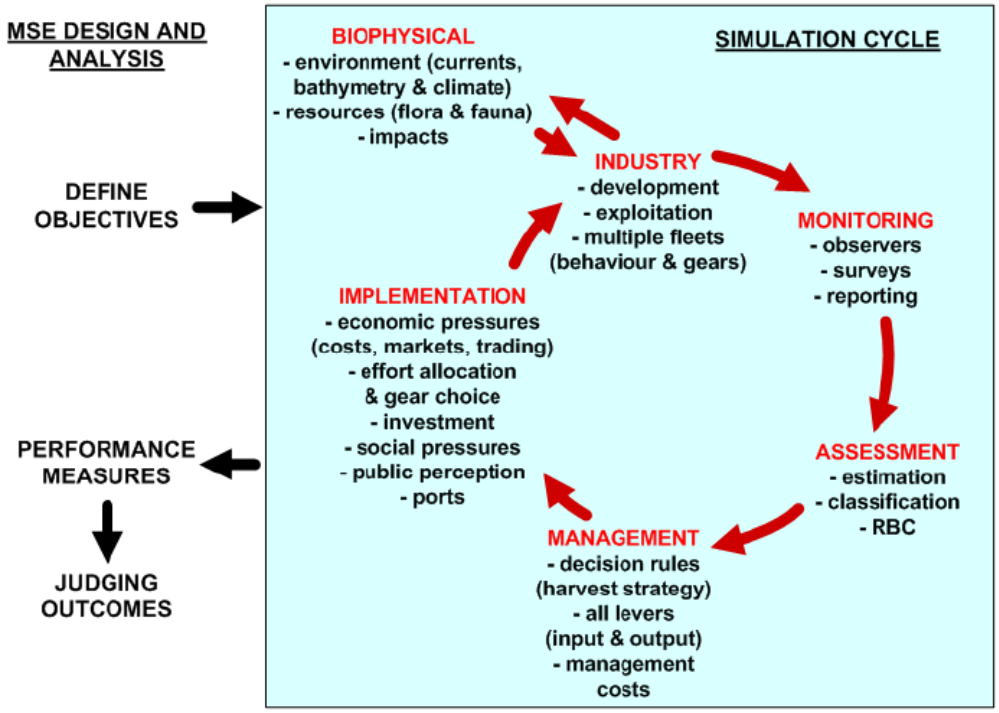
30. Most of the complexity in the AHF model comes from the representation of the age structure of multiple species, which adds considerable dimensionality to the harvest function. Beyond this, the economic content of the model is not large, with investment being the only major economic choice variable and other economic features observed as model outputs rather than part of an endogenous optimisation. As a recursive model, endogenous variables are recalculated based on the evolution of state variables. While the model does include cost of production and therefore could in principle evaluate a change in fuel costs due to FTC reform, it is unlikely that the results would be useful as the focus of the model lies in stock evolution over time with respect to management control.

Atlantis Model

31. Atlantis is an ecosystem model that considers all parts of marine ecosystems - biophysical, economic and social. Originally focused on the biophysical world and then fisheries it has grown to begin to be used for multiple use and climate questions. Atlantis includes modules for each of the major steps in the adaptive management cycle and so can be a useful management evaluation and policy tool (Figure 4). Atlantis was developed by a team from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia. Atlantis is open to public use and representations of fisheries in various parts of the

world are in different phases of development. The model has been fully developed only for certain fisheries in Australia (Fulton *et al.* 2007) and the west coast of the United States (Smith *et al.* 2011).

Figure 4. Management Strategy Evaluation Cycle in Atlantis Model



Source: Fulton *et al.* (2007)

32. The biophysical sub-model tracks nutrient (usually Nitrogen and Silica) flows through the main biological groups in a system defined and modelled in three dimensions. The primary ecological processes modelled are consumption, production, waste production, migration, predation, recruitment, habitat dependency, and mortality. Major trophic levels and species are represented. The physical environment is also represented explicitly, via a set of polygons matched to the major geographical and bioregional features of the simulated marine system. Biological model components are replicated in each depth layer of each of these polygons.

33. Atlantis also includes a detailed fisheries sub-model. This model deals not only with the impact of pollution, coastal development and broad-scale environmental (e.g. climate) change, but is focussed on the dynamics of fishing fleets. It allows for multiple fleets, each with its own characteristics of gear selectivity, habitat association, targeting, effort allocation and management structures. At its most complex, the model includes explicit handling of economics, compliance decisions, exploratory fishing and other complicated real world concerns such as quota trading and high grading. All forms of fishing may be represented, including recreational fishing (which is based on the dynamically changing human population in the area).

34. The fisheries model interacts with the biophysical model as well as a management sub-model. This last sub-model is typically a set of decision rules and fisheries management actions, which can be drawn from an extensive list of fishery management instruments, including: gear restrictions, days at sea, quotas, spatial and temporal zoning, discarding restrictions, size limits, bycatch mitigation, and biomass reference points.

35. Atlantis shows its roots as a biophysical model, containing a tremendous amount of detail about the biology of the modelled ecosystem. The fisheries model is also quite extensively detailed, and follows a "process" approach whereby decision-making is modelled as following a flow-chart of decision rules, including iteration and feedback. This approach is less explicitly theoretic, as it uses an atomistic set of rules (for expected revenue, for example) instead of a theoretically-consistent and complete approach based on economic principles. However, it allows for a good deal of richness in the simulation of the fishery, including such details as the degree of "friendliness" between fishers as a factor in trading of quotas, for example. The consequence of such an atheoretic approach is generality and robustness of the results; the model becomes a story told by the modeller, which the user either believes or does not.

36. The Atlantis model contains most of the desirable model elements: it represents the cost of fuel in an explicit manner, the management regime is also included as a factor, and there is a good deal of differentiation in terms of fleet segments and gears. Therefore, it does well on the applicability scale. Evaluating this model in terms of how informative it is yields mixed results; the large amount of detail provides for a certain degree of confidence in expressing results as being conditioned on specific factors such as elements of the management regime or technology used. This allows for rather precise conclusions on the impacts of FTCs in the model. On the other hand, the lack of an explicit and unified theoretical structure raises the question as to whether the results have meaning outside of the set of assumptions made in the model's construction. In terms of practicality, this remains to be seen. The model exists in a complete form for two important fisheries, but operating the model would depend on the availability of experienced users. It is unlikely that the Secretariat would be able to develop the expertise required to run the model and interpret its results, and development of a representation of a new fishery in the model would be prohibitively expensive and time-consuming.

BEMMFISH Model

37. The BEMMFISH model (Bioeconomic Modelling of Mediterranean Fisheries) has been developed with the purpose of testing the effects of different fisheries policies and management measures for Mediterranean fisheries. The model aims to represent the characteristics typical of Mediterranean fisheries: interactions between multiple species, multiple fleets and gear types. The model allows for effort controls, but no output controls in the fishery.

38. The model is a simulation model designed to make projections of a set of biological and economic variables into the future according to a set of initial variables and parameters representing the fisheries in the initial year. Like AHF, the model is a recursive dynamic representation of the development of the two basic state variables in the model - the biomass and the number of vessels in each fleet, with investment as the main control variable determining effort and profits. The fish stock evolves over time according to the growth function and harvests, and the number of vessels in each fishing fleet evolves according to investments undertaken by the fishing industry. Fish stocks are specified as one biomass for each species and fishing fleets as a collection of identical fishing vessels. The model allows for up to four different fish species and three different fishing fleets. Three basic fisheries management control variables are included: (a) fishing effort by fleet and species; (b) taxation of landings; and (c) limitation on vessel numbers.

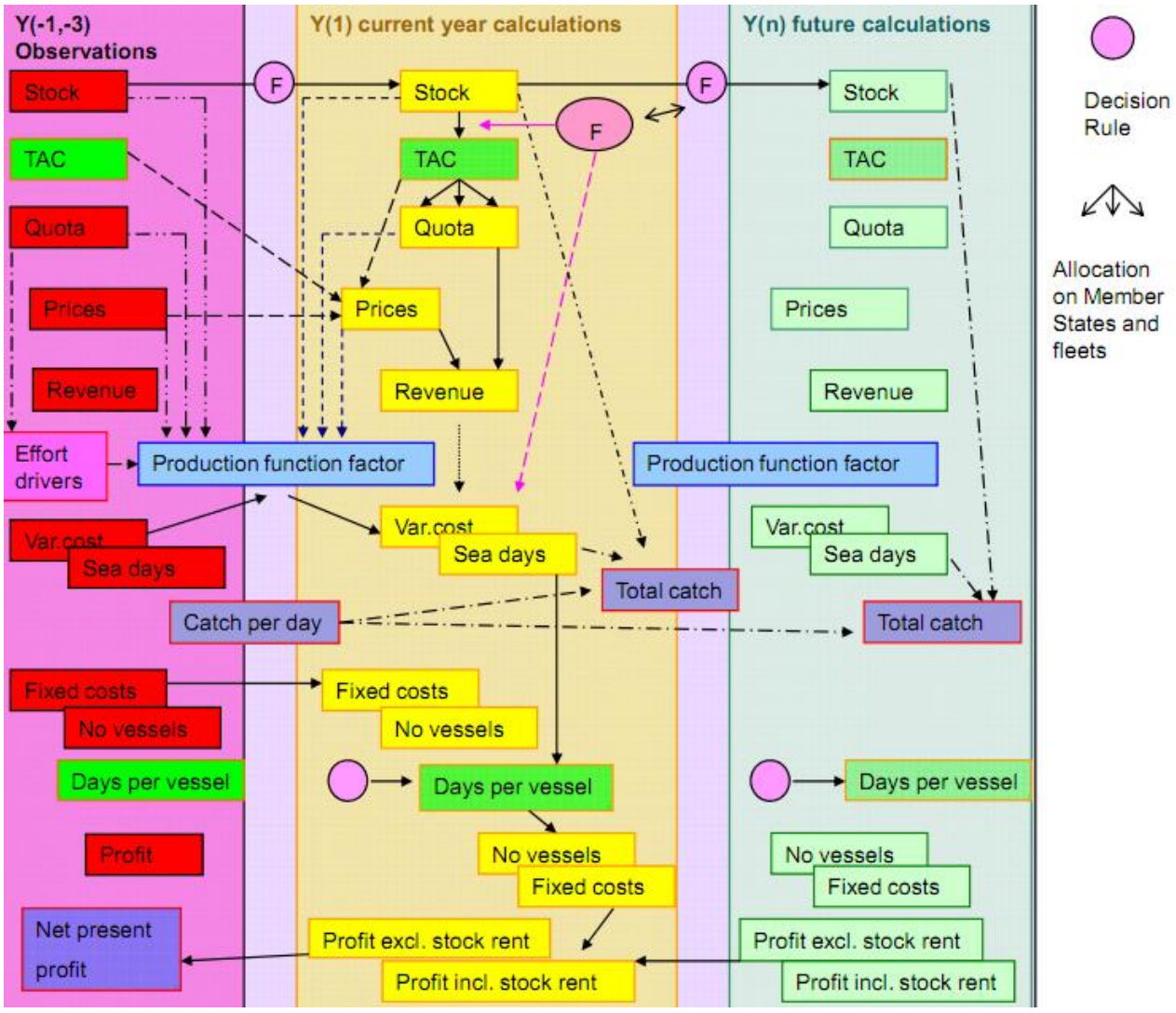
39. The model contains a significantly disaggregated representation of costs, including fuel use and price. This representation of costs allows for the management regime to alter costs, such as through taxation. This along with revenue from landings determines profit. Investment is the intertermporal control variable; the level of investment is chosen on the basis of the previous year's profit to maximise expected profit in the current year.

40. This model should be viewed as fundamentally similar to the AHF model in approach, though applied to a different set of conditions in the fishery and with many specific differences in implementation. Both models produce projections of trends over time on the basis of simple recursion with limited control variables operating in a complex system determining state variables. The basic economics of profit maximisation are approximated via the investment function, but this is not an economic model in the traditional sense. This is a common approach for dynamic simulations of fisheries. (see Prellezo *et al.* 2009).

EIAA Model

41. The EIAA (Economic Interpretation of AFCM Advice) model was developed by the Danish Institute of Food and Resource Economics to assess the impacts of TAC/quota allocations to EU member states and fleets. It simulates a multiple fleet, multiple stock fishery for a ten year time horizon, with the assumption that a steady state obtains after ten years. The schematic structure of the model is shown in Figure 5.

Figure 5. EIAA Model Structure



Source: Frost *et al.* (2009)

42. The EIAA model produces economic indicators calculating gross revenue, crew remuneration, cash flow, and net profits. It also calculates expected over- or under-fishing with respect to a given TAC or quota, number of sea-days.

43. Fuel costs are included in the model as part of "running costs" but are not further disaggregated. Production uses an inverse Cobb-Douglas to impute effort from landings (and therefore TAC or quota). Harvest is determined by the exogenous TAC or quota, so the production function is essentially calculating costs and effort as a function of landings and stocks.

44. The EIAA model has some advantages over other models in that the production system, while simplified, is not ad-hoc. The model is less practical than some other options as it is at once relatively complicated while having only a small amount of detail around the economics of fuel use. Moreover, it may be the case that it is seeing less use as newer models are developed, so finding a willing consultant could be a problem. It is applicable to fisheries analysis, though its design focus is very much on TAC and quota issues, giving it limited flexibility for other applications.

ENV-Linkages Model

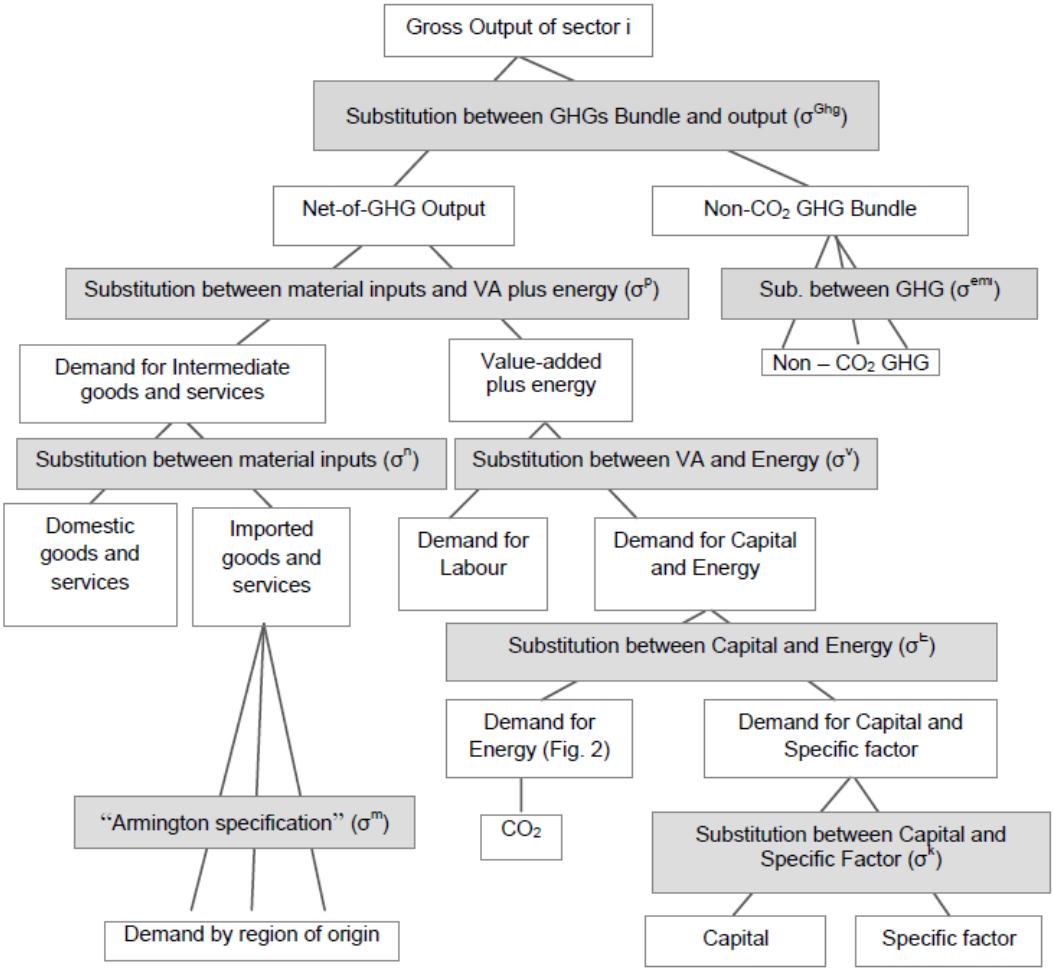
45. The ENV-Linkages model is a recursive dynamic neo-classical general equilibrium model maintained by the Environment directorate of the OECD [ENV/EPOC(2010)16]. It is a global economic model built primarily on a database of national economies. Each of the regions is underpinned by an economic input-output table (usually sourced from national statistical agencies). Those tables identify all the inputs that go into an industry, and identify all the industries that buy specific products.

46. All production in ENV-Linkages is assumed to operate under cost minimisation with an assumption of perfect markets and technologies that exhibit constant returns to scale. The production technologies are specified as multi-level (nested) production functions that assume constant elasticities of substitution (CES) in a branching hierarchy (Figure 6). The top node thus represents an output – using intermediate goods combined with value-added, on the one hand, and non-CO2 greenhouse gases (GHGs) in sectors that emit these gases as joint-products (see below), on the other hand. This structure is replicated for each output, where the parameterisation of the CES functions may differ across sectors.

47. In order to be able to perform the numerical simulations, it is necessary to keep the total size of the model limited. In the current version of the model, all economic activity within a region is aggregated into 22 economic sectors (Table 1). In addition, 5 distinct electricity production technologies are identified to be able to appropriately simulate responses in the electricity sector to the climate policies.

48. In similar fashion, rather than carrying out the analysis at the level of individual countries, most countries are grouped into geographical regions and only a few countries are separately identified in the model. In the baseline projection, 29 regions are distinguished.

Figure 6. ENV-Linkages Structure of Production



Source: ENV/EPOC(2010)16

Table 1. ENV-Linkages Sectors represented

Sectors	Description
Rice	Paddy rice: rice, husked and in the husk.
Other Crops	Wheat: wheat and meslin Other Grains: maize (corn), barley, rye, oats, other cereals Vegetables and Fruits: vegetables, fruits, fruit and nuts, potatoes, cassava, truffles Oil Seeds: oil seeds and oleaginous fruits; soy beans, copra Cane & Beet: sugar cane and sugar beet Plant fibers: cotton, flax, hemp, sisal and other raw vegetable materials used in textiles Other Crops
Livestock	Cattle: cattle, sheep, goats, horses, asses, mules, and hinnies; and semen thereof
	Other Animal Products: swine, poultry and other live animals; eggs, in shell, natural honey, snails
	Raw milk
	Wool: wool, silk, and other raw animal materials used in textile
Forestry	Forestry: forestry, logging and related service activities
Fisheries	Fishing: hunting, trapping and game propagation including related service activities, fishing, fish farms; service activities incidental to fishing
Crude Oil	Parts of extraction of crude petroleum & service activities incidental to oil extraction excl. surveying
Coal	Coal: mining and agglomeration of hard coal, lignite and peat
Gas Extraction and Distribution	Parts of extraction of natural gas & service activities incidental to gas extraction excl. surveying Distribution of gaseous fuels through mains; steam and hot water supply
Electricity	Electricity: production, collection and distribution
Petroleum & coal products	Petroleum and coke: coke oven products, refined petroleum products, processing of nuclear fuel
Food Products	Cattle meat: fresh or chilled meat and edible offal of cattle, sheep, goats, horses, asses, mules
	Other meat: Pig meat and offal. Preserves and preparations of meat, meat offal or blood, flours
	Vegetable oils: crude and refined oils of soya-bean, maize, olive, sesame, groundnut, olive seeds
	Milk: dairy products
	Processed Rice: rice, semi- or wholly milled
	Sugar
	Other Food: prepared and preserved fish or vegetables, fruit & vegetable juices, prepared fruits, all cereal flours
	Beverages and Tobacco products
Other Mining	Other Mining: mining of metal ores, uranium, gems. other mining and quarrying
Non-ferrous metals	Non-Ferrous Metals: production and casting of copper, aluminum, zinc, lead, gold, and silver
Iron & steel	Iron and steel: basic production and casting
Chemicals	Chemical Rubber Products: basic chemicals, other chemical products, rubber and plastics products
Fabricated Metal Products	Fabricated Metal Products: Sheet metal products, but not machinery and equipment
Paper & Paper Products	Paper and paper products: includes publishing, printing and reproduction of recorded media
Non-Metallic Minerals	Non-metallic minerals: cement, plaster, lime, gravel, concrete
Other Manufacturing	Textiles: textiles and man-made fibers
	Wearing apparel: Clothing, dressing and dyeing of fur
	Leather: tanning and dressing of leather; luggage, handbags, saddlery, harness and footwear
	Other transport equipment: Manufacture of other transport equipment
	Electronic Equipment: office, accounting and computing, radio, television and communication equipment
	Other Machinery & Equipment: electrical machinery, medical, precision and optical, watches
	Other Manufacturing: includes recycling
	Motor Vehicles: cars, lorries, trailers and semi-trailers
	Lumber: wood and products of wood and cork, except furniture; articles of straw and plaiting materials
Transport Services	Other Transport: road, rail ; pipelines, auxiliary transport activities; travel agencies Water transport Air transport
Services	Trade: all retail sales; wholesale trade and commission trade; hotels and restaurants; repairs of motor vehicles and personal and household goods
	Water: collection, purification and distribution
	Retail sale of automotive fuel
	Communications: post and telecommunications
	Other Financial Intermediation: includes auxiliary activities but not insurance and pension funding
	Insurance: includes pension funding, except compulsory social security
	Other business services: real estate, renting and business activities
	Recreation and other services: recreational, cultural and sporting activities, other service activities; private households with employed persons
	Other services (government): public administration and defense; compulsory social security, education, health and social work, sewage and
	refuse disposal, sanitation and similar activities, activities of membership organizations n.e.c., extra-territorial organizations and bodies
Construction and Dwellings	Construction: building houses factories offices and roads Dwellings: ownership of dwellings (imputed rents of houses occupied by owners)

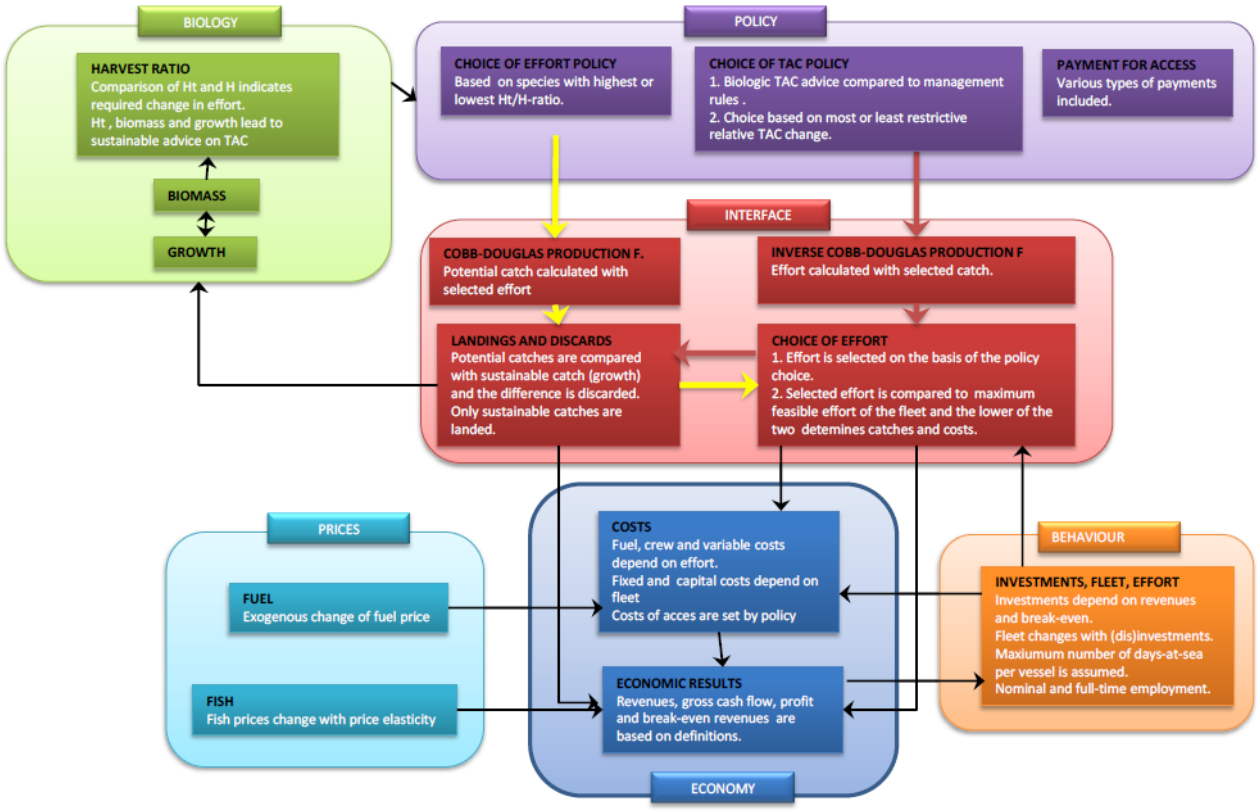
Source: ENV/EPOC(2010)16

49. ENV-Linkages is a good example of a computable general equilibrium (CGE) model based on the GTAP (Global Trade Analysis Project) structure and database. It shows both the virtues and limitations of such models - excellent inter-industry and trade representation based on sound economic theory, very high aggregation and lack of differentiation across sectors. In particular, the fishery sector is composed not only of fishing, but also hunting and trapping and related services. However, it is possible to improve the disaggregation of fisheries and potentially include other fisheries-specific details with sufficient investment in model development.

FISHRENT model

50. The FISHRENT model is a multi-species multi-fleet simulation and optimisation model that is user-customisable for different fisheries (Salz *et. al* 2011). The model is similar to the EIAA model in many ways, and its development was motivated in part by the increasing complexity of that model for users. The basic version covers 8 fleet segments and species and simulates a 25-year time horizon. The model is composed of six separate modules covering the three main elements of biological, economic and management factors (Figure 7). The model is developed by the Framian consulting firm, LEI and others for the EU project "Remuneration of spawning stock biomass". As the name implies, the main objective of the model is to estimate resource rents in a fishery. Importantly, this means that fuel cost is included as a variable that can be the subject of a policy scenario.

Figure 7. Fishrent modules



51. FISHRENT, while having fairly high dimensionality in terms of number of species and fleets, is not a particularly complicated model. Exogenous policies such as TAC and effort controls largely determine output, and the production and growth functions that underlie the other model components have very simple implementations—the fisher's production function is Cobb-Douglas, for example. This is a

very different approach from an extraordinarily detailed model like ATLANTIS that is intended to accurately simulate a fishery. FISHRENT is designed to compare policy alternatives without purporting to present an accurate view of the fishery over a 25-year span. However the main elements are there—profit maximisation, flexible growth functions for multiple species with possible interactions, an investment rule to adjust fleet size over time, and some endogenous prices.

52. The model in its basic form contains synthetic data—elasticities of one, stock size of 100—such that it requires additional data input to be used for analysis of specific fisheries. This has been done for a number of species for the EC study *Remuneration of Spawning Stock Biomass* (Salz *et al.* 2010), and that version of the model could potentially be used[3]. Alternatively, a specific stock representation is not strictly required to get useful results from the model, as even nominal parameter and data values could generate useful economic insights based on the economic structure of the model.

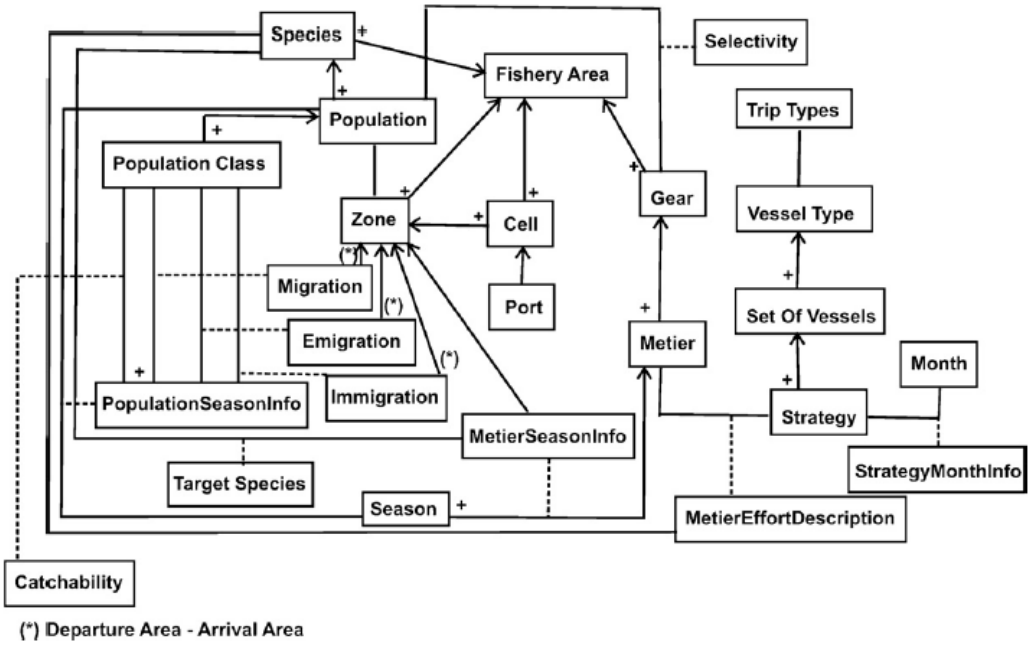
53. FISHRENT is unusual for a fisheries simulation model in that its focus is on basic economic principles and enabling policy comparisons. This feature makes it a relatively strong candidate for a FTC study, as it does well in terms of its practicality, applicability, and generality. It is feasible for the model to be run by Secretariat staff or by a consultant (or the two in concert). It has the essential elements of a fishery model, so is applicable to the project, but also has enough theoretical content and flexibility to generate results that are informative and useful for policy analysis. Endogenous price formation in the model allows for calculation of rents to fishers and consumer surplus to consumers, but there is no representation of the downstream market beyond the single-parameter demand function.

ISIS-FISH model

54. ISIS-FISH is a large-scale model with multidimensional biological (species and location) economic (fleet metiers) and management components. It is an iterative dynamic model with a structure as shown in Figure 8. ISIS-FISH is designed as a user-customisable framework for application to different fisheries. Users therefore have to calibrate the model for the fishery of interest before it can be applied.

3. Depending on availability and permission of the relevant parties.

Figure 8. ISIS-FISH model schematic



Source: Pelletier *et al*. 2010

55. ISIS-FISH is positioned somewhere between the ATLANTIS and EIAA models in terms of complexity. Like ATLANTIS, this model aims to provide an accurate simulation of a fishery in detail, though the level of complexity is somewhere between ATLANTIS and the EIAA model. Like many of the dynamic models described here, it is an iterative dynamic model based on time steps and following a schematic structure.

56. ISIS-FISH is a flexible and powerful simulation tool that can provide complex analysis of a wide variety of situations. However, the level of complexity implies a significant time investment for the modeller and is likely greater than is required for an analysis of FTC impacts. Further, there is no simulation of downstream sectors, so socio-economic indicators outside of the fishery are limited. The structure of the model, while applying reasonable economic decision rules and calculations, does not have the theoretical robustness of either optimisation or static simulation models that explicitly establish economic equilibria.

Seung and Waters CGE model

57. Seung and Waters (2010) construct a CGE model of the Alaskan economy containing four fisheries-related sectors (Alaskan Pollock, Other, Processing of Pollock, other processing) and seventeen non-fisheries sectors. They investigate three scenarios: change in TAC, increase in fuel costs, and reduction in consumer demand. The model produces indicators of change in output, employment, value added, and household income. As was the case for the Kirkely *et al*. I/O-LP model, this model is built using the IMPLAN tool with specific modifications for the fisheries sector. As a CGE model, it differs from standard I/O models in that prices are endogenous, allowing for estimations of changes in consumer surplus.

58. The model uses a simplified version of standard CGE modelling techniques. Production technology in each industry is represented by a constant elasticity of substitution (CES) value added

function assuming constant returns to scale. Intermediate inputs are used in fixed (Leontief) proportions. Finally, value added and intermediate inputs are combined in fixed ratios to produce output. Labour and capital are the only primary inputs. This is a much less flexible approach than the ENV-Linkages model, for example, which allows for more flexibility in substitution between inputs. The model is run with two labour market options. The "Keynesian" version assuming fixed wages and mobility between regions and the "neoclassical" assuming flexible wages and less mobility.

59. As the CGE structure of the model does not include a management component for fisheries, the scenario evaluating the reduction in TAC is carried out by modifying a shift parameter in the Pollock production function to reduce production by 10%. An increased cost of fuel scenario is estimated by increasing the exogenous price of fuel by 50% (Table 2).

Table 2. Impact of 50% increase in fuel cost on output, employment, value added and income

percent change

	Output	Employment	Labor Income	Value Added
Keynesian CGE				
Pollock harvesting	−2.8	−5.6	−5.6	−7.4
Harvesting all other species	−1.8	−3.5	−3.5	−4.5
Pollock processing	−3.3	−4.3	−4.3	−4.6
Processing all other species	−2.0	−2.7	−2.7	−2.8
Seafood Industry Total	−2.3	−3.5	−3.5	−4.2
Non-Seafood Industries Total	−0.3	−0.6	−0.6	−0.6
TOTAL	−0.5	−0.8	−0.8	−0.8
Neoclassical CGE				
Pollock harvesting	−2.2	−4.5	−5.1	−6.5
Harvesting all other species	−1.2	−2.3	−2.8	−3.5
Pollock processing	−2.6	−3.5	−4.0	−4.2
Processing all other species	−1.3	−1.7	−2.3	−2.4
Seafood Industry Total	−1.6	−2.5	−3.0	−3.6
Non-Seafood Industries Total	0.2	0.1	−0.4	−0.3
TOTAL	0.03	0.0	−0.6	−0.5

Source: Seung and Waters (2010)

60. The model developed by Seung and Waters scores well on practicality, as it is a recent model using a well-understood technique and public platform (IMPLAN). It contains an explicit representation of fuel cost and CGE elements that make evaluation of some socio-economic impacts possible. The representation of the fishery in the model is very basic, as it lacks a management or biological component and the economics are represented in a highly stylised manner. However, most of the value that the model could provide in a FTC policy analysis is already reported in their article (Table 2).

WBF model

The World Bank and FAO developed a global fisheries model as part of the *Sunken Billions* study and book (World Bank, 2009). Ragnar Arnason was mainly responsible for model development. This is essentially an application of the Schaefer model applied to a single global aggregate fishery. The model is

intended to provide an estimate of global fishery rents, in particular the difference between current and optimal rents in the fishery. The Schaefer model is modified with the addition of a profit function and an endogenous calculation of rents derived from the fishery. It is solved as a static model; time paths are not calculated and it is assumed that it is possible to reach the simulation equilibrium from the initial starting point.[4] Rents are defined as the difference between the revenue and cost curves at a given stock.

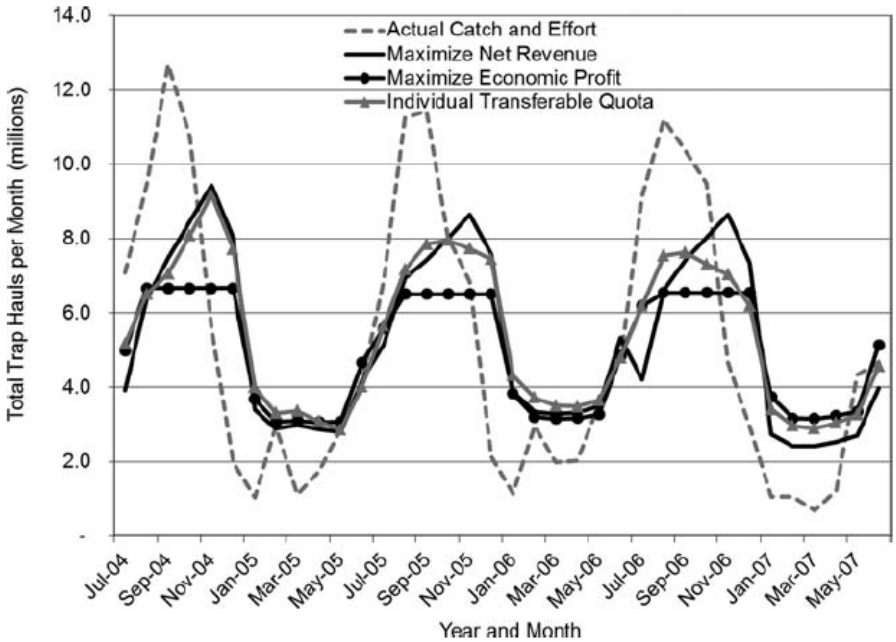
This model is a good example of an analytical model applying estimated coefficients to obtain a numerical result. The results conform well to theory - he model is a pure application of theory - but the level of aggregation of the model would make most biologists uncomfortable. While the model is very practical to use, the lack of detail surrounding firm costs and the high level of aggregation lowers its applicability to the problem of FTC analysis. The model scores well on generality, but its information content is less than optimal as few socio-economic indicators other than global rents could be calculated.

Econometric Models

61. Holland (2011) develops an econometric model of the New England Lobster fishery, separately estimating (aggregate) demand and (individual) production functions and using the resulting estimates to infer the optimal behaviour of fishers under a number of scenarios. The production function includes a number of fixed and variable cost elements, and the optimal number of vessels can be calculated as part of the analysis. The results demonstrate that actual profits in the fishery are much below potential profits due to overcapacity and sub-optimal time allocation of fishers over the length of the fishing season (Figure 9) This is a good example of an econometric analysis of a fishery using administrative panel data from the fishery to directly estimate the production function of fishers. The inclusion of fuel cost as an explicit parameter estimated as part of this allows for scenarios that change fuel costs, though as usual these must be conditioned on assumptions regarding the nature of the management regime. The applicability of the results beyond the study fishery is doubtful. This is true in general of econometric analysis, but in this case the results are also influenced by the particularities of this sedentary and highly seasonal fishery.

4. This condition can be assured given the choice of the growth function. The growth functions used in the model are the Logistic and Fox functions, neither of which exhibit critical depensation and so the stock can recover from any initial size.

Figure 9. Actual and Optimal effort in the New England lobster fishery



Source: Holland (2011)

62. This model could be applied to FTC scenario analysis under contract with the author. It is likely that the results would be timely and deliverable with high certainty as the econometric estimation has already been undertaken. Being a fisheries model it is applicable, though perhaps too specific to be highly informative.

Discussion

63. It is clear that the choice of a method to analyse the impacts of FTC policies will involve making trade-offs between desired elements. There does not appear to exist at once a model that can contains a detailed view of the fishery and the economic interactions between the fishery and the local, regional, or national economy (Table 3).

Table 3. Characteristics of Reviewed Models

Model	Practical			Applicable						Informative		
	Possible consultancy	feasible in-house	short timelines	FTC scenario possible	Management module	Biological module	Economic module	Includes demand function	endogenous input markets	Generality	Accuracy	Theoretical content
Aglink		+	+	+	-	-	+	+	-	-	-	+
AHF		-		+	+	+	+	+	-	-	-	-
Analytical[2]	+	+	+	+	+	+	+	+	+	+	-	+
Atlantis		-	-	+	+	+	+	-	-	-	+	-
BEMMFISH		-	-	+	+	+	+	-	-	-	-	-
EIAA	+	-	-	+	+	+	+	+	-	+	-	+
ENV-Linkages		+	+	+	-	-	+	+	+	+	-	+
FISHRENT	+	+	+	+	+	+	+	+	-	+	-	+
Holland et. al.		-		+						-		+
ISIS-Fish		-	-	+	+	+	+	-	-	-	+	-
Kirley et. al.		-		+	-		+	+	+	+	-	+
Kompas et. al.		-		+		+	+			-	+	+
Önal et. al.		-		-	-	+	+	+		-	-	+
Seung and Waters		-		+	-	-	+	+	+	+	-	+
WBF	+	+	+	-	-	+	+	-	-	+	-	+

1. + indicates presence of characteristic, - indicates absence. Empty cell indicates unable to evaluate characteristic or not applicable.

2. Indicates possible characteristics of an analytical model to be developed.

64. Given the caveats already identified in the measurement of FTCs [TAD/FI/(2010)8], it is unlikely that the actual data contained in the OECD FTC database will be usable as part of the model analysis under consideration. Any investigation of FTC policy would take the form of an exogenous shock on the order of 10% introduced to fuel prices in the fishery. Results would be interpreted on the basis of that fuel price change. Such a price shock has already been investigated in some of the models described in this report. While those were designed to investigate the impact of increased market prices, the implementation and analysis is identical for the case of FTCs.

65. Some of the main trade-offs that have become evident in choosing between different modelling alternatives are as follows:

Detailed stock dynamics vs. economic content

66. Most of the dynamic models considered are primarily concerned with the evolution of the fish stock over time (Atlantis, BEMMFISH, ISIS-FISH). These models put relatively more effort into the representation of the biological system, including recruitment, multiple species and spatial details. This level of detail makes implementing the economic component of the model difficult. Complex decision-making is handled atomistically as a set of nodes in a decision-tree-like schematic framework. This allows for a rich specification of the scope of possible actions by fishers, but in a manner where the theoretical properties of the model results are impossible to determine. These models approximate economic behaviour, but are hypothetical in nature. This makes it difficult to draw general conclusions from the results of these models. Dynamic models incorporating a more formal economic structure (AHF, EIAA, FISHRENT) do so by removing much of the biological detail contained in the other dynamic models, and rely on relatively simple economic specifications. Analytical approaches may be dynamic or static in nature and are explicitly economically robust, but can become impractical beyond a certain level of detail.

Fisheries-specific detail vs. broader impacts

67. Socio-economic impacts have been identified as an area of interest in studying FTC policies. This encompasses a potentially broad range of derived indicators that require the model to encompass a broader

scope of economic interactions. The objective of estimating broad impacts stands in tension with the observation that the details specific to a particular stock or management system are crucial to understanding the impacts of FTC policy. The ENV-LINKAGES model is the only model considered here that estimates a full set of national and international general-equilibrium effects, and it is completely lacking in fisheries-specific detail. The Kirkley *et al*. I/O-LP model has a general-equilibrium representation of the regional economy, but a very simple fisheries component. The Seung and Walters CGE model of the Alaskan Pollack fishery also lacks detail, though has already been used to investigate increasing fuel prices. Both of these models are designed to reflect specific regional economies and their results may not be readily generalised.

68. A minimum condition for evaluating downstream (consumer) impacts is an endogenous price-responsive demand function that allows for changes in consumer surplus to be calculated. Similarly, endogenous prices and market clearing in input markets are required to evaluate any upstream (local economy) impacts. Evaluating socio-economic impacts of FTC policies in a partial-equilibrium model will always be difficult, as using a demand function defined by a single elasticity parameter will yield results that are strongly dependent on that parameter choice. Whether the demand function is assumed to be short-run or long-run is also important, as the demand function may represent short-run processor demand or a reduced form of downstream consumption. The results from Seung and Waters (2010) shown in Table 2 are a good example of the type of results obtainable with basic upstream and downstream market representations.

Ease of use and practicality versus model complexity

69. As models grow in complexity, inevitably the details of their implementation will become more difficult for Secretariat staff to undertake within a reasonable amount of time, or consultancies will become prohibitively costly. For this reason, it is important to identify the most important outcomes of the analysis and pick the approach that targets that most directly while not having too much complication in details extraneous to that.

70. Atlantis, ISIS-FISH and EIAA are all models with some strong elements in their favour, but whose complexity in use and interpretation of results make them less pragmatic as choices for FTC analysis. FISHRENT is essentially a simplified version of EIAA that retains most of the main elements, which makes is a preferred choice over EIAA. The LP models can be relatively practical to implement, though some examples of this type can also be complex (Kompas *et al*. 2010).

71. Econometric models can be relatively straightforward in their implementation, but add a good deal of data collection and preparation to the analysis. The results tend to be more difficult to interpret, and there are many reasons for perverse or inconclusive results that cannot be controlled for.

72. Analytical approaches such as a modified Schaefer model can range in difficulty according to complexity, but it is possible to customise the model to focus on key issues, and the standard nature of this approach makes it likely that there are a number of researchers who would be able to carry out the work as consultants. The outputs of analytical work are also easier to interpret for the non-modeller and can be more directly policy relevant. Extending such models beyond the fishery is probably impractical, however.

73. Data availability will be an issue for any model that is not already fully specified and in use. This imparts a strong bias in favour of pre-existing models or analytical approaches. However, most off-the-shelf approaches will not address the full set of indicators of interest to COFI. The capacity of member states to provide useful data, both for parameters such as elasticities and for structural data such as fleet costs and stocks, will be an important decision factor.

Recommendations

74. Finding a balance between the different characteristics of the approaches described here is a matter of setting priorities for the outcome of the analysis and accepting the trade-offs that modelling approaches imply. If the committee chooses to carry out an analysis of FTC policies using modelling approaches, the practicality, applicability to fisheries and amount of information for policy recommendations that would come out of the analysis needs to be carefully evaluated.

75. The initial request for this analysis referenced a broad range of indicators to be generated by model analysis, spanning social and economic dimensions within and outside the fisheries sector. This evaluation makes it clear that such a complete set cannot be generated by any single modelling exercise. A more typical set of model results can be seen in the results from Seung and Waters (2010) where four indicators - output, employment, labour income, and value added - are produced (Table 2). While the expected output is dependent on the model used, all models produce results more limited than initially envisaged, and this is an important factor in evaluating the benefits and cost of this form of analysis.

76. Any modelling exercise will be resource-intensive. That is, the potential work should be evaluated in the context of the 2013-14 Programme of Work discussion, as choosing to carry out this analysis will mean that other work under the Green Growth heading will be deferred. In addition, modelling work may require additional funds to cover the necessary consultancies.

77. The recent development of a fisheries component of the Aglink model also has the potential to offer the capacity for COFI to carry out more quantitative modelling work. While Aglink is not appropriate for the study of many policy questions, including FTCs, due to its design limitations, it will be able to produce scenarios on topics related to the evolution of demand, supply and trade of fish products, in particular for aquaculture. The Aglink fish module is in a relatively early stage of development and will also require resources to reach its potential, but it is clearly an option worth considering.

78. In light of the above the fundamental questions for consideration by the COFI are the following: What are the key economic and policy questions (of which FTC is one) of interest to delegations – and which of them are amenable to being addressed through the use of models? Is the COFI willing to make the necessary investments in developing new modelling capacity, suitable to address these specific policy interests, over the coming period?

79. If there is an interest to study the impacts of FTC policies, the following approaches are recommended in order of preference.

2. **Use of an analytical model to investigate impacts of fuel price changes to consumers, fishers, and input suppliers**. An analytical model offers the right balance of practicality, customisability and applicability to the conditions that generally apply in fisheries. An analytical model can produce results that are transparent and can be generalised in order to draw policy conclusions. This work would involve a consultant who would work with the Secretariat to further define the structure of the analytical model to be developed. It is possible that numerical results could be generated following an approach similar to that of the WBF model (World Bank, 2009). This would require data to be acquired from member states or other sources to implement. However, the main value-added of the analysis would be the identification of the key factors determining the impact of FTC policies and how they transfer through the system.

3. **The FISHRENT model provides a flexible platform to carry out comparative policy analysis**. The clear structure of this model combined with its complete, albeit simple, representations of the major elements of a fishery make it a practical and useful choice. The

model can be augmented with data in order to represent a specific—but simplified—fishery, or using stylised data to generate more general results. The main developers of the model, LEI and Framian, are available for consultancies, but may be expensive relative to usual OECD consultants. It is possible for Secretariat staff to operate the model, which is freely available, in order to reduce costs.

4. **The ENV-Linkages model provides the most complete approach to evaluating socio-economic impacts**. While having only a rudimentary representation of the fishery sector, the ENV-Linkages model is the only model available that can evaluate cross-sectoral impacts on a national scale. The ENV-Linkages model contains representations of most OECD countries, allowing for a country-specific look at impacts that eliminates the uncertainty inherent in applying model results for one region to another. As an OECD model, this option is relatively low cost, though it will require agreement and coordination with the Environment Directorate where it resides. Modifying the model to improve the representation of fisheries is possible, but implies a greater investment in the analysis.

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TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

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GREEN GROWTH AND ENERGY USE IN FISHERIES AND AQUACULTURE

23-25 April 2012

This document is presented to the 109th session of the Committee for Fisheries for DISCUSSION and GUIDANCE.

Contact: Roger Martini (roger.martini@oecd.org)

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NOTE BY THE SECRETARIAT

This document evaluates the determinants of energy use in fisheries. It is undertaken as part of the Committee for Fisheries' work on green growth in fisheries and aquaculture. This work was proposed in a scoping paper at the 108th meeting of the Committee for Fisheries and approved at that meeting. This version is presented for discussion and guidance. A revised version taking into account comments received and adding additional material will be presented to the 110th meeting of the Committee for Fisheries.

TABLE OF CONTENTS

Tables

Figures

Boxes

GREEN GROWTH AND ENERGY USE IN FISHERIES AND AQUACULTURE

Introduction

1. The purpose of this report is to examine energy use in fisheries and aquaculture from a green growth perspective. The OECD "Green Growth Strategy" represents a set of principles that aim to ensure that policies can best promote economic growth that is sustainable and matched to public objectives. In the case of energy use in fisheries, there are several reasons to believe that looking at policies through the perspective of Green Growth principles is important as:

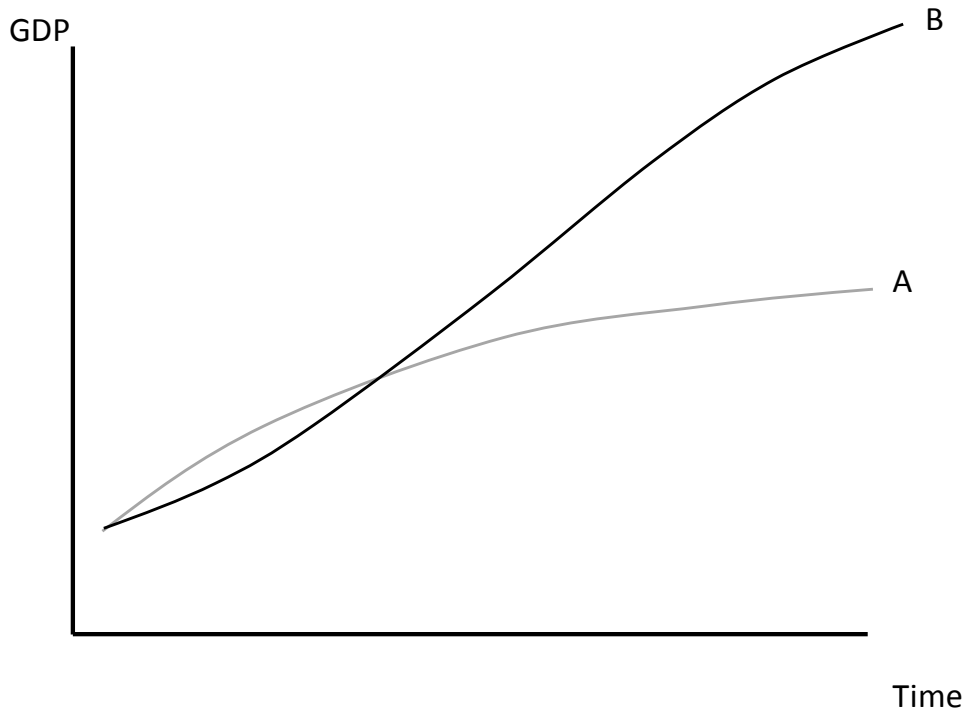
- Energy use is a strong proxy for the climate change impacts of the sector. Climate change is an important environmental externality that can have important and widespread long-term impacts. As such, many countries have objectives and policies in place to mitigate the risks of climate change. Ensuring that fisheries policies enable the sector to contribute to these objectives (i.e. green) is essential to their success.

- Energy, mainly in the form of diesel fuel, is a major component of the overall cost of fishing in many cases. Improved energy efficiency is one way to help improve the profitability of fisheries (i.e. growth), which is an objective of fisheries policy in many OECD countries. Improved policy coherence can help improve efficiency while not compromising other objectives for the sector.

- Impediments may exist that slow the adoption of new technologies or techniques that can improve energy efficiency. While maximising energy-efficiency is not necessarily the goal, identifying and removing barriers preventing cost-effective investments can improve both efficiency and profitability (i.e. green and growth).

2. The scale of energy use and efficiency in the sector is an outcome of the conditions and options facing fishers and aquaculture producers. Operators are acting to maximise their profitability as best they can, so the current situation is economically optimal in the sense that there are not systematic and predictable errors being made on the part of individuals. Consider two possible growth paths of the sector over time (Figure 1). Paths A and B both represent possible levels of economic activity over time. If we consider path A to be business as usual and path B to be a possible path of growth given some changes in the underlying policy environment, then we can define the "green growth" problem as finding the set of policy reforms that move the economy from path A to path B.

Figure 1. Possible growth paths



3. In the figure, path B is drawn as having slower growth in the near term with better long term growth prospects while path A has stronger short-term growth followed by stagnation. This is a commonly-seen metaphor in discussions of green growth principles. Near-term investments in sustainability lead to a longer term payoff in higher, more sustainable rates of growth.[1]

4. The importance of policy coherence and a broad view of policy impacts are central principles of the OECD Green Growth strategy. Recognising that improvements in energy efficiency are possible and that reductions in climate change emissions will be necessary should not immediately lead the policy maker to conclude that policies should be put in place to maximise fuel efficiency. This is because it is important to maintain policy coherence with other objectives in the fishery that could be harmed by a single-minded focus on efficiency. Not only should improvements in fuel efficiency be compatible with profit-maximising behaviour, any improvements in efficiency should be the result of choices that maximise profits in efficient markets. Anything else is unlikely to be sustainable as a policy. In particular, subsidies and market interventions are by definition distortions of markets and imply deadweight losses and other costs that bring their long-term sustainability into question.

5. This report has the following objectives. It will review the literature on the relationship between energy use and other aspects of the fishery, including the management regime, technology, and the range of behavioural options available to the fisher. It will synthesise the results of this literature review in order to draw conclusions as to the likeliest path for improvement, taking into account the OECD Green Growth principles. It will set the stage for future analysis of the potential benefits available from different policy

1. This is just an illustration and is unlikely to be true in every situation. One can imagine that in the case of fisheries, it depends on the current stock status and fleet size relative to optimal levels, among other things.

actions. While the document will have capture fisheries as a main focus, it will also evaluate energy use in aquaculture operations and from downstream in the marketing chain. The paper will conclude with recommendations for next steps for this work.

Assessing energy use in fisheries.

6. There exists a broad literature on the subject of energy use in fisheries, and more generally on the costs of fishing. There are many different ways to categorise this body of work. Energy efficiency can be considered on a fishery-specific basis, either by species or by gear type. It can be considered across countries, fleet types, or region. It can focus on the technical relationships between hull style, engine, propeller or other physical characteristics, or it can focus on the choice of the skipper regarding steaming speed or distance travelled to fishing grounds or to markets. Energy efficiency can be considered in terms of weight of fish caught or landed, or the value of same. The limitations imposed by the management regime can be studied, or the market forces at work, such as the price of fuel versus the price of fish.

7. Given the number of different angles at which one can approach this subject, there is no single best way to structure a discussion of the determinants of energy use. It is, however, useful to consider three main categories that divide along issues of technical efficiency, behaviour and the management system:

- **Technical efficiency** is the impact of investments in gear or vessel components that can increase fuel efficiency. That is, they increase fuel efficiency regardless of behaviour or management system. Some investments in efficiency may imply or require changes in vessel operation.

- **Behaviour** of the fisher or aquaculture producer describes the choices determining relative factor intensity between energy and other production inputs. Fishers can increase fuel efficiency by trading-off between time and other costs for example with respect to steaming time and other operational – on the fishing ground - choices.

- **The management system** sets the overall framework that is important in determining how energy is used by fishers. Not only can it shape decision-making, it can be decisive in technology and techniques of fishing through regulatory requirements. Most importantly, its effectiveness in maintaining a healthy stock status helps determine overall efficiency of fishing as measured by catch per unit effort (CPUE).

An Overview of Energy Use in Fisheries

8. The FAO[2] estimates that capture fisheries consumed 14 million tons of fuel in 2005, costing USD 22 billion and corresponding to about 25% of the sector's revenue. Estimates of fuel costs over the past several years show an increasing share of costs of fuel over time (Table 1). OECD member country estimates of fuel costs are generally higher for mobile-gear fleets than for fixed-gear fleets that fish close to the coast (Table 2). For example, UK North Sea beam trawlers have fuel costs that can reach as much as 78% of all operating costs; while in some fixed-gear coastal fisheries fuel costs can reach a percentage as low as 3% to 5% of operating costs. While fuel costs are high as a share of total costs in fisheries, this does not imply that capture fisheries are inefficient relative to terrestrial food sources (Box 1.).

2. *The State of the World's Fisheries and Aquaculture*, 2006, FAO

Box 1. Fuel Consumption in fisheries vs. other food sources

Fisheries account for about 1.2% of global oil consumption and directly emit more than 130 million tonnes of CO_2 into the atmosphere. The energy content of the fuel burned by global fisheries is 12.5 times greater than the edible protein energy content of the resulting catch. While the fishing sector consumes a substantial amount of fuel, its use of energy is far more efficient than many other contemporary food production systems, a finding that flies in the face of some widely held perceptions of capture fisheries in general. This seeming incongruity between perception and reality may, in part, result from the relatively high proportion of total energy inputs, and resulting energy-related costs that accrue at the level of the fishing enterprise itself. In contrast, in the case of many other animal protein production systems, the majority of energy inputs tend to occur farther back in the production chain.

Source : Tyedmers *et. al.* (2006)

9. Fuel use generally represents a higher share of costs in mobile-gear fleets. However, the "catch effectiveness" of fishing gear can make efficient mobile gear more fuel-efficient per tonne landed than some fixed gears, e.g. Danish seine for mackerel vs. set nets for plaice. Higher value fish can be profitably targeted even when the required gear has higher fuel costs - prawn is a good example of a high-value product with high harvest costs.

Table 1. Fuel costs of developing and developed countries

as a percentage of revenue from fish landed

	1995-97	1999-2000	2002-03	2005[1]
Developing Countries				
Active demersal	17.19	30.28	26.15	52.30
Active pelagic	17.33	17.60	16.99	33.98
Passive gear	18.78	17.06	19.33	38.66
Average	18.52	20.65	21.63	43.26
Developed Countries				
Active demersal	10.57	8.64	14.37	28.74
Active pelagic	n.a.	7.65	5.48	10.96
Passive gear	5.57	4.95	4.61	9.22
Average	11.08	9.78	10.20	20.40
Global Average	14.85	16.70	18.53	37.06

1 Estimate

Source: FAO

Table 2. Fuel costs as a proportion of operating costs in selected OECD countries

Country and fishery	Fuel costs as percentage of operating costs
Australia	
Torres Strait prawn	39
Commonwealth trawl sector	23
Eastern tuna and billfish	17
Gillnet, hook and trap sector	10
France	
Chalutiers de fond exclusifs (12-16m)	22
Chalutiers drageurs (12-16m)	16
Arts dormants (12-16m)	7
Iceland	
Pelagic trawlers / purse seiners	15
Trawlers	13
Freezer trawlers	15
Coastal vessels (<10m)	3
Norway	
Trawlers	19
Purse seiners (blue whiting)	15
Purse seiners (other)	12
Pelagic trawlers (herring, blue whiting)	20
Trawlers (cod)	20
Coastal vessels (<13m, cod)	5
Spain	
Mediterranian National waters/longliners	35.4
North Atlantic national waters/longliners)	30.5
North Atlantic No-National waters longliners	31.5
Ùnited Kingdom	
North Sea beam trawl (over 300 kW)	78
Area VIIA nephrops twin-rig trawl	38
Irish Sea demersal trawl	36
UK pelagic (over 40m)	25
UK pelagic (10-40m)	16
Potters and creelers (over 12m)	12

Source: Vieira and Hohen (2007), Vieira *et al*. (2007), Seafish Industry Authority (UK). Planchot and Daures (2008), STECF (2006).

10. A majority of recent work to identify the fuel intensity of fishing appears to have taken place in Norway, though a number of other countries have been studied. The results indicate that, as expected, active forms of fishing are more fuel intensive and that there is a great variation in the fuel intensity across country and gears (Table 3). It is likely that the differences between countries are driven by the nature of the fisheries in those countries, differences in fleet size and modernity (perhaps policy-driven) and difference in stock size with respect to MSY as well as the management system in place. It is possible that fuel tax concessions play a role as well.

Table 3. Fuel use by gear type, selected countries

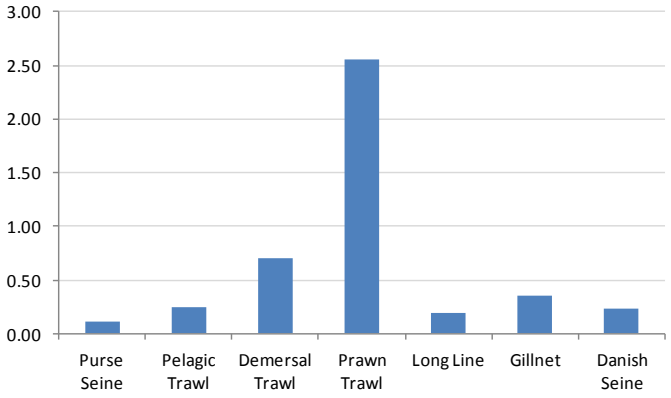
litres diesel per kg fish landed

Country	Gear	Fuel use	Source	Country	Gear	Fuel use	Source
Norway	Other long line	0.15	*Winther et al.*	**Australia**	Danish seine, 16m vessel	0.48	*Thomas et al (2010)*
	long line (Autoline)	0.31			Demersal trawl (prawn)	4.99	
	Bottom Trawl (Bunntral)	0.43					
	Trolling Line	0.14		**USA**	Purse seine atlantic herring	0.02	*Driscoll and Tyedmers (2010)*
	Pelagic line	0.10			Midwater trawl	0.11	
	Pelagic trawl	0.10			Pair Trawl	0.12	
	Pelagic pair trawl	0.09			Average	0.09	
	Hand line/jig	0.15					
	Gillnet	0.15		**Faroe islands**	Pair trawlers	0.36	*Thomsen et al. (2010)*
	Purse Seine	0.09			Large Single Trawlers	0.78	
	Danish Seine	0.12			Large Longliners	0.24	
	Undefined gillnet	0.25			Small Single Trawlers	0.50	
	undefined seine	0.08			Factory Trawlers	0.63	
					Pelagic vessels	0.08	
	Bottom trawlers	0.63	*Eyjolfsdottir et al 2003, Tyedmers 2001 and 2004*	**Sweden**	Gillnet	0.34	*Ziegler and Hansson (2003)*
	Purse Seiners	0.08			trawl	1.41	
	Long liners	0.03					
				Malaysia	Lines	0.19	*Smith (2007) cited by FAO doc*
	Autolining	0.37	*Schau et al. (2009)*		traps	0.24	
	Purse Seiners	0.11			gillnets	0.23	
	Shrimp trawling	1.25			purse seines	0.25	
	Bottom trawl	0.34			trawls	0.40	
	Double trawl	1.21					
	pelagic trawl	0.11		**North Sea**	Beam trawling	2.91	*Smith (2007) cited by FAO doc*
	gillnet	0.23			Bottom trawling	1.43	
	hand line and trolling line	0.18			Shrimp trawling	1.41	
	Danish seine	0.11			Mid-water trawling	0.69	
	trap (crustaceans)	0.13			Gillnetting	0.81	
					Danish pair seine	0.82	
					Danish Seine	0.20	

11. Prawn trawling is the most energy intensive method studied, with demersal trawls also being relatively fuel intensive. Other forms of fishing have broadly comparable intensities (Figure 2). Considering the high variation in fuel use by different gear types, Driscol and Tyedmers (2010) observe: "*While such large differences in energy performance between gears within a fishery seem remarkable, it attests to the fact that fuel costs, while never trivial, have clearly not dominated decision-making amongst skippers and vessel owners."* The relationship between fuel costs and profitability is not obvious, depending on other input costs, the price obtained for fish, and spatial dynamics of the fishery. Fuel subsidies may also play a role in sustaining fuel intensive techniques.

Figure 2. Fuel use by gear type, average of studies

Litres diesel per kg fish landed



Source: Winther *et al.* (2009, Eyjolfsdottir et. al. (2003), Tydemers (2001) (2004), Schau et. al. (2009), Thomas et. al. (2010), Thomsen et. al. (2010), Ziegler and Hansson (2003), Smith (2007).

12. Taking a look at fuel efficiency of harvest by species rather than gear reinforces the view that the value of the targeted species is a strong determinant of fuel intensity. Prawn and demersal flatfish consistently are seen to exhibit the highest fuel consumption per landed quantity (Table 4). In particular, forage species such as mackerel or herring tend to have relatively low intensities of fuel use (Figure 3).

Table 4. Fuel use by species

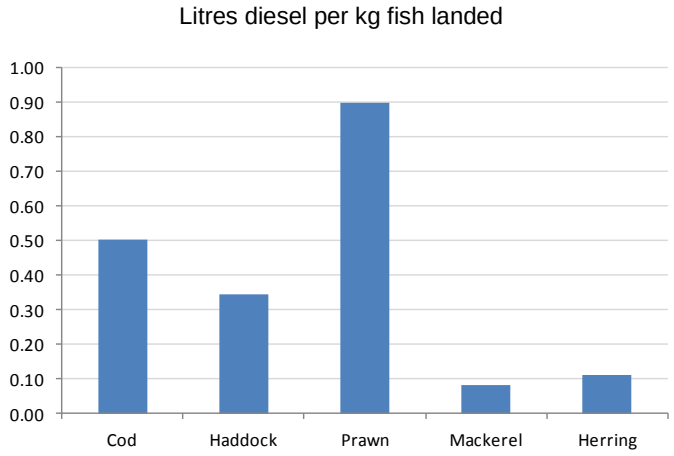
Litres diesel per kg fish landed

Country	Species	Fuel factor	Source	Country	Species	Fuel factor	Source
Norway	Cod	0.24	*Winther et al. (2009)*	**Denmark**	Cod	0.36	*Thrane (2004)*
	Haddock	0.29			Flatfish	0.97	
	Saithe	0.29			Prawns	0.76	
	Herring	0.09			Shrimp	1.03	
	Mackerel	0.09			Norway Lobster	6.05	
					Mussels	0.01	
	Cod	0.35	*Schau et al. (2009)*		Herring	0.18	
	Herring	0.09			Mackerel	0.06	
	Wolffish	0.34			Industrial Fish	0.06	
	Beaked redfish	0.48					
	Blue Ling	0.32		**Spain**	Atlantic Tuna	0.53	*Hospido and Tyedmers (2005)*
	Blue Whiting	0.09			Indian Ocean Tuna	0.45	
	Prawn	1.04			Pacific Tuna	0.63	
	Dover Sole	2.45			Average all tuna	0.52	
	Greenland Halibut	0.43					
	Haddock	0.40					
	Hake	0.29		**USA**	Atlantic Herring	0.09	*Driscoll and Tyedmers (2010)*
	Mackerel	0.09					
	Plaice	1.84		**Sweden**	Cod	1.01	*Ziegler and Hansson (2003)*
	Turbot	2.08					
	Whiting	0.40		**Iceland**	Capelin	0.02	*Agustsson et. al. (1978)*
					Groundfish	0.28	*Eyjolfsdottir et. al. (2003)*
	Cod	0.56	*Ellington and Aanondsen (2006)*				
	pelagic for feed	0.08					

13. Tyedmers (2001) conducts a similar review of energy use for capture of different species, using older data in many cases. The data indicates a trend toward lower energy efficiency over time, despite higher fuel prices:

"The energy intensity of a fishery can change dramatically over time as the abundance of fisheries resources change, fleets expand, the average size of vessels increase, vessels travel further to fish, and become more technologically advanced. For example, Brown and Lugo (1981) estimated that between 1967 and 1975, while the fuel consumed by the U.S. fishing fleet (excluding vessels under 5 GRT) increased from 150 to 319 million gal/year, the catch did not increase accordingly. As a result, the fossil energy input to edible protein energy output ratio for the U.S. fleet increased from 8:1 to almost 14:1 over the same period. Similarly, Mitchell and Cleveland (1993) found that between 1968 and 1988, the fuel energy input to edible protein output ratio of the New Bedford, Massachusetts fleet rose from ~6:1 to over 36:1." (Tyedmers, 2001).

Figure 3. Fuel use by species, average of studies



Source: Winther et. al. (2009), Eyjolfsdottir et. al. (2003), Tydemers (2001) (2004), Schau et. al. (2009), Ziegler and Hansson (2003), Hospido and Tydemers (2005), Ellington and Aanondsen (2006),Agustsson et. al. (1978).

Technical Efficiency

14. Investments in improvements in the technical efficiency of fishing operations can yield benefits in terms of increased energy efficiency. Improving technical efficiency increases energy efficiency independently of behavioural choices or the incentives and requirements of the management system. It is worth returning to the point that this does not imply that all such investments are desirable - this depends on the return to such investments relative to other possible investments (in fisheries or elsewhere). From a policy perspective, the question is whether the policy environment may be altered to render such investments more attractive without compromising other policy objectives, including importantly the green growth principles of market-orientation and trade openness.[3]

3. This thread runs through this entire document; identifying possible measures to increase energy efficiency is not sufficient to justify implementing those measures. Ultimately, they need to be profitable for the fisher. The role of public infrastructure and policy in determining whether such investments are profitable is more relevant for the policy maker. For example, fuel tax incentives act as a disincentive to invest in energy efficiency.

15. Leaving aside the optimality of any particular investment in efficiency, this section will discuss the range of technical changes available to fishers to reduce the energy intensity of fishing operations. The range of possible improvements is large, but not all claimed improvements have been proven in practice. There are a number of modifications that are the subject of current research and development, and many of the products in the marketplace are associated with claims that cannot be independently confirmed.

16. Potential areas for improvement are in hull design, propulsion systems, power-plants and engines, non-fishing power demand (mainly refrigeration), and gear modifications. The potential for improving fuel efficiency depends on the physics of energy (mainly diesel fuel) transformation into useful work (Box 2.).

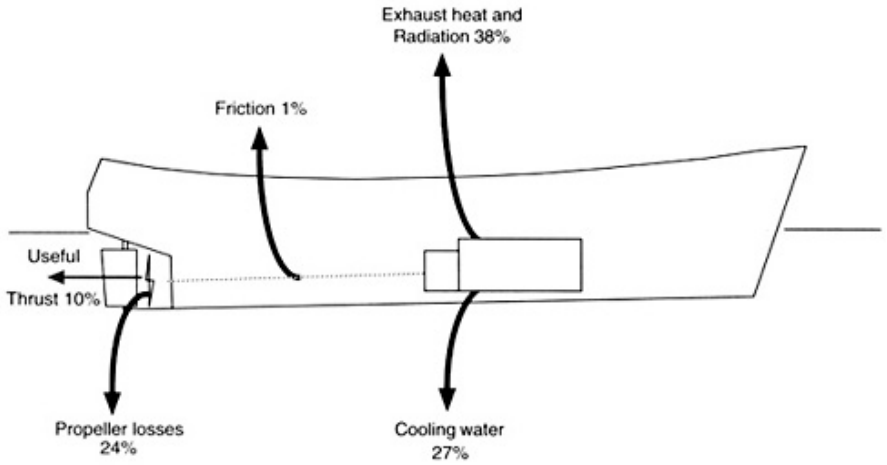
Box 2. Sources of Inefficiency

In addressing the problem of energy efficiency it is useful to understand just where the energy is expended in a fishing vessel and what aspects of this can be influenced by the operator, boatbuilder or mechanic.

In a small slow-speed vessel, the approximate distribution of energy created from the burning of fuel is shown in the figure below. Only about *one-third* of the energy generated by the engine reaches the propeller and, in the case of a small trawler, only one-third of this is actually spent on useful work such as pulling the net.

In a vessel that does not pull a net or dredge, of the energy that reaches the propeller:

- 35% is used to turn the propeller;
- 27% to overcome wave resistance;
- 18% to overcome skin friction;
- 17% to overcome resistance from the wake and propeller wash against the hull; and
- 3% to overcome air resistance.



Source : Wilson (1999)

17. Bjorshol (2007) cites research demonstrating gains from using two ducted propellers instead of one. He also points out the potential from recovering the 60% of energy in diesel fuel that is lost as waste heat, either to supply on-vessel heating requirements or to generate electricity (Table 5). Van Balsfoort, and Grandidier (2006) describe the efficiency gains and other benefits of the "pulse beam" modification to beam trawlers in The Netherlands. This design, which uses a hydrodynamic beam and replaces beater chains with electrical stimulation, also claims to reduce damage to the sea floor.

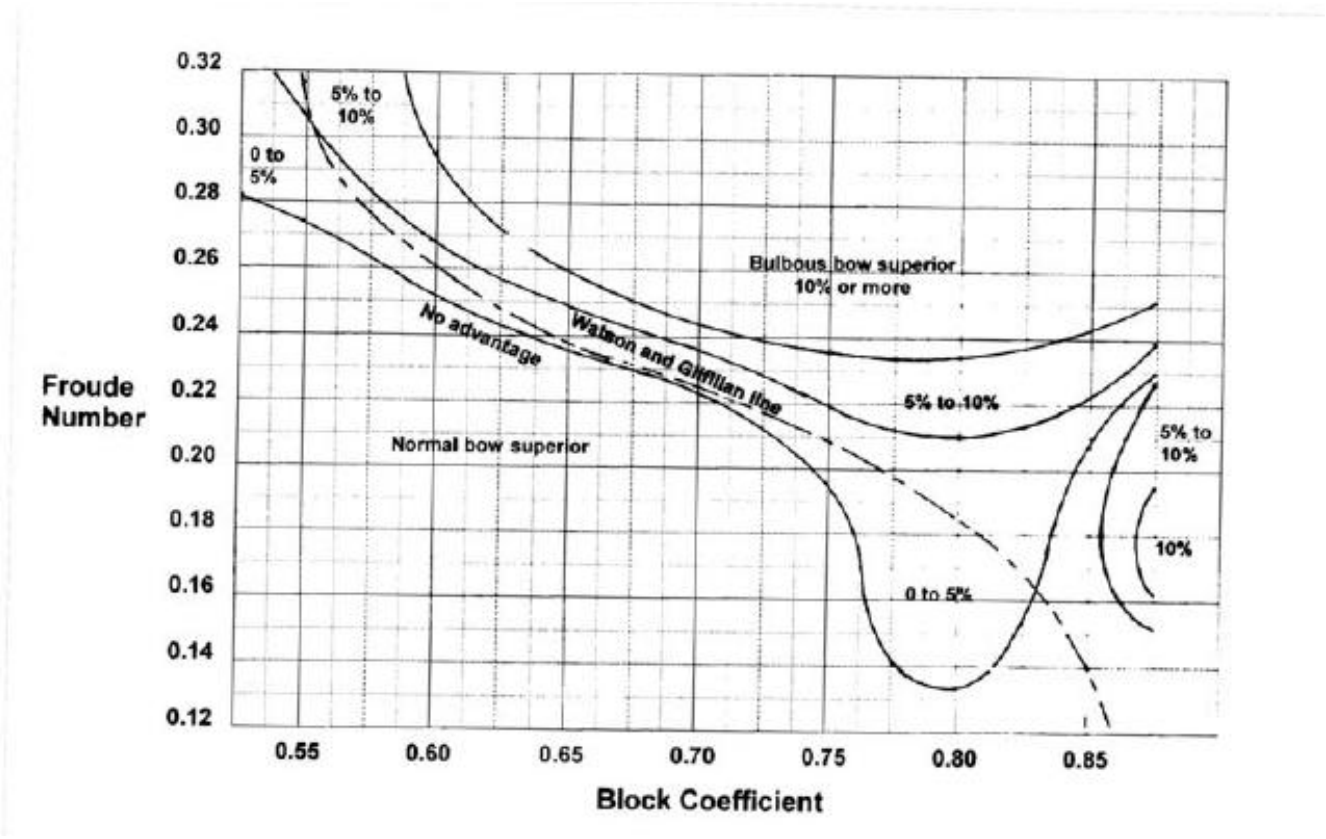
18. Sterling and Klaka (2007) identify a number of factors that increase resistance and reduce efficiency, including inefficiently designed rudders, poor trim, and hull appendages such as transducers or cooling ports. They suggest a number of improvements that could be retrofitted to existing vessels.

Table 5. Technical improvements to energy efficiency

Modification	% improvement	Notes	Source
Engine after-cooling	10	With respect to non-after-cooled motors. Improvement is with respect to fuel consumption per power output	Ziegler and Hansson (2003)
Antifouling	7	After one month without treatment	Swedish International Development Authority/FAO, 1986
Antifouling	44	After six months without treatment	Swedish International Development Authority/FAO, 1987
Propeller maintenance	4	reduction in efficiency after 12 months use	Wilson (1999)
Ducted propeller	20	For trawler	Wilson (1999)
Dual ducted propeller	20	With respect to single ducted propeller	Bjorshol, Nils Harald (2007)
Waste heat capture	13	for heating or electrical production	Bjorshol, Nils Harald (2007)
Hydrodynamic pulse bean	40	potential improvement over traditional beam trawl	Van Balsfoort and Grandidier (2006)
Bulbous bow	10	reduction in resistance (dependant on vessel characteristics)	Thomas et. al (2010)
Aerofoil rudder	4	compared with flat rudder	Sterling and Klaka (2007)
Hull protrusions	20	change in total drag for all componenets	Sterling and Klaka (2007)

19. Adding a bulbous bow can increase vessel efficiency by reducing wave resistance. Whether it provides a benefit depends on the Froude Number (speed divided by vessel length) and the Block coefficient (vessel cross-section), but an improvement of 10% can be achieved in the best case (Figure 4).

Figure 4. Benefits of a bulbous bow



Source: Sterling and Klaka (2007)

20. When actively trawling, about 80% of energy is expended on towing the trawl. For this reason, improving the energy efficiency of the gear can lead to significant improvement in the overall energy efficiency of fishing. Suuronen et. al (2012) suggest a number of modifications that can reduce the drag of gear in water, or improve gear performance (Table 6). They also compare the relative strengths and weaknesses of different types of fishing gear (Table 7).

Table 6. Potential energy saving techniques and adaptations for demersal trawling

Technique/measure	Effect	Constraints–barriers
Use of thinner and stronger twines, super fibres, knotless netting, square mesh netting, T90 net, less netting, larger mesh size	Reduces the amount, weight and surface area of netting and increases water flow through the net, thereby reducing the overall drag	High price and availability of materials; use of larger meshes can reduce the catch of marketable species and sizes; cost benefit analyses not carried out for most fisheries
Use of smaller and/or multiple nets for species that exhibit poor avoidance behavior to the presence of the fishing gear (e.g. shrimp, flatfish)	Reduces the overall netting surface area and thereby the weight and the drag without reduction in catch	Policy, complexity of rigging, resistance to change
Use of effective bycatch and benthos reduction devices (BRDs)	Allows the escape of unwanted species or sizes of fish and other unwanted objects thereby reducing the weight and overall drag	Variability in performance, lack of technical support to test and optimize BRDs, loss of revenues of target species and sizes, perceptions
Using four-panel design (instead of typical two-panel) in the belly, extension piece and codend, using square mesh netting in the belly	Ensures easier installation of BRDs and better geometry and stability for the back end of the trawl	Cost benefit analyses not carried out for most fisheries
Use of hydrodynamic trawl doors and use of optimal warp length (that corresponds to optimal door efficiency)	Less drag (traditional trawl doors contribute up to 25-35% of the overall gear drag), less weight, better fuel efficiency	Price, performance monitoring, control in different sea conditions and depths
Use of raised or flying trawl doors where the weight element of the door is separated from the spreading element (doors can be flown above the seabed to open the trawl)	Better spread, less drag and less pressure on the bottom (less seabed disturbances)	Price, performance monitoring, control in different sea conditions, depths, not suitable for all species
Better rigging of the gear, lighter ground-gear, shorter ground-gear, less discs and better rotation capacity, self-spreading ground gear, composite ropes, lengthened bridles, off-bottom bridles, lightweight warps, and proper matching of trawl net and trawl doors	Lighter and reduced contact points to seabed, less seabed pressure, smaller impact area, less drag	Performance monitoring
Use of hydrodynamic shape of floats, kites, beams, pulse trawls, SumWing-design	Reduced drag, reduced seabed contact	Performance monitoring, speed dependence
Converting from single boat trawling to pair trawling	Reduces fuel consumption, less seabed damages	Policy, human behavior
Improving real-time monitoring and control of gear with acoustic gear surveillance technology	Maintenance of optimal gear performance, reduces energy consumption and bycatch	Price, training
Installing real-time camera observation system for informing skipper of fish behavior and composition in the trawl	Helps to maintain optimal gear performance, reduces bycatch and collateral impacts. The next step may be an active mechanism to release unwanted catch	Price, training
Improving navigation and fish finding, and improving knowledge on fishing grounds (GPS, electronic charts, sea-bed mapping)	Maximizes catches and minimizes time, energy and collateral impacts	Price, training
Use of speed controls, reduction of towing speed	Reducing speed directly reduces the fuel consumption	Human behavior
Vessel and propulsion system optimization, preventive maintenance of vessel and engine, change in trip planning practices	Reduces fuel consumption	Price, human behavior

Source: Suuronen et. al (2012)

Table 7. Advantages and disadvantages of different demersal gears

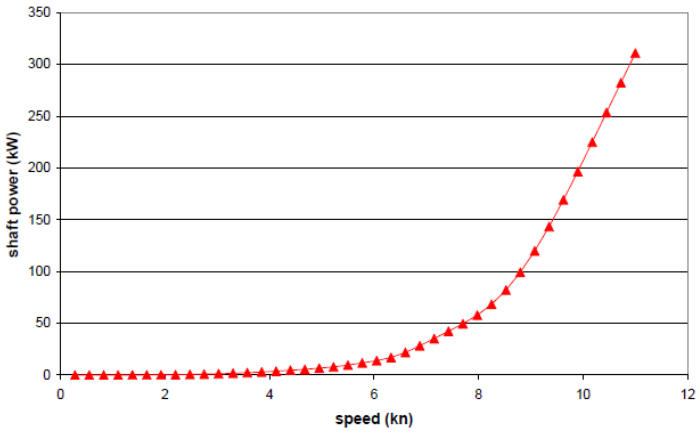
Gear	Advantages	Disadvantages	Priority actions
Trap-net and pound-net	• Low energy use • Selective for species and sizes (if properly designed) • Live capture (possibility) • Minimal habitat impact	• Not easily portable • Operation may be labor intensive • Maintenance labor-intensive • Expensive to construct • Operation limited to relatively shallow waters • Occasionally significant bycatches	• Development of designs and practices that prevent the entangling of non-fish species in the mooring ropes and nettings of the trap
Pot	• Low energy use • Flexible and transportable • Can be operated in rough bottoms • Selective for species and sizes • Live capture—good catch quality • Potential for low bycatch mortality • Minimal habitat impact • Predator safe • Availability of wide variety of suitable local (natural) materials • Cheap to construct	• Low capture efficiency for many finfish species • Ghost fishing of lost pot • Lost pots contribute to marine debris • Low catch rates	• Fish behavior studies to enhance ingress and reduce escape • Alternative attractants • Comparative fishing experiments • De-ghosting technologies • Human behavior–barriers to a change • Research and development work at infancy
Long-line	• Low energy use • Portable • Flexible and versatile • Species selective • Minimal habitat impact • Good catch quality • Cheap to manufacture	• Labor intensive and time consuming to operate • Incidental bycatch of non-target species • Snagging on benthic epifauna • Availability and price of bait • Low catch rate for many species	• Bait issue/bait availability • Alternative attractants
Gill-net	• Low energy use • Easily portable • Versatile and flexible • Good size selectivity (except trammel-nets) • Possible to target specific size range allowing effective exclusion of small and large fish. • Relatively cheap to manufacture	• Labor intensive • Most fish die during capture • Catch quality • Poor species selectivity • Capture of non-target species, often sea birds, turtles and other charismatic species • Ghost fishing of lost nets • Benthic impacts	• Development of practices and technologies that reduce bycatch
Bottom seine	• Relatively low energy use • Possible to operate with low horsepower vessels • Reduced bottom impacts compared to bottom trawling • Requires less space than bottom trawling (possible to operate in small patches of good ground) • Allows easy moving between fishing ground • Relatively low gear costs • Less gear damage and wear than in bottom trawl fishery • Easier to use and repair (than bottom trawl) • High fish quality • Great scope for modifications and improvements	• Not as flexible and effective as bottom trawling • Operation limited to relatively flat and clean grounds (warps snag easily on boulders) • Operation can also be restricted by depth, strong tides, bad weather and lack of daylight • Not effective for non-herded animals such as shrimp and nephrops • Operation requires good skills • Workload can be relatively high • Relatively poor selectivity for species and sizes • Potential sea bed impacts • A large seine can be expensive to manufacture	• Research and development work needed in improving the operation on rough grounds, in sea currents, and in deeper waters • Substantial energy saving possibility • Training is needed because the technology not well known
Beam trawl	• Effective • Relatively easy and practical to use	• Seabed impacts • High fuel consumption • Bycatch • Suitable only for relatively clean grounds • Expensive	see Table 1
Bottom trawl	• Effective • Versatile	• Seabed impacts • High fuel consumption • Bycatch • Expensive • Operation requires high skills and advanced equipments	see Table 1

Source: Suuronen et. al. (2012)

Fisher behaviour

21. Changing operational procedures on the fishing vessel can lead to important changes in energy efficiency. The most important of these is steaming speed. Because the wave resistance of the hull increases dramatically as speed increases, at higher speeds a small reduction in speed can lead to significant improvements in fuel efficiency (Figure 5). For example, a 15m vessel that reduces its speed from 10 knots to 9 can increase efficiency by 40% (Sterling and Klaka 2007). Providing feedback on fuel-consumption by the use of on-vessel fuel consumption meters can help to change the behaviour of vessel captains (van Marlen and Salz 2010). This feedback quantifies the savings from slower speeds, but such savings will be compared against the opportunity cost of time in determining optimal speeds.

Figure 5. Required shaft power vs. speed for 15 m fishing vessels



Source: Hullspeed (2006)

22. Aside from steaming speed, gear choice and use are crucial determinants of energy efficiency. It is well-known that passive gears are less fuel-intensive than active gears, and trawling typically has the highest level of fuel consumption per quantity of fish harvested. Fishers chose the most profitable gear, not the most fuel efficient one, but increases in the cost of fuel can motivate changes in gear choice over the long term. In addition, many factors complicate the decision to change gear types (Box 3).

Box 3. Considerations for changing gear type

As a rough estimate the costs of an average Belgian beam trawler can be split into 30% wages, 45% fuel and 25% other costs. Taking into account that almost the entire Belgian fleet consists of beam trawlers, this means that 45% of the value of all Belgian quota is spent on fuel… Today, many sea trips of beam trawlers are concluded with a financial loss for the vessel owner and it is clear that the beam trawler fleet is on the edge of not being profitable. Fuel is the critical factor and hits the beam trawler fleet very hard. On the other hand, there are examples in Belgium of fishing vessels carrying out a very profitable fishery based on passive fishing methods with a fuel bill less than 5% of the revenues. It is clear that profitable alternatives exist but a conversion is not straightforward. Problems of investment costs, conflicts between fishing methods, availability of sufficient quota and suitable fishing grounds, lack of fishermen's knowledge of alternative fishing methods, etc. can hinder a conversion. It is therefore necessary that potential alternatives are studied thoroughly so that realistic alternatives (in terms of vessel type and fishing method) can be presented to the industry and a restructuring of the fleet can start.

Source : Polet *et al*. (2006)

23. Changing fishing strategy can lead to fuel efficiency improvements. Increased fuel costs have already led to some of these being observed. Some potential changes in strategy are as follows (Rossiter, 2006) :

- Fishing on grounds closer to port, and focussing generally on inshore fisheries.
- Reducing effort during periods or conditions where CPUE is usually lower. This includes fishing in bad weather, fishing during tides and avoiding less "clean" fishing grounds.
- Changing the choice of port for landing catch, preferring ports closer to the point of catch to those with higher expected prices or home ports.
- Targeting (subject to quota availability and other restrictions) different species, such as Nephrops.
- Ceasing fishing activity entirely when fuel prices are high or fish prices low.

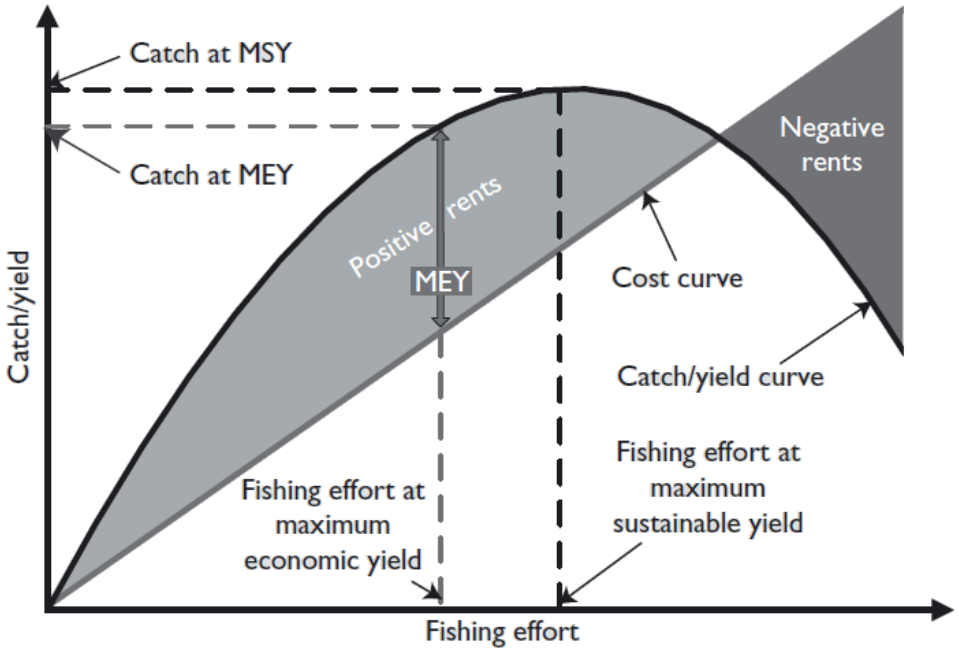
24. Fishers can also switch from single to pair trawling, where two vessels tow a single net. This can improve fuel efficiency by up to 10% (Wilson 1999).

Management regime

25. Changing the management regime – including technical requirements - is one of the more direct ways that the policy maker can influence the fuel efficiency of the fishing fleet. While it is unlikely that a first priority of fisheries management is energy efficiency, many changes in management seen as generally beneficial or improving will also serve to increase fuel efficiency.

26. One of the most important single determinants of energy efficiency is the status of the fish stock. Depleted stocks, everything else being equal, lead to lower CPUE and therefore lower energy efficiency per quantity harvested. Maintaining stocks at maximum economic yield (MEY) can reduce fuel consumption by fishers by up to 50% and improve profitability generally by reducing effort and increasing the stock of fish (Figure 6). For example, fuel consumption by Icelandic fishers reduced by 45% after the introduction of the ITQ system that led to reduced numbers of vessels and improved fish stocks (Arnason 2010).

Figure 6. Profits vs. effort in fisheries



Source: World Bank (2009)

27. Improvements in energy efficiency subsequent to the introduction of an ITQ regime have also been observed in the groundfishery in eastern Canada (Grafton Squires and Fox, 2000) and the west coast Halibut fishery (Dupont and Grafton, 2001), as well as in Alaska longlining (Sigler and Lunsford, 2001). Deacon, Parker and Costello (2008) note that when management systems promote co-operation between fishers (in this specific case by allowing the formation of a profit-sharing cooperative), the result can be improved energy efficiency. This is because fishers can fish over a longer period of time, closer to port, and spend less effort searching for fish.

28. Mitchell and Cleveland (1993) demonstrate how much energy efficiency can decline when efforts above MSY lead to lower stocks and lower CPUE. In a study of the fishery in New Bedford in the United States, they observe a 500% increase in energy intensity of production between 1968 and 1988 due to the large increase in the fishing fleet over that period and the concomitant decline in stocks. This effect was observed more generally for US fisheries by Brown and Lugo (1981).

29. Driscoll and Tydemers (2010) study the New England Atlantic Herring fishery, where a ban on mobile gear led to a conversion to Danish seine and a resulting significant increase in fuel efficiency. Factors of interest here are that trawling had displaced Danish seine before the ban, possibly because of the ease with which trawlers can target multiple fisheries, and that a profitable Danish seine fishery was able to arise after the change in regulation.

Processing and aquaculture

30. Numerous life-cycle analyses confirm that fish capture is the most energy intensive part of the value chain for fish products, including aquaculture (where wild fish are used as feed). (Tydemers 2004, Pelletier 2009, WorldFish 2011). Energy inputs into Salmon aquaculture are more than 90% from feed

inputs (Pelletier *et al.* 2009), as is the case for some Tilapia production systems, which have a reputation as being more efficient. Even for pond-grown Tilapia, more than 50% of the energy inputs come from feed (Pelletier and Tydemers 2010). For Tilapia, only about 5% of feed is fish-based, while for salmon the percentage is closer to 40% (Pellitier *et al.* 2009).

31. The long distances that fish products can travel between fishing ground, processing facility and final consumer has raised concerns on efficiency grounds. However, most life-cycle analysis work confirms that modern containerised transportation contributes a relatively small amount to the total energy used to produce and deliver fish products. This is because of the high fuel efficiency per kilo of this form of transportation. For example, for Tilapia fillets delivered from Indonesia to Rotterdam, transport makes up only about 10% of the total energy budget (Table 8).

Table 8. Energy used in production of one tonne of frozen Tilapia fillets in Indonesia

	Gigajoules per tonne
Fish Production	18.2
Processing	7.0
Packaging	2.1
Transport	3.9
Total	30.3

Source: Pelletier and Tydemers, 2010

32. Winther *et al.* (2009) provide detailed calculations of the greenhouse emissions from capture fisheries and aquaculture, which is a close analogue to energy use, the main difference being the impact of refrigerants with a large greenhouse effect. They find a relatively more important impact from transportation when compared with Pelletier and Tydemers, but the conclusion that most of the energy is from fish or other inputs into feed production is supported by their research. They break down the energy inputs in some of the steps in processing salmon from aquaculture, showing that filleting is the largest component but a total much less than reported for Tilapia by Pelletier and Tydemers (Table 9).

Table 9. Energy use in selected components of processing salmon from Agriculture in Norway

	GJ/tonne
Slaughter	0.29
Filleting	2.69
Freezing	0.48
Drying	0.77
	Kj/Kg/day
Cold Storage	0.44
Frozen Storage	2.60

Source: Winther et. al. (2009)

Discussion

33. It is clear that the determinants of energy use in fisheries are complex. The wide variation in energy intensity across fisheries and gear types indicates that fuel costs alone are not the prime determinant of fishing behaviour, even though fuel is the largest single expense for many fishers. Moreover, fisheries objectives seldom target fuel efficiency directly, and this is for good reason. Stock management and the economic health of the sector are by and large the first priority of fisheries policy and management, and energy efficiency policy should not lose sight of this.

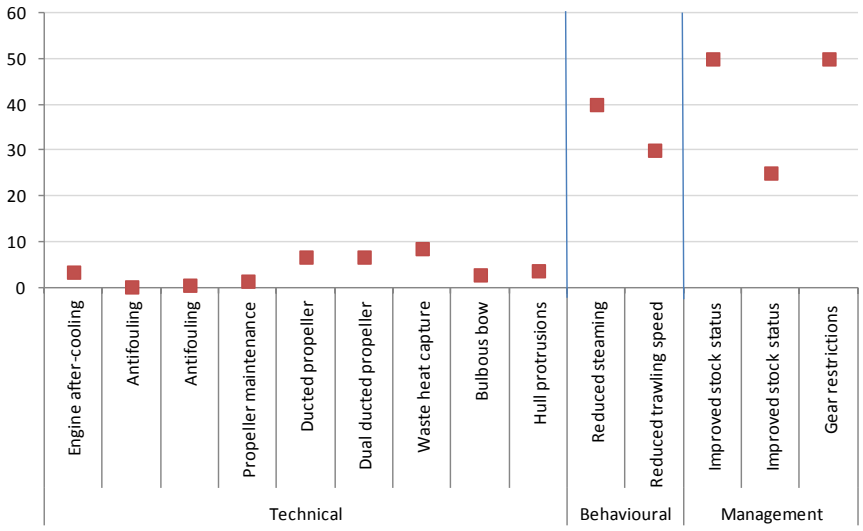
34. There remains a role for better policy coherence, however. Energy use in fisheries is an important issue not just because of recent increases in fuel prices, though this has had a significant impact on fisheries in many countries. It is also important because countries have goals and objectives with regard to climate, change, renewable energy, and energy independence and security. The vast majority of energy used in fisheries and the entire fish marketing chain is in the form of fossil fuels, mainly diesel. Reducing the amount of fossil fuels used by the sector can contribute to reaching those objectives that lie outside the fisheries sector, as well as potentially improving the economics of fishing for the sector.

35. The challenge then is for governments to find the means by which energy use in fisheries can be considered in the context of larger social objectives and how these objectives can be met while not compromising the need for competitive, profitable, well-managed fisheries. Fortunately, there seems to be considerable opportunity to do this. Fossil fuel subsidies have been singled out by the G20 as inefficient and counterproductive in light of climate change objectives. The fisheries sector in most countries enjoys exemptions from fuel taxes that can impact fuel efficiency in important ways.

36. Even more potential seems to exist in simply doing fisheries management better. Maintaining a healthy stock has been seen in this report to be a key way to increase the efficiency of fishing in general, with concomitant reductions in fuel use in particular when capacity is matched available resources. The behaviour of skippers has also been seen to be more important than the characteristics of the vessels they operate. Reduced speed and travelling shorter distances have good potential to reduce fuel consumption while not harming profitability. In many cases, these behavioural decisions are strongly influenced by the nature of the management regime, leaving scope again for a well-designed management system to give proper incentives to maximise profits and efficiency.

37. This report considered energy use in fisheries from three main perspectives: Technical efficiency having to do with the nature of the vessel and the gear it uses, the impact of behaviour and the choices made by fishers, and the role of the management system in influencing fuel use. While much interest and research has been conducted into technical improvements, the potential in changes in behaviour and management system stand out (Figure 7).

Figure 7. Potential improvements in energy efficiency by type



Note: improvements from technical efficiency as shown in Table 5 show improvements for specific elements of vessel efficiency only. Those values are converted to changes in overall vessel efficiency here.

Source: See Table 5, Wilson 1999, Driscol and Tyedmers 2010, Sigler and Lunsford 2001, Arnason 2010.

38. While research into potential technical improvements holds lots of potential - theoretical improvements of up to 40% are claimed for certain gear improvements - available technologies offer improvements that are much more modest. This seems to indicate a role for governments to provide the necessary incentives and infrastructure for research and development, a role many governments are already playing.

Next steps

39. The next version of this document will build upon the current content, adding additional sources and discussion and compiling the data into a more consistent format that can permit a more complete view of energy use and the potential for improvements. It will expand upon the coverage of the processing and aquaculture sectors and provide a view of energy use in the overall fish marketing chain. There will also be an increased investigation of the linkages between fuel use and the fisheries management system. A revised version will be presented at the 110th Session for approval.

40. In the Programme of Work proposal to be discussed during the 109th Session [TAD/FI(2011)12/REV], there is a proposal for follow-on work to this document under the Green Growth heading. This work would shift the focus of the research to the role of policies, building upon the observation in this report that behaviour and management are key determinants of energy efficiency. This proposed work would explore this aspect of energy efficiency in fisheries further and develop, using case studies and analysis, policy recommendations and best practices.

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TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

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EVALUATION OF ALTERNATIVE METHODS FOR ANALYSIS OF FUEL TAX CONCESSIONS IN FISHERIES

23-25 April 2012

This document is presented for DISCUSSION and DECISION to the 109th meeting of the Committee for Fisheries.

For further information contact Roger MARTINI (roger.martini@oecd.org)

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TABLE OF CONTENTS

Tables

Figures

EVALUATION OF ALTERNATIVE METHODS FOR ANALYSIS OF FUEL TAX CONCESSIONS IN FISHERIES

1. Fuel tax concessions (FTCs) are a significant part of overall support to fisheries in many OECD countries [TAD/FI(2010)/8/REV4]. Understanding the impact of this support on fishers and other sector participants up and down the chain contributes to the evaluation of the benefits and costs of this form of tax expenditure policy. This has gained in importance with the introduction of climate change objectives and targets and the increasing fiscal pressures faced by many countries.

2. Policy analysts have recourse to a number of different tools to evaluate the impacts of policies, many of which may be applied to the question of FTC impacts. An important family of policy tools is modelling analysis, a heterogeneous group of mathematically-based approaches that relate different elements of a studied system. This document considers the different categories of models and evaluates their potential for use in OECD analysis of FTCs. This evaluation considers as well specific models that are currently in use for policy analysis in fisheries and enumerates their strengths and weaknesses. This evaluation responds to the request by the COFI for an evaluation of options concerning future quantitative work on illustrating the effects (on catches, stocks, income, profitability, employment and competition) of phasing out fossil fuel subsidies.

Why use economic models?

3. Models are a means of providing a simplified representation of a real system in order to investigate those elements that are of interest to the researcher. Economic models are an abstracted and simplified representation of reality. This simplification offers a number of advantages:

- Direct observation of reality is often unhelpful because complexity and lack of experimental controls prevent the testing of hypotheses.

- Implementation of models are limited by computing power, availability of data and other practical limitations that render models infeasible beyond a certain level of complexity.

4. Reducing a real system to a simplified set of elements is a central characteristic of models. This involves holding variables not of interest to the researcher *exogenous* while specifying rules that define the behaviour of *endogenous* variables of interest. This central characteristic is also a key limitation: models cannot consider impacts of variables outside the scope of their design. Moreover, even when a variable is endogenous to the model, if it is not part of the main focus of the model its behaviour may be treated in a very simplistic manner that is not useful for its direct study. It is for this reason that models are usually designed and used for a specific research task, rather than being developed as a general purpose tool that is applied to a number of different research questions. A notable exception is the Global Trade Analysis Project (GTAP) model and database that provides a general framework for computable general equilibrium (CGE) modelling (though most serious users significantly customise the model to tailor it for specific applications). Applying an existing model to a new problem for which it was not designed is possible in some cases, but requires careful consideration of its appropriateness to the task and limitations.

Prediction vs. pedagogy

5. Models can be used to provide *predictions* - forecasts of future developments, quantification of the impact of reforms or evaluating the value of market or non-market goods. This use of a model is primarily output-centric; it is concerned with the results the model produces. Alternatively, models can

serve a *pedagogical* role - illustrating the implications of certain economic assumptions or parameter values such as prices or elasticities. Using a model to provide insight into how a system works and thereby deriving recommendations or conclusions is a more fundamentally structure-centric approach. In this case, the numerical results of the model are less important than how they are obtained.

Typology of models

6. "Models" as a concept covers a broad variety of approaches. While they all share a mathematical basis, they may be applied in many different ways for fisheries analysis purposes. Models may be economic, biological, spatial, or any combination of these or other domains[1]. Lane (1989) identified five major areas of fisheries systems modelling: (1) descriptive mathematical modelling; (2) mathematical programming and optimisation; (3) statistical analysis and estimation procedure; (4) computer simulation; and (5) decision theory. This classification of approaches to modelling remains relevant today despite the large advances in numerical techniques since that time. In this report, the following types of models will be considered:

- *Analytical Models*. These models are typically composed of a system of equations that is solved for an equal number of endogenous variables representing the factors of interest to the modeller, such as prices or quantities produced or traded. More generally, these may be any mathematical system that may be manipulated to produce useful economic insights. Analytical modelling in this general sense is the foundation of modern economics. The strength of analytical modelling is its clarity and rigour, combined with allowing better understanding of the implications of the underlying assumptions. These models can be limited in scale for reasons of tractability and often produce results that are more directed at academic users than policy makers.

- *Econometric Models*. These models apply data to a functional form to derive estimates of parameter values. Econometric models can be viewed as elements of an analytical model to which data is applied. The parameter estimates produced may be subsequently used to for forecasting or the other forms of output described earlier. Econometric models may be composed of one or many equations, and may stand alone, operate within a larger model, or supply data to a separate model. The strength of econometric modelling is a sound empirical basis, but their relatively poor job at forecasting makes the results of econometric analysis often more important as inputs into other forms of modelling.

- *Simulation Models*. When completed with data for exogenous elements such as initial conditions or parameters (that define how the endogenous variables relate to each other), an analytical model becomes a numerical or simulation model. Using numerical approaches to solve a model enables a larger number of equations and variables to tractably included, allowing for greater model complexity and richness. As well, such models may be used to produce numerical estimates or predictions that are useful to policy makers. Simulation models can take a *comparative static* or *dynamic* approach. Static simulation models solve for the difference between an initial situation and some alternative situation in a future period (days or years ahead). Static models do not consider the process of adjustment between those two time periods or stock-flow relationships, except in a reduced form, but allow for comparison between two equilibria. Dynamic models can use several different mathematical approaches, and are designed to reflect the evolution of the modelled system over a number of time steps. Dynamic models are less focused on establishing an economic equilibrium than evaluating stock-flow relationships over time. Simulation models have become widespread as computer power has increased and

1. In this section, models are considered through the lens of the proposed work on investigating the impacts of FTCs, so the discussion is not intended as a general or treatment of models as a class of analytical tools.

have become a standard tool of analysis in many places. Their ability to provide concrete predictions must be weighed against the risk of their becoming a "black box", where the limitations of the underlying data and model structure are ignored or poorly understood by consumers of the model results.

- *Optimisation Models*. While simulation models define an economic system and investigate changes or shocks to it, optimisation models explicitly maximise an objective function subject to constraints. Typically this is profit maximisation of a firm or set of firms in a defined area. Optimisation models are usually designed for micro-level analysis, whereas simulation models can be at any level of aggregation. Optimisation models use linear and nonlinear programming techniques that excel at explicitly modelling complex structure and cost of firms through a set of constraint equations that accompany the objective function. While they can be structurally very rich, they tend to do a poor job of prediction and their small scale can limit the generality of the results. Using linear programming in fisheries analysis has two disadvantages: the first is the frequently made assumption of constant per-unit price and cost; and the second is the difficulty in incorporating harvest-effort-stock relationships (Önal *et al.* 1991).

Choice Criteria

7. According to Padilla and Charles (1994) "the value of bioeconomic modelling can be judged both by its generation of useful 'theoretical' insights into the operation of fisheries systems, and by its application to real-world fisheries". Also, "to be truly useful, a bioeconomic model must be 'accessible' in that (a) its use must be less demanding of detailed knowledge than its original creation, and (b) it should be directly usable (or easily adapted) to analyse fisheries that differ in their characteristics and their information availability from those for which the model was developed".

8. In order to choose the best approach to investigating the effect of FTCs on fisheries, a set of decision criteria can allow the relative strengths and weaknesses of each to be evaluated. Any decision will involve trade-offs between desirable characteristics of different options, and institutional limitations may play a role. While it is unlikely that a single best option for all purposes can be found, understanding the strengths and weaknesses of a particular choice will help ensure a cost-effective analysis that produces results that are both useful and interesting.

9. Options will be evaluated according to the three following criteria:

1. ***Practicality***: Evaluating the probability of success in carrying out the work. This is determined by, *inter alia*:

   - *Resources required*. Models are preferred that require less secretariat time and lower consultant expenses. Relatively few of the options considered here can be done purely in-house by Secretariat staff, for a number of reasons. Therefore, availability and cost of potential consultants is a main factor. Several of the models reviewed do not see routine use, so finding a competent consultant can be challenging.

   - *Timeliness*. Models are preferred that can produce results in a shorter time-frame. This is also significantly a function of the availability of consultants.

   - *Feasibility*. Models are preferred that are able to be directly applied to the problem without modification or additional development. There will always be a trade-off between applying a model "as-is" and accepting any limitations with respect to FTC analysis or modifying a model to be more able to directly address issues of interest.

2. ***Applicability***: Evaluating the appropriateness of the model for the objectives of the study. This is determined by, *inter alia*:

   - *Specificity to fisheries*. Models that are explicitly developed for fisheries and that contain relevant elements, such as a bionomic model and representation of the management regime, or more specifically species and gear types. In general, this attribute will be in tension with the generality of the model, discussed below.

   - *Inclusion of fuel cost*. The price of fuel is the key element influenced by FTCs, and a representation of the cost of fuel or energy in the model is a key factor in its applicability to the problem of evaluating impacts of FTCs.

   - *Inclusion of outcomes of interest*. Models are preferred that can shed light on the impacts of FTCs of interest to the COFI. It is unlikely that a single model can provide indicators in all relevant areas, so some trade-offs are likely here. A number of socio-economic indicators have been identified as being of interest to the COFI, spanning stock, sector and regional impacts. The only models that can encompass wider economic impacts are general equilibrium (GE) models that represent the whole economy. However, it is generally the case that the wider the scope of the model, the less detail is present in the representation of specific sectors.

3. ***Informativeness***: Evaluating the utility of the results for drawing policy conclusions. This is determined by, *inter alia*:

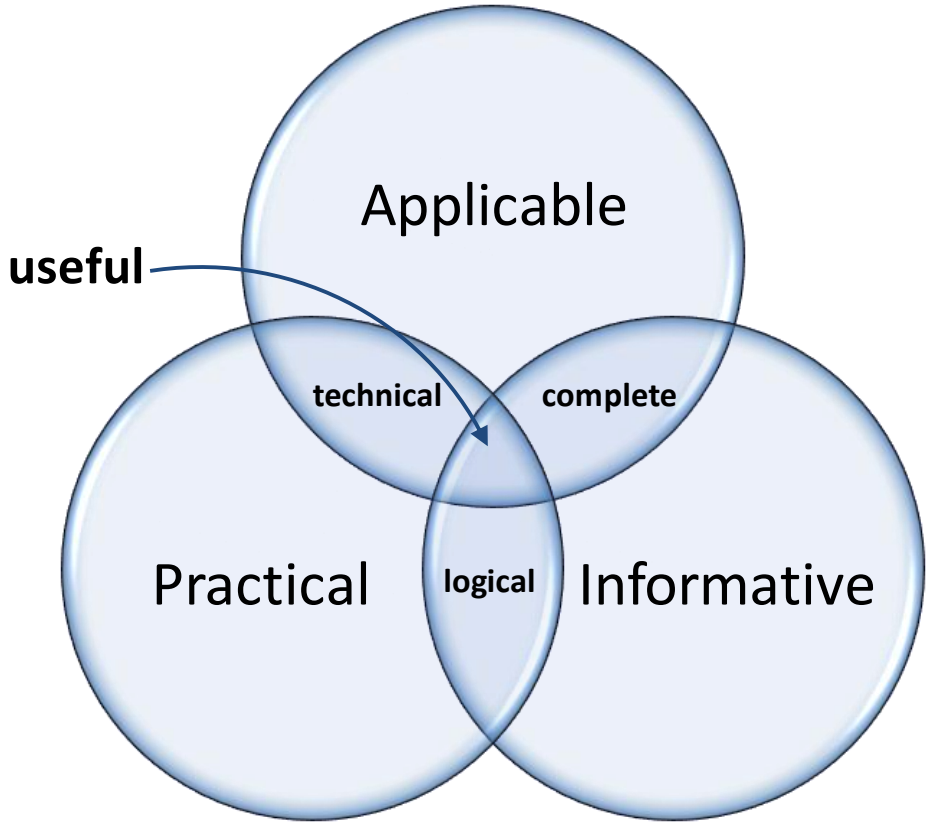
   - *Generality*. Models are preferred that are relevant to a broader scope of situations, either by virtue of the nature of the approach or by incorporating multiple scenarios or situations. Fishery models are often very specific to a localised fishery in order to reflect important details of biology and fishing techniques. This makes generalisation difficult in many cases.

   - *Accuracy*. Models are preferred that can produce results with a good track-record of reliability, or with a means to evaluate their accuracy, such as through sensitivity analysis. Whether for forecasting or counterfactual analysis, model results often compare poorly to ex post observed outcomes. This is due to the *ceteris paribus* nature of modelling; forces outside the scope of the model can dominate real outcomes. That said, few models are intended to be purely predictive, intending rather to shed light on the interactions of factors that influence the outcome of policy changes.

   - *Theoretical relevance*. Models are preferred that elaborate upon established theory and whose results can be explained in terms of the theoretical structures that underpin them. Many of the simulation models reviewed here focus strongly on the biological component of the model and are intended for stock forecasting. While useful for that purpose, they are less adapted to evaluating policy options when multiple criteria are relevant.

   - *Applicability to Green Growth and Development themes*. Models are preferred that can more directly support OECD policy priorities.

Figure 1. Choice Criteria for models



10. Looking at the interactions between these criteria, a model that is both practical and applicable but not very informative could be characterised as a *technical* model (Figure 1). An example would be a simple single-species single-year fishery model. This is straightforward to implement and has clear application to the problem at hand, but would not be expected to yield results that would be novel or interesting. Models that are both applicable and informative but not very practical could be characterised as *complete* models that have the full suite of theoretical content and specific application to fisheries, but would pose too many data or implementation challenges or be too expensive to use for the proposed work. The highly-detailed Atlantis model could be an example: There are relatively few current users, and development time for a representation of a new fishery can be up to two years. Models that are practical and informative, but not applicable to fisheries could be called *logical* models. Such models would explore the theoretical problem in a satisfactory manner and could produce useful conclusions, but would not be specific to fisheries. The large global trade model GTAP could be an example; it is very fully developed and well-understood but with little in the way of specific detail of importance to fisheries.

Review of models

11. There are a very large number of fisheries models existing in the literature. Bjorndal *et al.* (2004) describe some 35 examples spanning different approaches, while Prezello *et al.* (2009) consider 14 simulation models of different EU fisheries. Modelling is a fundamental approach to economic analysis, and so there are hundreds of publications using what could be termed mathematical models to support their analysis. This evaluation narrows the focus to examples that have potential to be of practical use in a study of the impacts of FTCs, though as will be seen, not all of the examples presented will be satisfactory and there is no ideal approach.

Analytical Models

12. Analytical models have been a standard part of natural resource economics at least since Schaefer (1954). Schaefer defined the following model:

$$\dot{X} = rX\left(1 - \frac{X}{K}\right) - Y = 0$$

$$Y = qEX$$

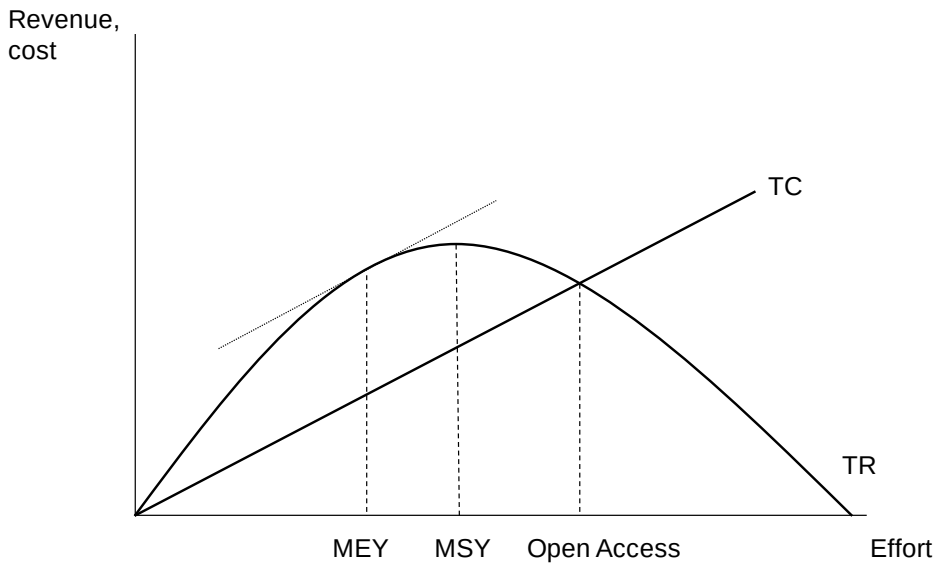
Where X is the stock, r is the intrinsic growth rate, K is the carrying capacity, Y is harvest, q is the catchability coefficient and E is effort. This can be solved for the steady-state values of X and Y as follows:

$$X = K\left(1 - \frac{qE}{r}\right)$$

$$Y = qKE\left(1 - \frac{qE}{R}\right)$$

13. This model can be used in both dynamic and static contexts. The most famous static version is the Gordon-Schaefer model identifying open access equilibrium and MSY in a fishery (Figure 2). The model as expressed here is very simple, but even relatively complicated simulation models can incorporate elements of this approach. For example, the BEMMFISH model incorporates a harvest function Y=qE as part of its economic module, abstracting away even from stock effects (Guillen *et al.* 2004).

Figure 2. Gordon Schaefer Static Model of a Fishery



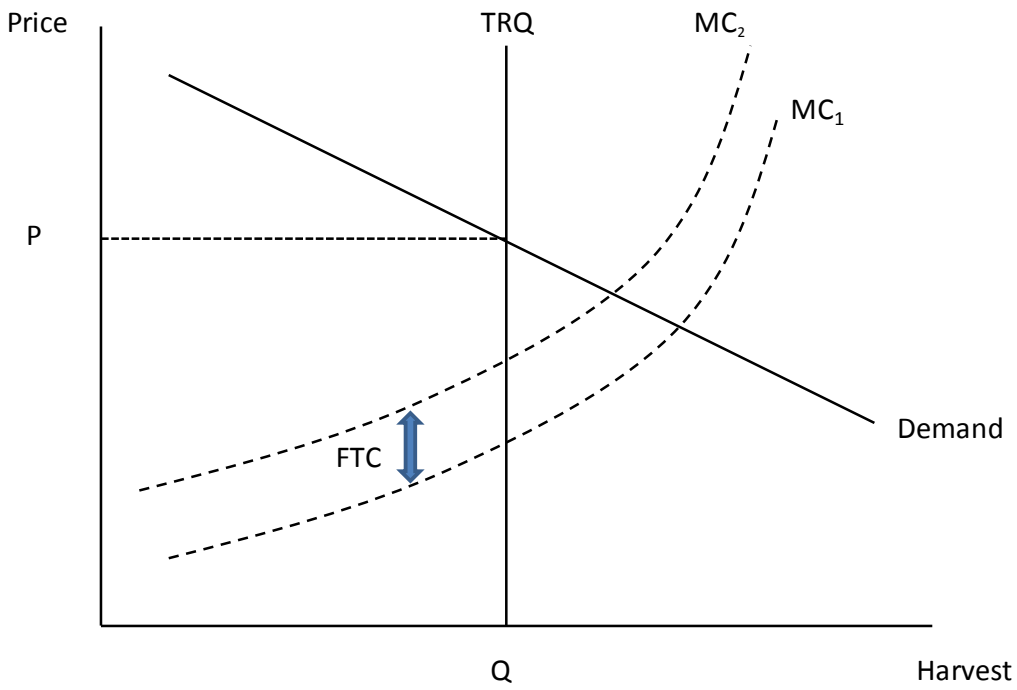
14. There are innumerable variations of this model[2]. Some notable versions are the Beverton-Holt (1957) version incorporating different age cohorts, the Goodwin (1967) model including predator-prey relationships between species and the effect of stochastic risk (Reed 1979). Given the broad application of this approach, it is not helpful to pick out particular examples to review in this evaluation, but rather to

2. A search of "Bioeconomic Model Fishery" in Google Scholar yields 10,000 results.

point out that a version incorporating fuel cost as a variable in the harvest equation, replacing the catchability coefficient *q* with the a functional form based on a more general approach Y=H(E(C),X).

15. Bioeconomic models of fisheries often have only very rudimentary treatment of the production costs of fishers. This is not just because the typical focus is on stocks and harvest, but also because treating the management system in a model often renders the cost element redundant. That is, if an output quota or effort restriction is binding, harvest and price are constant for a broad range of costs (and by implication, FTCs) (Figure 3). This is a general problem of over-specification that is not limited to analytical models. In these cases, the role of costs in the model will be for indicators other than price and harvest - profits or fleet structure, for example.

Figure 3. Cost in a model including TRQ



16. This approach would yield an analysis of the impacts of FTC expenditures that is theoretically sound and useful for policy analysis. It is practical, as there are a large number of potential consultants who could carry out the work; indeed Secretariat staff could undertake this analysis up to a certain scale. Adding complexity, such as endogenous demand would allow for investigation of some socio-economic impacts of interest. The model could be elaborated with explicit parameters using data representative of a specific fishery or type of fishery. This would allow for some estimation of quantitative impacts of FTC policies. Comparative static analysis based on equilibrium conditions is a useful basis for policy analysis; it is both applicable (specific to fisheries) and informative (yields useful general results).

Programming models

Önal et al. LP model

17. Önal *et al.* (1991) provide a model of the Texas shrimp fishery using an linear programming (LP) approach that includes an approximation of the effort-stock relationship as well as the economic factors commonly treated by LP models. Their program maximises the value of the fishery taking into account different size classes and monthly harvest levels, endogenous demand, stock effects and cold storage

capacity. Nonlinear relationships are approximated with linear equations and an approximation variable using grid linearisation. Observable economic data is supplemented with biological data for the fishery are derived from the GBFSM simulation model (Griffin *et al.* 1988) to complete the model.

18. The model is able to obtain an optimal harvest pattern over the year and by size class, and can be used to calculate producer and consumer surplus as well as overall social welfare gain. It includes a cost variable for fishing, but no disaggregation of costs into fuel and other variable costs. Optimal harvest is derived without reference to management regime, so the model results indicate the parameters of an optimal management system in terms of overall TAC and effort.

19. The advantages of this model are the endogenous demand and stock-effort relationship. Improved biological representation makes the model more "appropriate" as a fishery model, and the demand function allows for some estimation of welfare impacts. On the other hand, both of these elements are represented in a limited and stylised manner. Combined with data that is now rather out of date and biological information that is only estimated, the accuracy of the model may be called into question for purposes of FTC analysis.

Kirkley et al. I/O-LP model

20. While most LP models are very micro-scale, Kirkley *et al.* (2011) connect an LP model with a general equilibrium system using an input-output (I/O) table for the regional New England economy incorporating 20 non-fishing sectors and two fishing sectors. They use a general-purpose I/O software platform called IMPLAN. The modified New England model is:

$$\max_{Q} TV = \sum_{i=1}^{22} Q_i$$

subject to:

$$Q_i = P_i X_i,$$

$$\sum_{i=1}^{22} A_{ij} Q_i \leq \mathrm{FD}_j,$$

$$C_s \geq \sum_{s=1}^{4} D_s B_s,$$

$$X_h + C_s \leq 0.5\ \mathrm{HB},$$

where Q_i is the 2006 dollar value of output of each sector, P_i the price of goods produced by each sector i, X_i the total output from sector i, h denotes herring, A_{ij} the input coefficients for sectors i and j, FD_j the final demand for output from sector j, C_s the quantity of herring consumed by predator species s, D_s the dietary requirements in terms of pounds of herring per unit biomass for predator species s, HB the herring biomass, and B_s the biomass of predator species s.

21. This model is optimising the value of the economy, subject to overall constraints that production and consumption (including as factors of production) must balance. This is a standard GE condition in modelling. As can be seen, the main difference between this and a standard LP approach is the multiple sectors in the objective function, and the I/O relationships contained in the matrix A. What is sacrificed is the level of detail for the fishery, which beyond the I/O component has a very simple representation of

harvest requiring that survival after harvest and predation be one-half of stock size. The model is static, meaning that it compares an initial situation with a final situation after a shock and adjustment to equilibrium.

22. This model, while limited in some aspects, has certain advantages. It can calculate economic multipliers from the fishery into the local economy, including changes in employment, so scores well on applicability, a fact which must be moderated by its relative lack of detail for the fishery itself. While the authors have not considered a production cost shock in the fishery, the model is able to carry out this type of scenario which is of interest in the context of FTC analysis. The model also does well in terms of its theoretical content, as it relies on a profit-maximising framework as well as I/O data in the form of a social accounting matrix (SAM), which offers a structured and consistent approach.

Kompas et. al Dynamic delay-difference model

23. Kompas et. al (2010) develop a model of the Australian Northern Prawn fishery using a dynamic delay-difference model combined with an economic optimisation model that maximises the value of the fishery over a 7-year study period. In that sense, the model represents something of a hybrid of LP and other approaches. The objective function of maximising profit is defined with respect to stocks, prices, effort, and costs and the net present value of profits for a seven year period is obtained by an optimal program of harvest taking stock recruitment dynamics into account. The terminal condition at the end of the 7 year period is that the MEY equilibrium is obtained. Cost is differentiated by those proportional to harvest (labour, other) and effort (fuel, repairs). The objective function is therefore

$$\sum_{t>y_{\text{cur}}} \pi_y = \beta_y \sum_w \left\{ \sum_s \left[v^s_{y,w} H^s_{y,w} - \left(c_L v^s_{y,w} H^s_{y,w} + c_M H^s_{y,w} \right) \right] - \sum_f \left[c_K E^f_{y,w} + c_F E^f_{y,w} \right] \right\}$$

The variables E and H denoting effort and harvest are a function of the stock and act to incorporate the dynamic biological system.

24. This model incorporates several useful features. It projects a 7-year period based on price and cost assumptions that may be varied as alternative scenarios, making it potentially useful to FTC analysis. It has a complex representation of cost that also supports FTC analysis. It is theoretically sound, an unusual feature for dynamic models which are usually based on iteration according to a flow-chart and decision rules. It is applicable to fisheries, though the generality of the results for policy analysis depends on the extent to which the results are conditioned on the rather specific recruitment function of the prawn fishery.

Simulation Models

Aglink Model

25. Aglink is a dynamic commodity forecasting model developed by the OECD and now co-developed by the OECD and the FAO. It is designed to provide a ten-year outlook on commodity production and prices for major traded agricultural commodities. A version of the model treating fisheries and aquaculture has recently been developed, though this component is not integrated with the rest of the Aglink model, so no market interactions between fisheries and other commodities are treated.

26. Aglink uses a set of commodity supply and demand functions using data provided through an annual survey or participating countries. In many cases, this data is taken from national models. The model is then calibrated to create a stable equilibrium defining a ten year "baseline". Simulations are produced that are reported as deviations from this set of baseline trends.

27. The model does not include any input markets or production technology; this is implicit in the supply function, which can be taken as a reduced form representation. There is no explicit representation of the fisheries management system. Fishing is assumed to be constrained by a binding TAC such that the supply function for the capture fisheries component is essentially a vertical line. Aquaculture production can respond to changes in the price of fish, which is treated in a highly aggregate manner with no explicit prices for separate species of fish. Demand is projected according to population and GDP trends over the ten-year study period.

28. Aglink is a large and complicated model overall, and much of its detail is given over to commodity market dynamics. The lack of connection to this in the case of the fishery model, combined with the absence of a biological model, a fisheries model, or a management model, make the model of limited use for an investigation of FTCs. It therefore rates poorly in terms of applicability and informativeness. On the other hand, as an in-house model it would be easy to implement for this study and could produce results in a timely manner.

AHF model

29. The AHF model was developed by the Danish Institute of Food and Resource Economics (FOI) to evaluate the trade-offs between different management control schemes and management objectives. It is a dynamic recursive model of a multi-age multi-species fishery. It is comprised of two separate models, one simulating a quota (TAC) and the other simulating effort (days at sea), switching between the two depending on which situation is the effective constraint on fishers in the year simulated. It contains a representation of a harvest function as a function of stock, a production function for a fishery based on the Cobb-Douglas function, and evaluative indicators of days-at-sea and profits. In each time step of the model, a level of fleet investment is chosen that determines effort. Quotas are represented as a limit on total landings for each fleet segment with discards making up the difference between amount harvested and amount landed. The quota level is chosen recursively to maintain the stock at a specified level. The model can be run for a number of simulated years and the trends in stock, harvest, and profits observed.

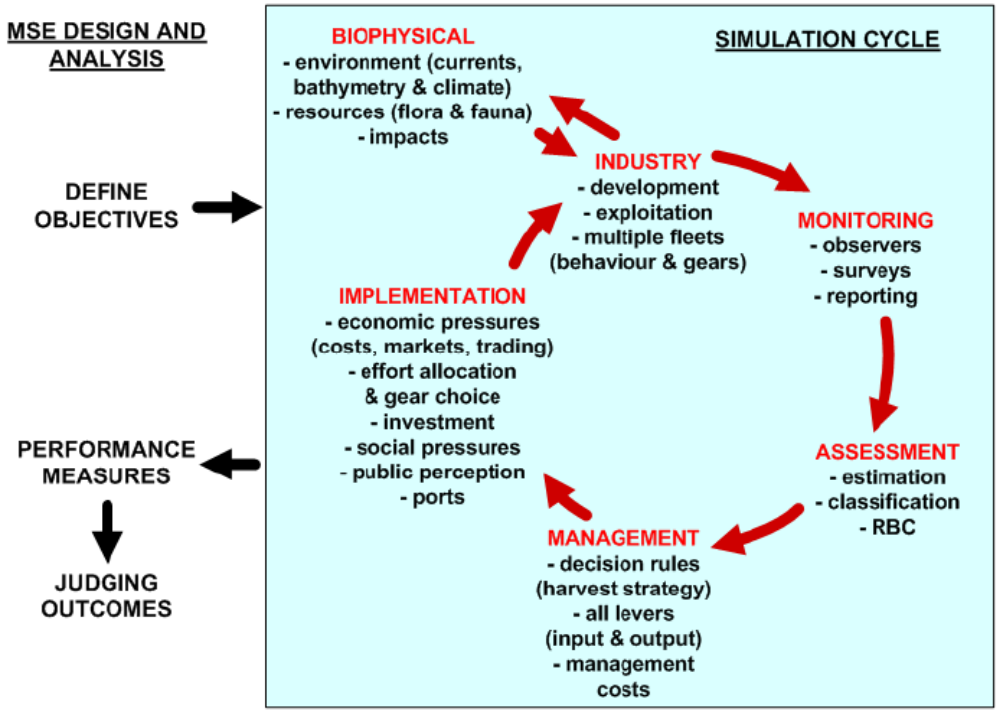
30. Most of the complexity in the AHF model comes from the representation of the age structure of multiple species, which adds considerable dimensionality to the harvest function. Beyond this, the economic content of the model is not large, with investment being the only major economic choice variable and other economic features observed as model outputs rather than part of an endogenous optimisation. As a recursive model, endogenous variables are recalculated based on the evolution of state variables. While the model does include cost of production and therefore could in principle evaluate a change in fuel costs due to FTC reform, it is unlikely that the results would be useful as the focus of the model lies in stock evolution over time with respect to management control.

Atlantis Model

31. Atlantis is an ecosystem model that considers all parts of marine ecosystems - biophysical, economic and social. Originally focused on the biophysical world and then fisheries it has grown to begin to be used for multiple use and climate questions. Atlantis includes modules for each of the major steps in the adaptive management cycle and so can be a useful management evaluation and policy tool (Figure 4). Atlantis was developed by a team from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia. Atlantis is open to public use and representations of fisheries in various parts of the

world are in different phases of development. The model has been fully developed only for certain fisheries in Australia (Fulton *et al.* 2007) and the west coast of the United States (Smith *et al.* 2011).

Figure 4. Management Strategy Evaluation Cycle in Atlantis Model



Source: Fulton *et al.* (2007)

32. The biophysical sub-model tracks nutrient (usually Nitrogen and Silica) flows through the main biological groups in a system defined and modelled in three dimensions. The primary ecological processes modelled are consumption, production, waste production, migration, predation, recruitment, habitat dependency, and mortality. Major trophic levels and species are represented. The physical environment is also represented explicitly, via a set of polygons matched to the major geographical and bioregional features of the simulated marine system. Biological model components are replicated in each depth layer of each of these polygons.

33. Atlantis also includes a detailed fisheries sub-model. This model deals not only with the impact of pollution, coastal development and broad-scale environmental (e.g. climate) change, but is focussed on the dynamics of fishing fleets. It allows for multiple fleets, each with its own characteristics of gear selectivity, habitat association, targeting, effort allocation and management structures. At its most complex, the model includes explicit handling of economics, compliance decisions, exploratory fishing and other complicated real world concerns such as quota trading and high grading. All forms of fishing may be represented, including recreational fishing (which is based on the dynamically changing human population in the area).

34. The fisheries model interacts with the biophysical model as well as a management sub-model. This last sub-model is typically a set of decision rules and fisheries management actions, which can be drawn from an extensive list of fishery management instruments, including: gear restrictions, days at sea, quotas, spatial and temporal zoning, discarding restrictions, size limits, bycatch mitigation, and biomass reference points.

35. Atlantis shows its roots as a biophysical model, containing a tremendous amount of detail about the biology of the modelled ecosystem. The fisheries model is also quite extensively detailed, and follows a "process" approach whereby decision-making is modelled as following a flow-chart of decision rules, including iteration and feedback. This approach is less explicitly theoretic, as it uses an atomistic set of rules (for expected revenue, for example) instead of a theoretically-consistent and complete approach based on economic principles. However, it allows for a good deal of richness in the simulation of the fishery, including such details as the degree of "friendliness" between fishers as a factor in trading of quotas, for example. The consequence of such an atheoretic approach is generality and robustness of the results; the model becomes a story told by the modeller, which the user either believes or does not.

36. The Atlantis model contains most of the desirable model elements: it represents the cost of fuel in an explicit manner, the management regime is also included as a factor, and there is a good deal of differentiation in terms of fleet segments and gears. Therefore, it does well on the applicability scale. Evaluating this model in terms of how informative it is yields mixed results; the large amount of detail provides for a certain degree of confidence in expressing results as being conditioned on specific factors such as elements of the management regime or technology used. This allows for rather precise conclusions on the impacts of FTCs in the model. On the other hand, the lack of an explicit and unified theoretical structure raises the question as to whether the results have meaning outside of the set of assumptions made in the model's construction. In terms of practicality, this remains to be seen. The model exists in a complete form for two important fisheries, but operating the model would depend on the availability of experienced users. It is unlikely that the Secretariat would be able to develop the expertise required to run the model and interpret its results, and development of a representation of a new fishery in the model would be prohibitively expensive and time-consuming.

BEMMFISH Model

37. The BEMMFISH model (Bioeconomic Modelling of Mediterranean Fisheries) has been developed with the purpose of testing the effects of different fisheries policies and management measures for Mediterranean fisheries. The model aims to represent the characteristics typical of Mediterranean fisheries: interactions between multiple species, multiple fleets and gear types. The model allows for effort controls, but no output controls in the fishery.

38. The model is a simulation model designed to make projections of a set of biological and economic variables into the future according to a set of initial variables and parameters representing the fisheries in the initial year. Like AHF, the model is a recursive dynamic representation of the development of the two basic state variables in the model - the biomass and the number of vessels in each fleet, with investment as the main control variable determining effort and profits. The fish stock evolves over time according to the growth function and harvests, and the number of vessels in each fishing fleet evolves according to investments undertaken by the fishing industry. Fish stocks are specified as one biomass for each species and fishing fleets as a collection of identical fishing vessels. The model allows for up to four different fish species and three different fishing fleets. Three basic fisheries management control variables are included: (a) fishing effort by fleet and species; (b) taxation of landings; and (c) limitation on vessel numbers.

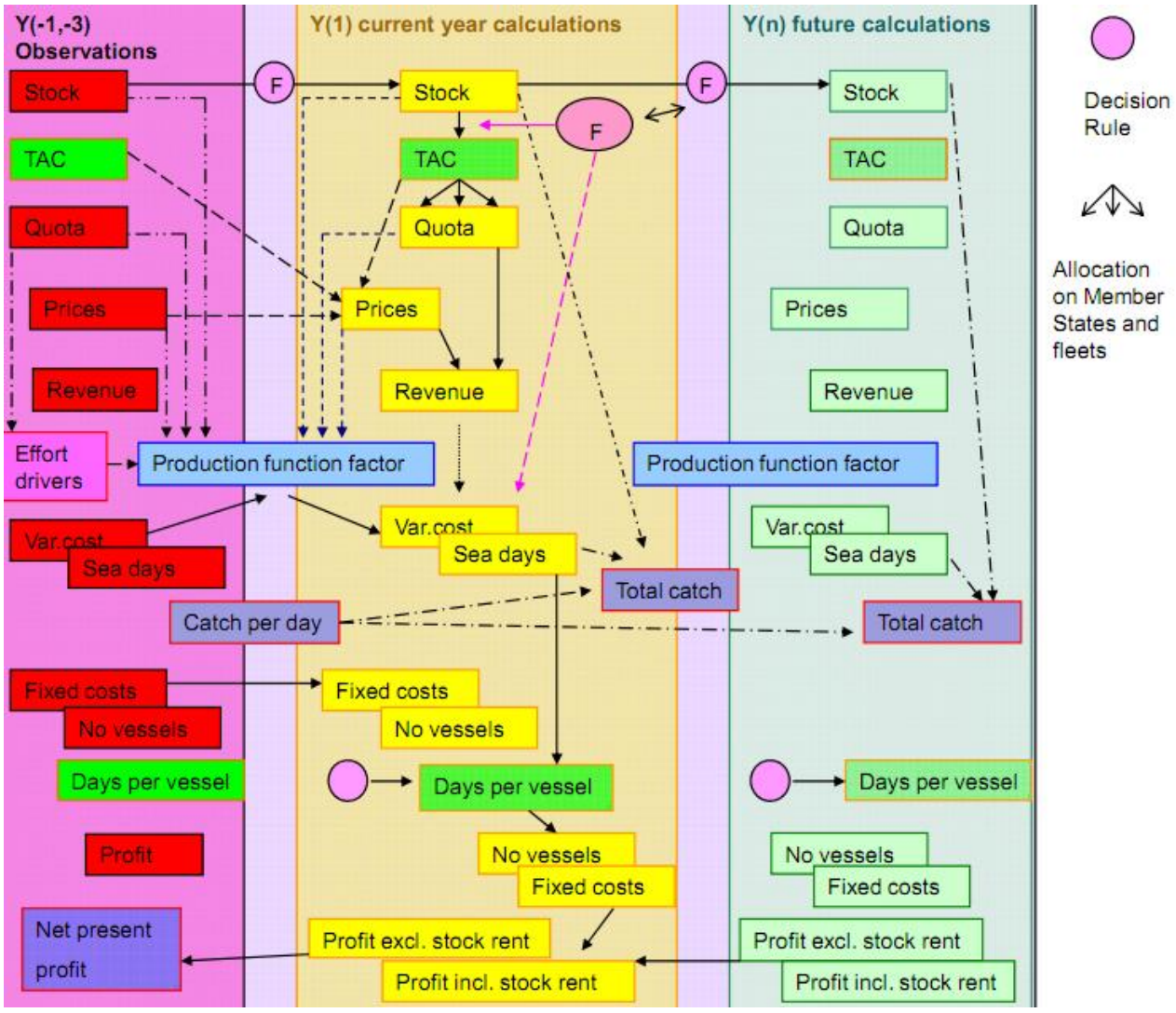
39. The model contains a significantly disaggregated representation of costs, including fuel use and price. This representation of costs allows for the management regime to alter costs, such as through taxation. This along with revenue from landings determines profit. Investment is the intertermporal control variable; the level of investment is chosen on the basis of the previous year's profit to maximise expected profit in the current year.

40. This model should be viewed as fundamentally similar to the AHF model in approach, though applied to a different set of conditions in the fishery and with many specific differences in implementation. Both models produce projections of trends over time on the basis of simple recursion with limited control variables operating in a complex system determining state variables. The basic economics of profit maximisation are approximated via the investment function, but this is not an economic model in the traditional sense. This is a common approach for dynamic simulations of fisheries. (see Prellezo *et al.* 2009).

EIAA Model

41. The EIAA (Economic Interpretation of AFCM Advice) model was developed by the Danish Institute of Food and Resource Economics to assess the impacts of TAC/quota allocations to EU member states and fleets. It simulates a multiple fleet, multiple stock fishery for a ten year time horizon, with the assumption that a steady state obtains after ten years. The schematic structure of the model is shown in Figure 5.

Figure 5. EIAA Model Structure



Source: Frost *et al.* (2009)

42. The EIAA model produces economic indicators calculating gross revenue, crew remuneration, cash flow, and net profits. It also calculates expected over- or under-fishing with respect to a given TAC or quota, number of sea-days.

43. Fuel costs are included in the model as part of "running costs" but are not further disaggregated. Production uses an inverse Cobb-Douglas to impute effort from landings (and therefore TAC or quota). Harvest is determined by the exogenous TAC or quota, so the production function is essentially calculating costs and effort as a function of landings and stocks.

44. The EIAA model has some advantages over other models in that the production system, while simplified, is not ad-hoc. The model is less practical than some other options as it is at once relatively complicated while having only a small amount of detail around the economics of fuel use. Moreover, it may be the case that it is seeing less use as newer models are developed, so finding a willing consultant could be a problem. It is applicable to fisheries analysis, though its design focus is very much on TAC and quota issues, giving it limited flexibility for other applications.

ENV-Linkages Model

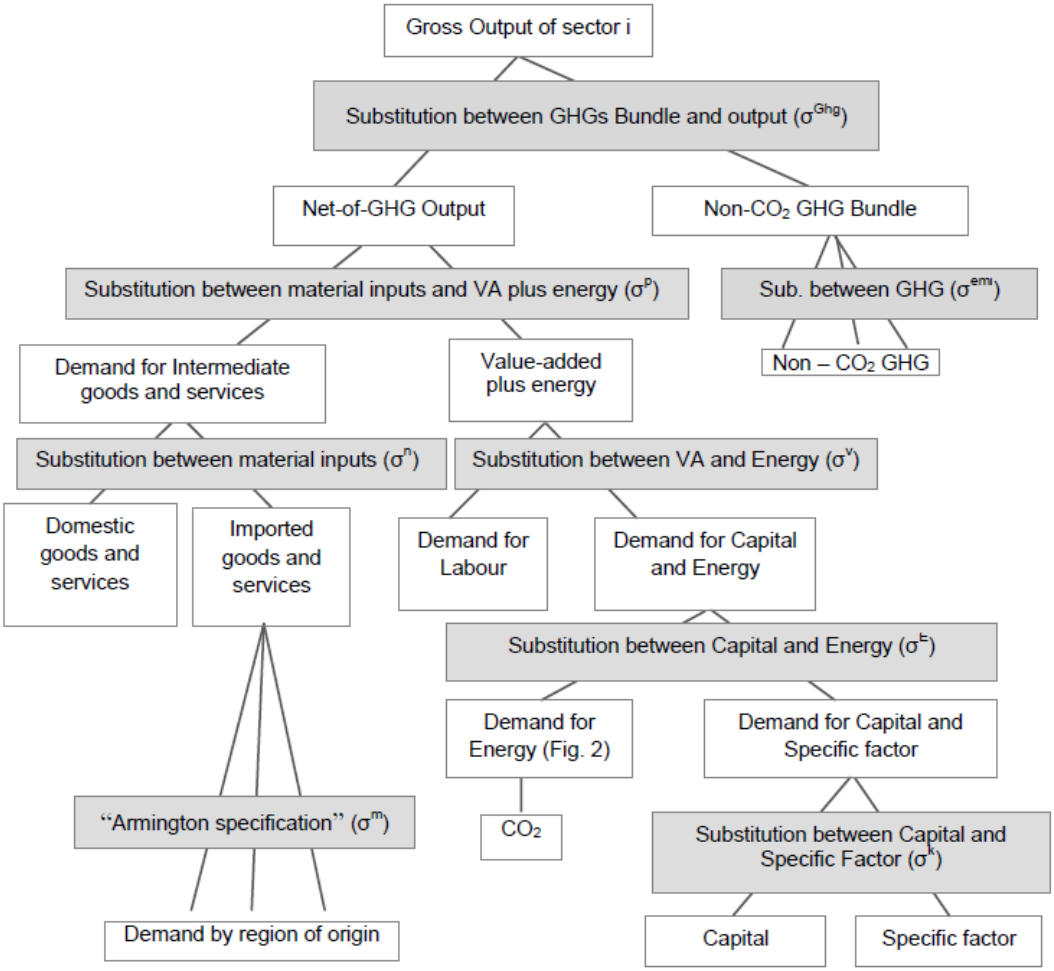
45. The ENV-Linkages model is a recursive dynamic neo-classical general equilibrium model maintained by the Environment directorate of the OECD [ENV/EPOC(2010)16]. It is a global economic model built primarily on a database of national economies. Each of the regions is underpinned by an economic input-output table (usually sourced from national statistical agencies). Those tables identify all the inputs that go into an industry, and identify all the industries that buy specific products.

46. All production in ENV-Linkages is assumed to operate under cost minimisation with an assumption of perfect markets and technologies that exhibit constant returns to scale. The production technologies are specified as multi-level (nested) production functions that assume constant elasticities of substitution (CES) in a branching hierarchy (Figure 6). The top node thus represents an output – using intermediate goods combined with value-added, on the one hand, and non-CO2 greenhouse gases (GHGs) in sectors that emit these gases as joint-products (see below), on the other hand. This structure is replicated for each output, where the parameterisation of the CES functions may differ across sectors.

47. In order to be able to perform the numerical simulations, it is necessary to keep the total size of the model limited. In the current version of the model, all economic activity within a region is aggregated into 22 economic sectors (Table 1). In addition, 5 distinct electricity production technologies are identified to be able to appropriately simulate responses in the electricity sector to the climate policies.

48. In similar fashion, rather than carrying out the analysis at the level of individual countries, most countries are grouped into geographical regions and only a few countries are separately identified in the model. In the baseline projection, 29 regions are distinguished.

Figure 6. ENV-Linkages Structure of Production



Source: ENV/EPOC(2010)16

Table 1. ENV-Linkages Sectors represented

Sectors	Description
Rice	Paddy rice: rice, husked and in the husk.
Other Crops	Wheat: wheat and meslin Other Grains: maize (corn), barley, rye, oats, other cereals Vegetables and Fruits: vegetables, fruits, fruit and nuts, potatoes, cassava, truffles Oil Seeds: oil seeds and oleaginous fruits; soy beans, copra Cane & Beet: sugar cane and sugar beet Plant fibers: cotton, flax, hemp, sisal and other raw vegetable materials used in textiles Other Crops
Livestock	Cattle: cattle, sheep, goats, horses, asses, mules, and hinnies; and semen thereof
	Other Animal Products: swine, poultry and other live animals; eggs, in shell, natural honey, snails
	Raw milk
	Wool: wool, silk, and other raw animal materials used in textile
Forestry	Forestry: forestry, logging and related service activities
Fisheries	Fishing: hunting, trapping and game propagation including related service activities, fishing, fish farms; service activities incidental to fishing
Crude Oil	Parts of extraction of crude petroleum & service activities incidental to oil extraction excl. surveying
Coal	Coal: mining and agglomeration of hard coal, lignite and peat
Gas Extraction and Distribution	Parts of extraction of natural gas & service activities incidental to gas extraction excl. surveying Distribution of gaseous fuels through mains; steam and hot water supply
Electricity	Electricity: production, collection and distribution
Petroleum & coal products	Petroleum and coke: coke oven products, refined petroleum products, processing of nuclear fuel
Food Products	Cattle meat: fresh or chilled meat and edible offal of cattle, sheep, goats, horses, asses, mules
	Other meat: Pig meat and offal. Preserves and preparations of meat, meat offal or blood, flours
	Vegetable oils: crude and refined oils of soya-bean, maize, olive, sesame, groundnut, olive seeds
	Milk: dairy products
	Processed Rice: rice, semi- or wholly milled
	Sugar
	Other Food: prepared and preserved fish or vegetables, fruit & vegetable juices, prepared fruits, all cereal flours
	Beverages and Tobacco products
Other Mining	Other Mining: mining of metal ores, uranium, gems. other mining and quarrying
Non-ferrous metals	Non-Ferrous Metals: production and casting of copper, aluminum, zinc, lead, gold, and silver
Iron & steel	Iron and steel: basic production and casting
Chemicals	Chemical Rubber Products: basic chemicals, other chemical products, rubber and plastics products
Fabricated Metal Products	Fabricated Metal Products: Sheet metal products, but not machinery and equipment
Paper & Paper Products	Paper and paper products: includes publishing, printing and reproduction of recorded media
Non-Metallic Minerals	Non-metallic minerals: cement, plaster, lime, gravel, concrete
Other Manufacturing	Textiles: textiles and man-made fibers
	Wearing apparel: Clothing, dressing and dyeing of fur
	Leather: tanning and dressing of leather; luggage, handbags, saddlery, harness and footwear
	Other transport equipment: Manufacture of other transport equipment
	Electronic Equipment: office, accounting and computing, radio, television and communication equipment
	Other Machinery & Equipment: electrical machinery, medical, precision and optical, watches
	Other Manufacturing: includes recycling
	Motor Vehicles: cars, lorries, trailers and semi-trailers
	Lumber: wood and products of wood and cork, except furniture; articles of straw and plaiting materials
Transport Services	Other Transport: road, rail ; pipelines, auxiliary transport activities; travel agencies Water transport Air transport
Services	Trade: all retail sales; wholesale trade and commission trade; hotels and restaurants; repairs of motor vehicles and personal and household goods
	Water: collection, purification and distribution
	Retail sale of automotive fuel
	Communications: post and telecommunications
	Other Financial Intermediation: includes auxiliary activities but not insurance and pension funding
	Insurance: includes pension funding, except compulsory social security
	Other business services: real estate, renting and business activities
	Recreation and other services: recreational, cultural and sporting activities, other service activities; private households with employed persons
	Other services (government): public administration and defense; compulsory social security, education, health and social work, sewage and
	refuse disposal, sanitation and similar activities, activities of membership organizations n.e.c., extra-territorial organizations and bodies
Construction and Dwellings	Construction: building houses factories offices and roads Dwellings: ownership of dwellings (imputed rents of houses occupied by owners)

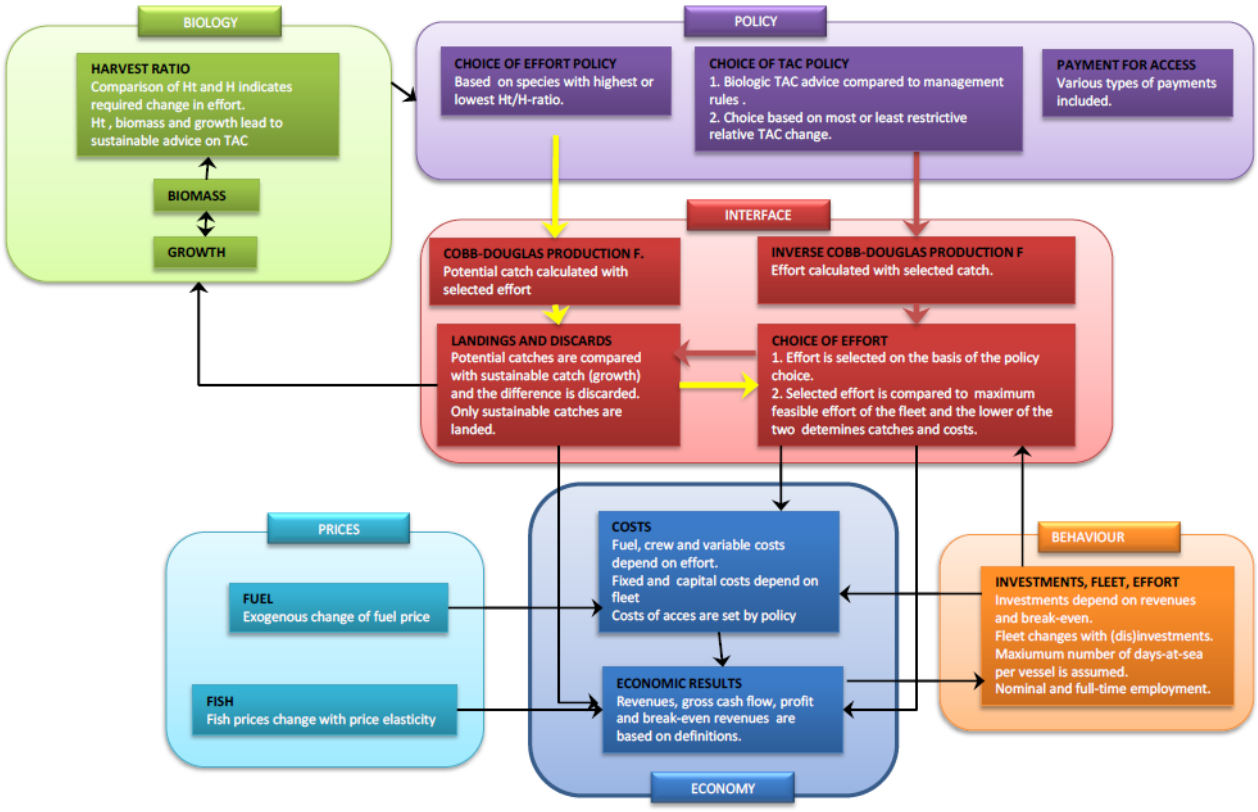
Source: ENV/EPOC(2010)16

49. ENV-Linkages is a good example of a computable general equilibrium (CGE) model based on the GTAP (Global Trade Analysis Project) structure and database. It shows both the virtues and limitations of such models - excellent inter-industry and trade representation based on sound economic theory, very high aggregation and lack of differentiation across sectors. In particular, the fishery sector is composed not only of fishing, but also hunting and trapping and related services. However, it is possible to improve the disaggregation of fisheries and potentially include other fisheries-specific details with sufficient investment in model development.

FISHRENT model

50. The FISHRENT model is a multi-species multi-fleet simulation and optimisation model that is user-customisable for different fisheries (Salz *et. al* 2011). The model is similar to the EIAA model in many ways, and its development was motivated in part by the increasing complexity of that model for users. The basic version covers 8 fleet segments and species and simulates a 25-year time horizon. The model is composed of six separate modules covering the three main elements of biological, economic and management factors (Figure 7). The model is developed by the Framian consulting firm, LEI and others for the EU project "Remuneration of spawning stock biomass". As the name implies, the main objective of the model is to estimate resource rents in a fishery. Importantly, this means that fuel cost is included as a variable that can be the subject of a policy scenario.

Figure 7. Fishrent modules



51. FISHRENT, while having fairly high dimensionality in terms of number of species and fleets, is not a particularly complicated model. Exogenous policies such as TAC and effort controls largely determine output, and the production and growth functions that underlie the other model components have very simple implementations—the fisher's production function is Cobb-Douglas, for example. This is a

very different approach from an extraordinarily detailed model like ATLANTIS that is intended to accurately simulate a fishery. FISHRENT is designed to compare policy alternatives without purporting to present an accurate view of the fishery over a 25-year span. However the main elements are there—profit maximisation, flexible growth functions for multiple species with possible interactions, an investment rule to adjust fleet size over time, and some endogenous prices.

52. The model in its basic form contains synthetic data—elasticities of one, stock size of 100—such that it requires additional data input to be used for analysis of specific fisheries. This has been done for a number of species for the EC study *Remuneration of Spawning Stock Biomass* (Salz *et al.* 2010), and that version of the model could potentially be used[3]. Alternatively, a specific stock representation is not strictly required to get useful results from the model, as even nominal parameter and data values could generate useful economic insights based on the economic structure of the model.

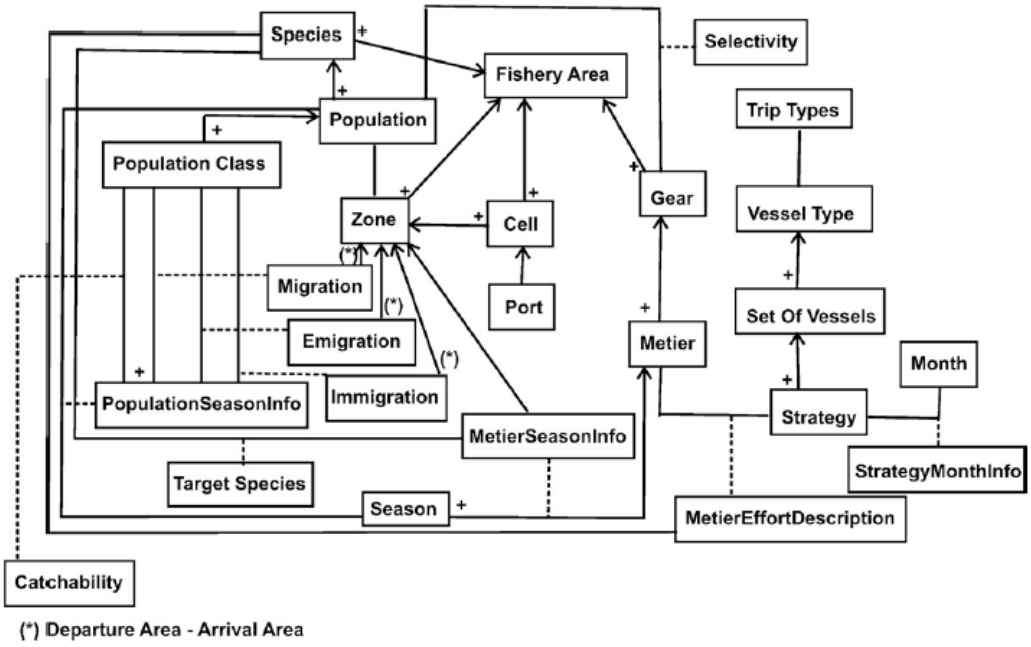
53. FISHRENT is unusual for a fisheries simulation model in that its focus is on basic economic principles and enabling policy comparisons. This feature makes it a relatively strong candidate for a FTC study, as it does well in terms of its practicality, applicability, and generality. It is feasible for the model to be run by Secretariat staff or by a consultant (or the two in concert). It has the essential elements of a fishery model, so is applicable to the project, but also has enough theoretical content and flexibility to generate results that are informative and useful for policy analysis. Endogenous price formation in the model allows for calculation of rents to fishers and consumer surplus to consumers, but there is no representation of the downstream market beyond the single-parameter demand function.

ISIS-FISH model

54. ISIS-FISH is a large-scale model with multidimensional biological (species and location) economic (fleet metiers) and management components. It is an iterative dynamic model with a structure as shown in Figure 8. ISIS-FISH is designed as a user-customisable framework for application to different fisheries. Users therefore have to calibrate the model for the fishery of interest before it can be applied.

3. Depending on availability and permission of the relevant parties.

Figure 8. ISIS-FISH model schematic



Source: Pelletier *et al*. 2010

55. ISIS-FISH is positioned somewhere between the ATLANTIS and EIAA models in terms of complexity. Like ATLANTIS, this model aims to provide an accurate simulation of a fishery in detail, though the level of complexity is somewhere between ATLANTIS and the EIAA model. Like many of the dynamic models described here, it is an iterative dynamic model based on time steps and following a schematic structure.

56. ISIS-FISH is a flexible and powerful simulation tool that can provide complex analysis of a wide variety of situations. However, the level of complexity implies a significant time investment for the modeller and is likely greater than is required for an analysis of FTC impacts. Further, there is no simulation of downstream sectors, so socio-economic indicators outside of the fishery are limited. The structure of the model, while applying reasonable economic decision rules and calculations, does not have the theoretical robustness of either optimisation or static simulation models that explicitly establish economic equilibria.

Seung and Waters CGE model

57. Seung and Waters (2010) construct a CGE model of the Alaskan economy containing four fisheries-related sectors (Alaskan Pollock, Other, Processing of Pollock, other processing) and seventeen non-fisheries sectors. They investigate three scenarios: change in TAC, increase in fuel costs, and reduction in consumer demand. The model produces indicators of change in output, employment, value added, and household income. As was the case for the Kirkely *et al*. I/O-LP model, this model is built using the IMPLAN tool with specific modifications for the fisheries sector. As a CGE model, it differs from standard I/O models in that prices are endogenous, allowing for estimations of changes in consumer surplus.

58. The model uses a simplified version of standard CGE modelling techniques. Production technology in each industry is represented by a constant elasticity of substitution (CES) value added

function assuming constant returns to scale. Intermediate inputs are used in fixed (Leontief) proportions. Finally, value added and intermediate inputs are combined in fixed ratios to produce output. Labour and capital are the only primary inputs. This is a much less flexible approach than the ENV-Linkages model, for example, which allows for more flexibility in substitution between inputs. The model is run with two labour market options. The "Keynesian" version assuming fixed wages and mobility between regions and the "neoclassical" assuming flexible wages and less mobility.

59. As the CGE structure of the model does not include a management component for fisheries, the scenario evaluating the reduction in TAC is carried out by modifying a shift parameter in the Pollock production function to reduce production by 10%. An increased cost of fuel scenario is estimated by increasing the exogenous price of fuel by 50% (Table 2).

Table 2. Impact of 50% increase in fuel cost on output, employment, value added and income

percent change

	Output	Employment	Labor Income	Value Added
Keynesian CGE				
Pollock harvesting	−2.8	−5.6	−5.6	−7.4
Harvesting all other species	−1.8	−3.5	−3.5	−4.5
Pollock processing	−3.3	−4.3	−4.3	−4.6
Processing all other species	−2.0	−2.7	−2.7	−2.8
Seafood Industry Total	−2.3	−3.5	−3.5	−4.2
Non-Seafood Industries Total	−0.3	−0.6	−0.6	−0.6
TOTAL	−0.5	−0.8	−0.8	−0.8
Neoclassical CGE				
Pollock harvesting	−2.2	−4.5	−5.1	−6.5
Harvesting all other species	−1.2	−2.3	−2.8	−3.5
Pollock processing	−2.6	−3.5	−4.0	−4.2
Processing all other species	−1.3	−1.7	−2.3	−2.4
Seafood Industry Total	−1.6	−2.5	−3.0	−3.6
Non-Seafood Industries Total	0.2	0.1	−0.4	−0.3
TOTAL	0.03	0.0	−0.6	−0.5

Source: Seung and Waters (2010)

60. The model developed by Seung and Waters scores well on practicality, as it is a recent model using a well-understood technique and public platform (IMPLAN). It contains an explicit representation of fuel cost and CGE elements that make evaluation of some socio-economic impacts possible. The representation of the fishery in the model is very basic, as it lacks a management or biological component and the economics are represented in a highly stylised manner. However, most of the value that the model could provide in a FTC policy analysis is already reported in their article (Table 2).

WBF model

The World Bank and FAO developed a global fisheries model as part of the *Sunken Billions* study and book (World Bank, 2009). Ragnar Arnason was mainly responsible for model development. This is essentially an application of the Schaefer model applied to a single global aggregate fishery. The model is

intended to provide an estimate of global fishery rents, in particular the difference between current and optimal rents in the fishery. The Schaefer model is modified with the addition of a profit function and an endogenous calculation of rents derived from the fishery. It is solved as a static model; time paths are not calculated and it is assumed that it is possible to reach the simulation equilibrium from the initial starting point.[4] Rents are defined as the difference between the revenue and cost curves at a given stock.

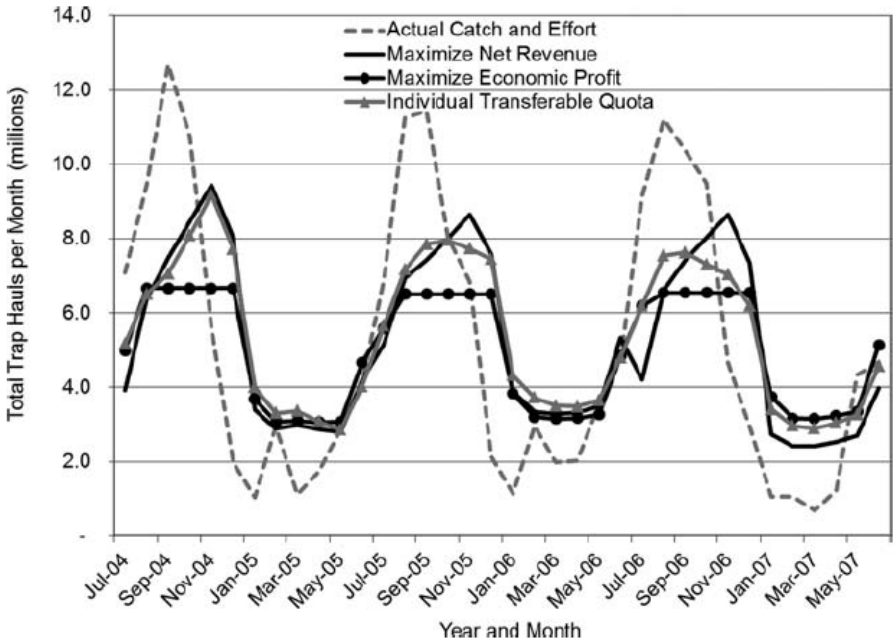
This model is a good example of an analytical model applying estimated coefficients to obtain a numerical result. The results conform well to theory - he model is a pure application of theory - but the level of aggregation of the model would make most biologists uncomfortable. While the model is very practical to use, the lack of detail surrounding firm costs and the high level of aggregation lowers its applicability to the problem of FTC analysis. The model scores well on generality, but its information content is less than optimal as few socio-economic indicators other than global rents could be calculated.

Econometric Models

61. Holland (2011) develops an econometric model of the New England Lobster fishery, separately estimating (aggregate) demand and (individual) production functions and using the resulting estimates to infer the optimal behaviour of fishers under a number of scenarios. The production function includes a number of fixed and variable cost elements, and the optimal number of vessels can be calculated as part of the analysis. The results demonstrate that actual profits in the fishery are much below potential profits due to overcapacity and sub-optimal time allocation of fishers over the length of the fishing season (Figure 9) This is a good example of an econometric analysis of a fishery using administrative panel data from the fishery to directly estimate the production function of fishers. The inclusion of fuel cost as an explicit parameter estimated as part of this allows for scenarios that change fuel costs, though as usual these must be conditioned on assumptions regarding the nature of the management regime. The applicability of the results beyond the study fishery is doubtful. This is true in general of econometric analysis, but in this case the results are also influenced by the particularities of this sedentary and highly seasonal fishery.

4. This condition can be assured given the choice of the growth function. The growth functions used in the model are the Logistic and Fox functions, neither of which exhibit critical depensation and so the stock can recover from any initial size.

Figure 9. Actual and Optimal effort in the New England lobster fishery



Source: Holland (2011)

62. This model could be applied to FTC scenario analysis under contract with the author. It is likely that the results would be timely and deliverable with high certainty as the econometric estimation has already been undertaken. Being a fisheries model it is applicable, though perhaps too specific to be highly informative.

Discussion

63. It is clear that the choice of a method to analyse the impacts of FTC policies will involve making trade-offs between desired elements. There does not appear to exist at once a model that can contains a detailed view of the fishery and the economic interactions between the fishery and the local, regional, or national economy (Table 3).

Table 3. Characteristics of Reviewed Models

Model	Practical			Applicable						Informative		
	Possible consultancy	feasible in-house	short timelines	FTC scenario possible	Management module	Biological module	Economic module	Includes demand function	endogenous input markets	Generality	Accuracy	Theoretical content
Aglink		+	+	+	-	-	+	+	-	-	-	+
AHF		-		+	+	+	+	+	-	-	-	-
Analytical[2]	+	+	+	+	+	+	+	+	+	+	-	+
Atlantis		-	-	+	+	+	+	-	-	-	+	-
BEMMFISH		-	-	+	+	+	+	-	-	-	-	-
EIAA	+	-	-	+	+	+	+	+	-	+	-	+
ENV-Linkages		+	+	+	-	-	+	+	+	+	-	+
FISHRENT	+	+	+	+	+	+	+	+	-	+	-	+
Holland et. al.		-		+						-		+
ISIS-Fish		-	-	+	+	+	+	-	-	-	+	-
Kirley et. al.		-		+	-		+	+	+	+	-	+
Kompas et. al.		-		+		+	+			-	+	+
Önal et. al.		-		-	-	+	+	+		-	-	+
Seung and Waters		-		+	-	-	+	+	+	+	-	+
WBF	+	+	+	-	-	+	+	-	-	+	-	+

1. + indicates presence of characteristic, - indicates absence. Empty cell indicates unable to evaluate characteristic or not applicable.

2. Indicates possible characteristics of an analytical model to be developed.

64. Given the caveats already identified in the measurement of FTCs [TAD/FI/(2010)8], it is unlikely that the actual data contained in the OECD FTC database will be usable as part of the model analysis under consideration. Any investigation of FTC policy would take the form of an exogenous shock on the order of 10% introduced to fuel prices in the fishery. Results would be interpreted on the basis of that fuel price change. Such a price shock has already been investigated in some of the models described in this report. While those were designed to investigate the impact of increased market prices, the implementation and analysis is identical for the case of FTCs.

65. Some of the main trade-offs that have become evident in choosing between different modelling alternatives are as follows:

Detailed stock dynamics vs. economic content

66. Most of the dynamic models considered are primarily concerned with the evolution of the fish stock over time (Atlantis, BEMMFISH, ISIS-FISH). These models put relatively more effort into the representation of the biological system, including recruitment, multiple species and spatial details. This level of detail makes implementing the economic component of the model difficult. Complex decision-making is handled atomistically as a set of nodes in a decision-tree-like schematic framework. This allows for a rich specification of the scope of possible actions by fishers, but in a manner where the theoretical properties of the model results are impossible to determine. These models approximate economic behaviour, but are hypothetical in nature. This makes it difficult to draw general conclusions from the results of these models. Dynamic models incorporating a more formal economic structure (AHF, EIAA, FISHRENT) do so by removing much of the biological detail contained in the other dynamic models, and rely on relatively simple economic specifications. Analytical approaches may be dynamic or static in nature and are explicitly economically robust, but can become impractical beyond a certain level of detail.

Fisheries-specific detail vs. broader impacts

67. Socio-economic impacts have been identified as an area of interest in studying FTC policies. This encompasses a potentially broad range of derived indicators that require the model to encompass a broader

scope of economic interactions. The objective of estimating broad impacts stands in tension with the observation that the details specific to a particular stock or management system are crucial to understanding the impacts of FTC policy. The ENV-LINKAGES model is the only model considered here that estimates a full set of national and international general-equilibrium effects, and it is completely lacking in fisheries-specific detail. The Kirkley *et al*. I/O-LP model has a general-equilibrium representation of the regional economy, but a very simple fisheries component. The Seung and Walters CGE model of the Alaskan Pollack fishery also lacks detail, though has already been used to investigate increasing fuel prices. Both of these models are designed to reflect specific regional economies and their results may not be readily generalised.

68. A minimum condition for evaluating downstream (consumer) impacts is an endogenous price-responsive demand function that allows for changes in consumer surplus to be calculated. Similarly, endogenous prices and market clearing in input markets are required to evaluate any upstream (local economy) impacts. Evaluating socio-economic impacts of FTC policies in a partial-equilibrium model will always be difficult, as using a demand function defined by a single elasticity parameter will yield results that are strongly dependent on that parameter choice. Whether the demand function is assumed to be short-run or long-run is also important, as the demand function may represent short-run processor demand or a reduced form of downstream consumption. The results from Seung and Waters (2010) shown in Table 2 are a good example of the type of results obtainable with basic upstream and downstream market representations.

Ease of use and practicality versus model complexity

69. As models grow in complexity, inevitably the details of their implementation will become more difficult for Secretariat staff to undertake within a reasonable amount of time, or consultancies will become prohibitively costly. For this reason, it is important to identify the most important outcomes of the analysis and pick the approach that targets that most directly while not having too much complication in details extraneous to that.

70. Atlantis, ISIS-FISH and EIAA are all models with some strong elements in their favour, but whose complexity in use and interpretation of results make them less pragmatic as choices for FTC analysis. FISHRENT is essentially a simplified version of EIAA that retains most of the main elements, which makes is a preferred choice over EIAA. The LP models can be relatively practical to implement, though some examples of this type can also be complex (Kompas *et al*. 2010).

71. Econometric models can be relatively straightforward in their implementation, but add a good deal of data collection and preparation to the analysis. The results tend to be more difficult to interpret, and there are many reasons for perverse or inconclusive results that cannot be controlled for.

72. Analytical approaches such as a modified Schaefer model can range in difficulty according to complexity, but it is possible to customise the model to focus on key issues, and the standard nature of this approach makes it likely that there are a number of researchers who would be able to carry out the work as consultants. The outputs of analytical work are also easier to interpret for the non-modeller and can be more directly policy relevant. Extending such models beyond the fishery is probably impractical, however.

73. Data availability will be an issue for any model that is not already fully specified and in use. This imparts a strong bias in favour of pre-existing models or analytical approaches. However, most off-the-shelf approaches will not address the full set of indicators of interest to COFI. The capacity of member states to provide useful data, both for parameters such as elasticities and for structural data such as fleet costs and stocks, will be an important decision factor.

Recommendations

74. Finding a balance between the different characteristics of the approaches described here is a matter of setting priorities for the outcome of the analysis and accepting the trade-offs that modelling approaches imply. If the committee chooses to carry out an analysis of FTC policies using modelling approaches, the practicality, applicability to fisheries and amount of information for policy recommendations that would come out of the analysis needs to be carefully evaluated.

75. The initial request for this analysis referenced a broad range of indicators to be generated by model analysis, spanning social and economic dimensions within and outside the fisheries sector. This evaluation makes it clear that such a complete set cannot be generated by any single modelling exercise. A more typical set of model results can be seen in the results from Seung and Waters (2010) where four indicators - output, employment, labour income, and value added - are produced (Table 2). While the expected output is dependent on the model used, all models produce results more limited than initially envisaged, and this is an important factor in evaluating the benefits and cost of this form of analysis.

76. Any modelling exercise will be resource-intensive. That is, the potential work should be evaluated in the context of the 2013-14 Programme of Work discussion, as choosing to carry out this analysis will mean that other work under the Green Growth heading will be deferred. In addition, modelling work may require additional funds to cover the necessary consultancies.

77. The recent development of a fisheries component of the Aglink model also has the potential to offer the capacity for COFI to carry out more quantitative modelling work. While Aglink is not appropriate for the study of many policy questions, including FTCs, due to its design limitations, it will be able to produce scenarios on topics related to the evolution of demand, supply and trade of fish products, in particular for aquaculture. The Aglink fish module is in a relatively early stage of development and will also require resources to reach its potential, but it is clearly an option worth considering.

78. In light of the above the fundamental questions for consideration by the COFI are the following: What are the key economic and policy questions (of which FTC is one) of interest to delegations – and which of them are amenable to being addressed through the use of models? Is the COFI willing to make the necessary investments in developing new modelling capacity, suitable to address these specific policy interests, over the coming period?

79. If there is an interest to study the impacts of FTC policies, the following approaches are recommended in order of preference.

2. **Use of an analytical model to investigate impacts of fuel price changes to consumers, fishers, and input suppliers**. An analytical model offers the right balance of practicality, customisability and applicability to the conditions that generally apply in fisheries. An analytical model can produce results that are transparent and can be generalised in order to draw policy conclusions. This work would involve a consultant who would work with the Secretariat to further define the structure of the analytical model to be developed. It is possible that numerical results could be generated following an approach similar to that of the WBF model (World Bank, 2009). This would require data to be acquired from member states or other sources to implement. However, the main value-added of the analysis would be the identification of the key factors determining the impact of FTC policies and how they transfer through the system.

3. **The FISHRENT model provides a flexible platform to carry out comparative policy analysis**. The clear structure of this model combined with its complete, albeit simple, representations of the major elements of a fishery make it a practical and useful choice. The

model can be augmented with data in order to represent a specific—but simplified—fishery, or using stylised data to generate more general results. The main developers of the model, LEI and Framian, are available for consultancies, but may be expensive relative to usual OECD consultants. It is possible for Secretariat staff to operate the model, which is freely available, in order to reduce costs.

4. **The ENV-Linkages model provides the most complete approach to evaluating socio-economic impacts**. While having only a rudimentary representation of the fishery sector, the ENV-Linkages model is the only model available that can evaluate cross-sectoral impacts on a national scale. The ENV-Linkages model contains representations of most OECD countries, allowing for a country-specific look at impacts that eliminates the uncertainty inherent in applying model results for one region to another. As an OECD model, this option is relatively low cost, though it will require agreement and coordination with the Environment Directorate where it resides. Modifying the model to improve the representation of fisheries is possible, but implies a greater investment in the analysis.

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TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

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A GREEN GROWTH PERSPECTIVE ON WASTE AND IMPROVED USE OF FISHERIES AND AQUACULTURE RESOURCES

23-25 April 2012

This first draft of the paper on waste in the fisheries value chain focuses on discards is distributed for DISCUSSION and GUIDANCE at the 109th Session.

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NOTE BY THE SECRETARIAT

The Summary Record of the 108th Session of COFI states the following from the discussion of this issue waste in the fishing and aquaculture industry:

"Delegates welcomed this proposal and found that it fitted well with the green growth strategy. Furthermore, for some members it was also a contribution to the development agenda as many developing countries have major challenges with waste. Delegates agreed with the suggested outline and focus of the paper recognising that there might be substantial data issues with respect to the post harvesting part of the value chain. Delegates looked forward to a first draft of the paper to be discussed at the 109th Session."

This paper is a first draft of elements that were approved by the Committee. It concentrates on primary production in the capture sector, in particular the aspects of waste associated with discards. The draft clarifies the extent of discarding practices and points to policy steps that have been developed internationally that governments may wish to take to reduce waste and improve the utilisation of the resources harvested.

TABLE OF CONTENTS

Tables

Figures

A GREEN GROWTH PERSPECTIVE ON WASTE AND IMPROVED USE OF FISHERIES AND AQUACULTURE RESOURCES

1. Introduction

1.1. Aim, Scope and Outcome of the Study

1. The study aims to identify and increase our understanding of waste in the value chain, provide policy recommendations and further insight into on the roles of different actors (government, industry, consumers, NGOs) and how these actors can contribute to achieve Green Growth objectives. In the context of the implementation of national policies, the study will indicate how governments can contribute to reaping the substantial potential gains from the systematic application of green growth policies. On the international scene, commitments undertaken have major implications relating to waste, climate change and food security issues. Furthermore, enhanced insight in conjunction with policy recommendations may assist international negotiation processes addressing these issues. An important aim of the study is to have a global outreach perspective as well as contributing to the enhanced engagement strategy of the OECD.

2. The study describes how fisheries are conducted and what part of the catch is not utilised (e.g. discards, cut-offs and trimmings, heads, etc). In this regard, the analysis will consider the roles of different actors (government, industry, consumers, NGOs).

3. The principal outcomes of the study include:

1. A factual description of how fisheries resources are used, including various forms of freezing and processing, use of cut-offs and trimmings, etc. This involves a description of the market segments for various products. Other issues addressed include: Once the catch is landed, what is the current utilisation-rate? What explains the current level of utilisation? What happens to those parts that are not currently marketed? What happens further up the value chain? How much is thrown away due to spoilage during transport and storage, not being sold for cosmetic or commercial reasons and how much is wasted because the final date of purchase is exceeded, etc?

2. An estimate of the potential for increased availability of fisheries products in the food system. This includes an attempt to clarify the relationship between "theoretical potential" and "realistic potential" for better use of the resources. Increasing the rate of utilisation of the fisheries resources and the efficient use of raw materials will be linked to the objective of increased efficiency in a way that supports green growth sector profitability, sustainability and increased food security.

3. Policy approaches and recommendations to increase the rate of utilisation of the fisheries resources and the efficient use of raw material. This includes suggested ways of improving the use of fisheries and aquaculture resources in line with the relevant green growth parameters identified by the OECD.

4. An analysis of the interaction between the main actors (government, industry, consumers, NGOs), identifying their respective roles and the contributions they can make to improve resource utilisation. In the context of the implementation of national policies, the report indicates how governments can contribute to reaping the substantial potential gains from the systematic application of green growth policies. On the international scene, commitments undertaken have major implications relating to waste, climate change and food security issues. Furthermore,

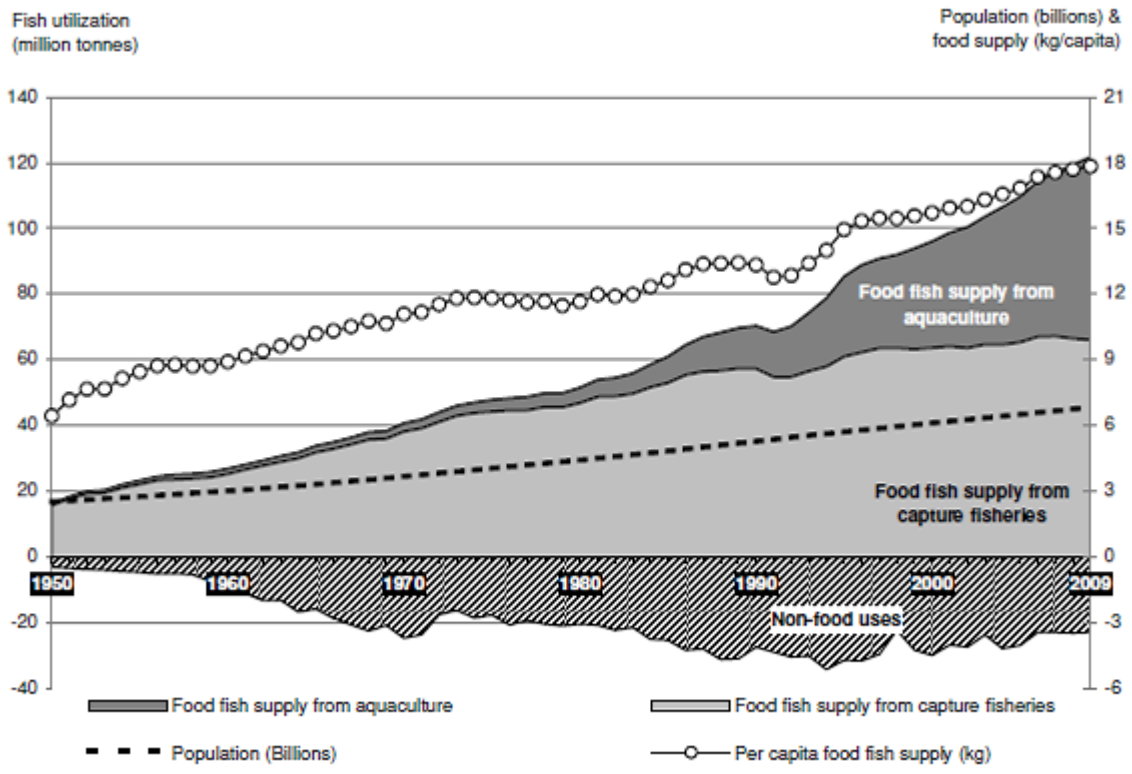
enhanced insight in conjunction with policy recommendations may assist international negotiation processes addressing these issues.

4. The study takes a global approach and focuses on the various challenges in OECD countries as well as those facing developing countries, in particular the Enhanced Engagement Countries. These are Brazil, China, India, Indonesia and South Africa.

1.2. Background

5. Seafood is a major source of food and protein globally. World population is estimated to increase to 9 billion by 2050, increasing demand for food by 70% from current levels. According to the FAO, total seafood production is presently around 160 million tonnes, of which approximately 89 million tonnes comes from capture fisheries. Seafood accounts for between 10 and 15% of global protein supply. If the fishing sector is to contribute to meeting future food demand, production will need to increase substantially. Simply keeping pace with projected population growth implies a need to increase total production of seafood by around 120 million tonnes. The recent OECD-FAO Agricultural Outlook 2011-20 projects that world production will increase to 164 million tonnes by 2020 (compared to a 2008-10 average of 143 million tonnes) and of which 73.7 million tonnes is from aquaculture (compared to a 2008-10 average of 54.6 million tonnes).

Table 1. World production



Source: FAO Fisheries and Aquaculture Statistics 2009.

6. The ability to increase production from capture fisheries is limited. According to the FAO, around 50% of world fish resources are fully exploited, around 25% overexploited and the remaining part (mainly low-value or in Antarctic waters) underexploited. The FAO thus predicts that any major expansion in global fish production will come from the aquaculture sector. How can the projected needs be met, keeping in mind that the most substantial increase will have to come from aquaculture?

7. The fisheries and aquaculture sectors are part of the food chain and characterised by sub-optimal use of seafood resources. Waste and losses take many forms. Discarding of fish at sea is one example. According to the FAO, around a quarter of fish stocks are currently overexploited and thus not sustainably utilised. A kilo of filleted fish is derived from 2.5 kilos of round fish and trimmings, cut-offs and offal have in many cases no current use or established markets. This means that even given conventional use of fish, e.g. fresh fish, for every kilo of fish taken out of the sea, a significant proportion is not used for direct human consumption.

8. This paper uses concepts such as "loss" and "waste". Academic literature makes use of "loss" to describe phenomena which are deemed to be outside the control of the producer, e.g. a natural catastrophes, pests or parasites destroying crops, etc., whereas "waste" denotes deliberate activities which assume that the raw material could be put to some kind of use, but is "wasted" for some reason or other. Food waste vs. food losses can be explained as follows:

- **Losses** – Deliberate removals of food items that at current prices and technology are not economical to conserve in the food chain. Losses in the food chain can be subdivided into those losses that are uneconomic to use, compared with those that are technically inedible in their common use. Such losses are typically a consequence of the profit maximisation of producers and processors.

- **Waste** – Food that is wasted in primary production, i.e. discarded at sea, or after primary production, food that is edible in its current form at the time of disposal, or is discarded. This includes food removed from the retail chain due to cosmetic considerations/ standards, plate waste or spoiled food that is not consumed in a timely manner.

9. The main difference between losses and waste is that losses generally are *unavoidable*, while waste/discards are generally *avoidable*.

2. The Scale of the problem

10. To our knowledge, there is no overall comprehensive and reliable compilation of facts and policy recommendations on this subject. Consequently, this paper aims to identify the most important sources of waste and losses in the fisheries and aquaculture value chains as well as attempting to provide for policy makers a better understanding of the current situation and its drivers as a basis for future improvements in good policy design.

11. Improved utilisation includes ensuring sustainable use of fisheries and aquaculture resources. It also includes examining how the fisheries and aquaculture sectors may better contribute to food security. These aspects should be seen within the green growth framework of how we can make better use of natural capital, i.e. in terms of pricing the use of the resource base and the ensuing environmental effects of such use, the role of innovation and how we can create incentives for the industry to profit from the emergence of new markets and activities.

12. Waste in various forms has been the subject of extensive studies, mainly as agriculture commodities both regionally as well as globally. A first step in identifying opportunities to improve the

efficiency of the fisheries value chain is to understand the scope and nature of the waste problem. This comprises primary production (capture fisheries or fish farming), processing (primary and secondary), distribution and retail and finally, consumption sales (including food services/restaurant).

13. As to losses and waste, there are significant differences in primary production between capture fisheries and aquaculture. However, once seafood enters further up in the value chain, the issues are mostly similar to those of food and foodstuffs in general.[1] It should also be noted that there is currently not a general measure of food waste that is consistent across countries. While some countries have dedicated research on fish waste, we lack a consistent global quantitative figure or global measurement of the extent of waste.

14. There is a global trend of growing awareness of the economic, social and environmental aspects of sub-optimal use of food resources. Just as in agriculture, waste can reach massive proportions in the fisheries sector. The most acute type of waste in the wild capture fisheries is "discards", whereby unwanted fish that are too small, of lesser value or of the wrong species are thrown back into the sea, normally in a state where this fish is unable to survive. In many fisheries, an estimated 70 to 80 % of the harvest is discarded in regular fishing operations.

15. An important element of the OECD Green Growth paradigm is the sustainable use of the environment, which implies that eco-system considerations are essential in the context of Green Growth. A special category of by-catches are for example other species than fish caught in certain fisheries. These species may or may not have a special protected status, such as, e.g. sea turtles, dolphins and other sea mammals, seabirds, etc. Furthermore, a substantial part of discards in many fisheries consist of other organism than species with an established commercial market, such as benthic organisms (bottom fauna and flora), sponges, starfish, jellyfish, etc. The incidences of such by-catches and their ensuing discards can have important and often negative environmental impacts. Discards can provide special niches of food supply for seabirds, it may impact and change local and larger ecosystems in the oceans and sea bottom. Although technically speaking they are considered to be by-catches and may be discarded, for the purpose of this report, we will leave these categories aside. It should, however, be noted that such bycatches may have important biodiversity ramifications.

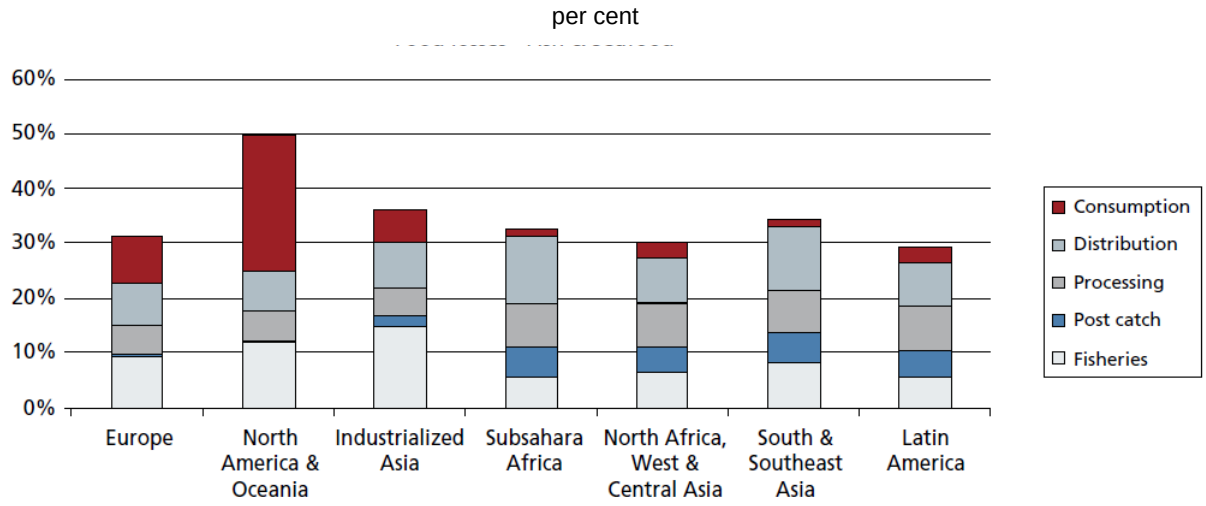
16. Former EU Fisheries Commissioner Joe Borg has stated that "Discarding means a waste of great quantities of valuable fish. It is a major environmental scandal that we must tackle". Richard Lochhead, responsible for fisheries in Scotland says, "I am appalled and frustrated at the scandalous level of waste and the economic and environmental madness discards represent". Recently, the European Parliament discussed the issue of waste of food in the European Union. According to a parliamentary study, 50 % is lost in the stages between production and consumption resulting in a daily waste of 240 000 tonnes. The EU-parliamentarians have adopted a resolution to reduce these waste-levels by 50 % by 2025.

17. Capture fisheries and aquaculture in terms of total seafood production accounts for a substantial part of total food supplies globally. In the context of losses and waste, however, there are major differences between agriculture and seafood production. This relates mainly to differences in ownership entitlements, differences in input factors, conditions of production, dependency on natural, biological and ecological factors. The most striking difference is the fact that capture fisheries in essence is a "hunting" activity where, in cases of a fully fledged regulatory regime, production levels (e.g. TAC's) are determined by the management authorities and not by the producers themselves. In fisheries where quota restrictions do not apply, production is mainly a function of availability of fish, and deployed fishing effort. Conditions of

1. Work in the TAD is presently underway on food waste management see "Waste Management in the Food Chain: Scoping Paper" TAD/CA/APM/WP(2011)7.

competition and market forces thus play different roles depending on which sectors within capture fisheries, aquaculture or agriculture production we are addressing.

Figure 1. Proportion of initial catch lost, discarded or wasted by region and by value chain element



Source: FAO 2011.

18. There are striking differences in the pattern of waste of seafood, a major factor being that waste in developed countries is considerable and most prominent in the consumer end of the value chain (Figure 1). The pattern for emerging economies is different and varies according to region, but show substantial losses in post harvesting, i.e. storage, processing and distribution.[2] Additionally, waste patterns in capture fisheries and in aquaculture differ significantly. In capture fisheries, discards of fish is a major waste factor, whereas in aquaculture, dead fish, cut-offs and trimmings in many cases are reused for feed or other purposes.

3. Avenues for improvements

19. Apart from increased fishing on underutilised fish stocks, improved fisheries management[3] and rebuilding of fish stocks, making increased food quantities available from capture fisheries can be achieved through making better use of the fish resources once harvested. Tentatively, the material available indicates that increases of 10 million tonnes could be made available from improved management alone. If we add discards in world fisheries which amount to about 10 million tonnes annually, a simple calculation would indicate that further availabilities of 100 million tonnes must be met by waste reduction, better utilisation of raw-material and increased aquaculture production to meet the requirements of an increase of 120 million tonnes of fish for human consumption.[4]

2. Whenever the concept "developing economies" is being used in this report, it should be taken to mean all categories of developing countries.

3. Including technical regulations such as minimum sizes of fish, minimum mesh-sizes, by-catch regulations, area closures, etc.

4. Projected need for increase by 2050: 120 million tonnes, minus 10 million tonnes from (MSY) improved management and 10 million tonnes in reduced discards.

20. If current losses from the fisheries value chain are 30%[5], then the theoretical potential gain from capture fisheries is 26 million tonnes (89 million tonnes x 0.3). However, not all losses from the food system can be eliminated, especially considering that some of this loss is optimal from an economic perspective. Nevertheless, it indicates that there is a substantial potential to increase the effective food supply from fisheries without increasing pressure on the resource base.

21. Market creation through research and innovation are key parameters in any strategy to improve the utilisation of the seafood raw-material as well as in helping the industry create and take advantage of new green market opportunities. In this context, the identification of bottlenecks is crucial. Bottlenecks are typically legal and administrative obstacles, established tax policies as well as other barriers to production and trade. Furthermore, lack of information (including research), skills and know-how are important bottlenecks to green growth.

22. Parts of the fish have no established markets, and there is a wide variety in prices for different parts of the fish. How can we best utilise all parts including offal, bone, skin, etc.? Surimi production is an example of innovative utilisation of fish meat parts, which otherwise would not be marketed. Improving utilisation and reducing losses from the food chain will not only contribute to food security, but can also improve profitability in some cases. Waste is costly, not just in terms of the cost of disposal, but also when it represents forgone revenue. Potential gains include the following components, which can be labelled under the generic phrase of "maximising the economic yield of each kilo of fish":

- Gains in quantitative or economic terms;
- Gains in terms of reduced costs; and
- Gains in terms of new market opportunities.

23. A central question in the context of Green Growth is whether actions can be taken by governments, industry or civil society to improve the utilisation of the raw material or products in the value chain. The potential, as indicated above, seems to be very substantial. However, the mere fact that some parts of the raw materials are not used does not necessarily mean that it *should* be used or that it *can* be used.

24. An important reason why parts of production are lost or wasted by discarding may be explained by the fact that regulators may stipulate conditions prohibiting the landing of fish that do not satisfy certain criteria, such as a set minimum size, a set percentage of a target specie, a by-catch exceeding a set level, etc. Similarly, regulators may prohibit the marketing of commodities that do not satisfy sanitary requirements or "not to be sold after… (date)". However, in cases not involving such legal requirements, the major reason for "wasteful" practices lies in the fact that there is no market for the product or that products are wasted for commercial reasons or due to consumer preferences. In many cases it makes economic sense not to utilise all the raw material. Market conditions therefore play a major role in defining the scope for potential gains.

25. The OECD Green Growth Strategy emphasises the use of market instruments and correcting market failures as key element of effective policy design. This includes the "pricing" of the use of natural resources as well as using the emerging market opportunities arising from the implementation of green growth strategies. Green growth provides a strong focus on fostering the necessary conditions for innovation, investment and competition that can give rise to new sources of economic growth.

5. Based on the FAO estimates.

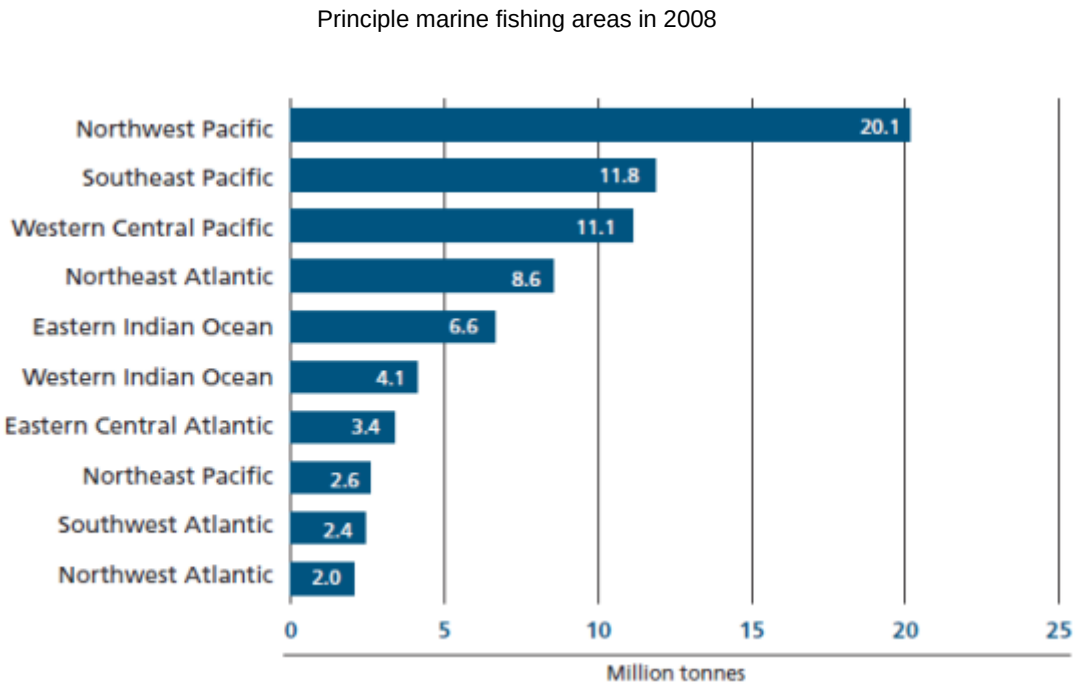
26. This study highlights the actions that governments and other actors can take and are taking to improve resource utilisation in fisheries. For example:

- Governments can create appropriate legal and economic incentive structures and improve market infrastructure, including communication and making the market more transparent. Public funding to research and development can support private initiatives for innovation and creativity taken by the industry;
- Industry can identify bottlenecks to the emergence of green market opportunities. Industry can investigate beneficial market arrangements such as co-location of fish processing and fishmeal processing facilities, exploring the trade-offs between economies of scale and network externalities;
- The public can express their preferences by making "green" choices in the marketplace and by exercising political and market pressure on industry and governments, insisting on green growth progress.

4. Primary production – wild capture fisheries – discards

27. Total catches approached around 90 million tonnes in 2008 (Figure 2). A substantial part of these catches are discarded, and thus not utilised.

Figure 2. Capture Fisheries Production



Source: FAO State of World Fisheries and Aquaculture, 2010

28. Discarding of fish has been an issue of paramount importance in the fisheries policy agenda for a number of years. A number of international instruments have been developed that addresses discard issues. These include, inter alia, the Kyoto Protocol and the United Nations Code of Conduct for Responsible

Fisheries. More recently, The FAO International Guidelines on Bycatch Management and Reduction of Discards was adopted in 2011.

29. Among the issues under heated debate internationally are questions such as: What are discards and what is the extent of discards? Are discards economically rational or simply wasteful? Are discards unavoidable and if not, how can discarding activities be regulated?

30. The FAO-paper Discards in the World's Marine fisheries (2005) describes the policy implications as follows:

> "The "discard problem" embraces several issues or sub-problems:
>
> - The moral problem of responsible stewardship of marine resources;
> - Designing a management regime that limits or prevents discarding while meeting multiple social, economic and biological objectives;
> - The practical problem of enforcing regulations designed to prevent or minimise discards, particularly as discards occur at sea where enforcement is most difficult;
> - The technical problems of gear selectivity and utilisation of species with a low market demand through transformation or adding value; and
> - The economic problems posed by efforts to reduce bycatch, increase landing of bycatches or increase utilisation of bycatch" (page xvii)

31. The instruments referred to above are built on the underlying idea "that wastage of natural resources is morally wrong (ibid xviii). This study will attempt to shed as much light as possible on discarding of fish as an activity which has very important eco-system implications. Furthermore, it will focus on the fact that discards are partly based on economic choices, partly a consequence of legal requirements in certain countries and partly a wasteful practice which involves use of scarce and renewable resources. Although there is international consensus on the need to reduce discards, countries around the world have different policies and approaches to the issue.

32. A number of countries have set up management regimes based on the principle of "no discards". "This policy moves the focus of attention of management measures from landings to catches and from fish production to fish mortality" (ibid xviii). In North-East Atlantic waters this includes Iceland, Greenland, Faroe Islands, Norway and Russia. "Bycatch reduction devices are mandatory in many Australian, European and North West Atlantic Fisheries Organization (NAFO) area fisheries". (ibid, xiii).

33. Under the Common Fisheries Policy of the European Union, regulations require fishers to discard that part of the catch which doesn't satisfy the stipulated requirements. This may be undersized fish, parts of the catch exceeding minimum by-catch provisions or fish where the fisher has no quota entitlement. EU fishers are thus only allowed to land a catch which is "legal"[6].

34. By-catches and discards are intimately linked. Leaving aside the fact that no commonly agreed international definition is available, by-catches involve: "(i) species and sizes not specifically targeted in a fishery; (ii) species that are protected, endangered or threatened; (iii) juvenile fish; and (iv) organisms for

6. EU discard policies may be revised, cf Commission proposal……, whereby the Commission, inter alia, has proposed to gradually phase in a "discard ban on a fishery by fishery basis."

which there is no intended use." (source 2.4.4. of FAO Guidelines). For the purpose of this paper, it is worth noting that by-catches may or may not be discarded.

35. "Discards are that portion of the total catch which is thrown away or slipped. Discards may be comprised of single or multiple species and may be alive or dead. In the context of these Guidelines discards refer to the throwing away or slipping of dead fish and fish that may not survive after live release…… Some examples of fishery-specific problems of discarding include, inter alia, (i) changes in food chain ecology through discarding dead fish or fish that may not survive after live release; (ii) perceived wastage of fish through discarding; and (iii) unsustainable fishing if the amount of discards is not included in the assessment of the status of the fishery and in the implementation of the relevant management plan." (source: 2.5 of the FAO Guidelines)

36. A particular category of discards are undersized fish, i.e. juvenile fish, which under certain circumstances are required to be discarded in some jurisdictions. This may either be a total prohibition against the landing of any undersized fish or that legal catch contains a set limitation on the amount of undersized fish that may be landed. As indicated below however, juveniles/ undersized fish may also, and perhaps in many cases be discarded for commercial reasons.

37. Before we provide estimates of discards globally, it may be useful to apply economic reasoning to highlight some of the rationale we can assume fishers base their decision on in order to explain why there are so many differences in discarding practices and levels.

38. If we assume that fishers act rationally in order to maximise the economic revenue of their catches, we would expect them, absent government regulations, to maximise those fish species and fish sizes that obtain the highest market prices. In an unregulated fishery, this would lead to the fisher discarding that part of the catch which has low economic value (assuming that sorting of the catch is practical, and thus not costly). In such fisheries, discard levels would also be a function of the fishing gear used. Small sized meshes would presumably result in high relative levels of discards, whereas bigger sized meshes would presumably lead to lesser relative levels of discards. If sorting "costs" are important, this would lead to the fisher to employ more selective fishing gear in order to try to maximise the retention of the higher valued "target" species.

39. In regulated fisheries, in particular those with a complex mix of quotas and technical regulations, maximising the value of the catch creates an incentive for "high grading" as fishers would want to maximise the value of their quota (which sets a limit to what they can legally land). In situations where quota limitations are "comfortable", this may not necessarily lead to increased discard rates. On the other hand, if the quota limitation is limiting the fishers income, the incentive to discard, and thus seeking to maximise the value of the quota, will be apparent.

4.1. Quantification of discards globally

40. Estimating the total quantity of discards globally is a challenge. Data is insufficient and of variable quality both in terms of countries, fisheries and species. In 1994, the FAO estimated that 27 million tonnes of fish were being discarded every year, representing around 30% of fish consumption at that time. A new FAO survey from 2005 using different data and methods estimated annual discards to 7.3 million tonnes (c.f. below).

41. In March 2009 the FAO published its latest estimate (classified as by-catches), indicating that the total "could be more than 20 million tonnes (equivalent to 23% of marine landings) and growing"[7]. UNEP, in a report published in February 2009 claims that total discards are around 30 million tonnes a year.

42. The 2005 FAO-report, as well as other sources, point to a reduction of discards over the last 20 years. This is attributed to, inter alia, the application of international instruments as well as deliberate and systematic attempts to reduce discard levels in a number of countries. There is compelling evidence indicating significant reductions in discards resulting from the use of more selective fishing gear, the introduction of by-catch and discard regulations, improved enforcement and reduction of fishing effort in fisheries with high discard levels, as well as increased use of bycatches for fishmeal.

43. At the same time, the average FAO figure is high in itself. At face value it demonstrates a global waste-figure not very far from the combined annual catches of India and Japan. Comparing this discard level to capture fisheries by region, the quantities approach the annual landings of the entire Northeast Atlantic area, i.e. the combined annual landings of Icelandic, Greenland, Faroese, Norwegian, Russian and EU vessels.

44. However, for the purpose of this study, it is not the intention to determine a best estimate of discards globally. Although the final figures indicated above may differ considerably, this fact is not of vital importance for this study. Here the focus is on the breakdown of data regarding discards into particular fisheries where such levels represent a high proportion of the catch. The discussion of discards is based on the 2005 FAO study.

45. According to that study, the sum of total recorded discards is 6.8 million tonnes for total recorded landings of 78.4 million tonnes. By applying the estimated weighted discard rate of 8% the total discard estimated amounts to 7.3 million tonnes.

46. Shrimp trawl fisheries represent the highest levels of discards both in terms of absolute quantities and in terms of proportion of the catch (62.3 %)[8]. Other fisheries with high discard proportions are tuna and HMS (Highly Migratory Species) longline fisheries (28.5 %). Demersal finfish trawling accounts for 1.7 million tonnes of discards, a rate of 9.6 %. However, the ranges of discard levels within these fisheries are substantial: Shrimp trawling (0 - 96%), Demersal finfish trawl (0.5 - 83%) and Tuna and HMS longline (0 - 40%).

7. This figure refers to bycatches and not to discards, although differences in definitions may confuse the matter. FAO (2009, p. 79) "Although no detailed estimate of bycatch is available, a crude estimate suggests that it could be more than 20 million tonnes globally (equivalent to 23% of marine landings) and growing. Decreases in abundance of traditional species, falling catch revenues, new markets for non-traditional species, increased demand for raw material for animal feeds and changes in regulations to prohibit discarding are all factors that may contribute to increased landings of non-target species".

8. For the purpose of this study, the terms shrimps and prawns are used interchangeably, and denotes both coldwater and warm water shrimps/ prawns species.

Table 2. Discards by major type of Fisheries (tonnes)

Fishery	Landings	Discards[1]	Weighted average discard rate (%)	Range of discard rates (%)
Shrimp trawl	1 126 267	1 865 064	62.3	0–96
Demersal finfish trawl	16 050 978	1 704 107	9.6	0.5–83
Tuna and HMS longline	1 403 591	560 481	28.5	0–40
Midwater (pelagic) trawl	4 133 203	147 126	3.4	0–56
Tuna purse seine	2 673 378	144 152	5.1	0.4–10
Multigear and multispecies	6 023 146	85 436	1.4	n.a.
Mobile trap/pot	240 551	72 472	23.2	0–61
Dredge	165 660	65 373	28.3	9–60
Small pelagics purse seine	3 882 885	48 852	1.2	0–27
Demersal longline	581 560	47 257	7.5	0.5–57
Gillnet (surface/bottom/trammel)[2]	3 350 299	29 004	0.5	0–66
Handline	155 211	3 149	2.0	0–7
Tuna pole and line	818 505	3 121	0.4	0–1
Hand collection	1 134 432	1 671	0.1	0–1
Squid jig	960 432	1 601	0.1	0–1

[1] The sum of the discards presented in this table is less than the global estimate, as a number of discard database records could not be assigned to particular fisheries.
[2] Low estimates in some fisheries (e.g. gillnet) are partly a result of the inclusion of high Chinese catches with low or negligible discard rates.

Source: FAO: Discards in the World's marine Fisheries, 2005

47. Before we proceed with analysing the available material, it may be useful to quote from the Scientific and Technical Committee for Fisheries, which is an advisory body for the European Union:

> *"STECF notes that fishers discard part of their catch for a variety of reasons, either for market/economic considerations or to comply with regulations. Lack of marketing opportunities, limits on the capacity of vessels to retain fish onboard, quality considerations, or large price differentials between or within species (highgrading) all induce discarding. It is noted that the management framework can have a strong influence on discard rates. Fisheries that are managed extensively by output controls such as total allowable catch (TAC) and catch composition regulations are often characterised by high discard rates. For any given catch, fishermen will always have an incentive to discard any fish for which the economic costs of retaining, landing and selling the fish exceeds the expected market price. STECF notes that tackling the discard problem in a specific fishery therefore requires an understanding of the incentives to discard in that fishery."*

48. STECF emphasises that incentives to discard to a large extent is fishery-specific. The three most important fisheries in terms of discard levels are shrimp, finfish trawl and tuna fisheries. These fisheries account for a substantial part of world fisheries in terms of quantity and value. The reported discards levels in pelagic trawl fisheries are moderate. Shrimp fisheries ranged between 3.3 and 3.1 million tonnes in the period 2003-09. In the same period, demersal finfish catches were between 14.0 to 10.9 million tonnes and tuna catches were in the range of 6.3 to 6.6 million tonnes[9]. In value terms, demersal trawls fisheries account for USD 13.5 billion, whereas tunas and shrimps account for USD 10.9 billion each.[10]

9. FAO Fishery and Aquaculture statistics Yearbook 2009, p.10.

10. 2009 figures, based on tables p. 49-50 of FAO Fishery and Aquaculture statistics Yearbook 2009.

49. Lastly, in the context of the geographical location of these fisheries, their economic significance and their national and regional importance, the Enhanced Engagement Countries are relevant to a larger or lesser extent in these types of fisheries.

4.2. Global Shrimp fisheries – an example

50. Shrimp fisheries around the world are characterised by high levels of discards. International trade in shrimps is the single most important commodity category of seafood, valued at USD 10 941 million.[11] Shrimp fisheries are essential in value creation for developing countries, and developing countries account for the lion's share of exports

51. The global annual nominal shrimp catch in the period 1992-2001 was around 2.5 million tonnes. Since then, shrimp catches have grown to 3.2 million tonnes. This implies 2 million tonnes of discards from these fisheries alone (applying the FAO/2005 discard ratio of 62.3%).

Table 3. Discard rates and discards in Shrimp Trawl Fisheries

Shrimp trawl fisheries	Discard rate for set of all records[1] with a discard rate			Discard rate and discards for set of complete records (records with landings, discards, discard rate)					
	Average discard rate (%)	No. records	Standard deviation	Average discard rate (%)	No. records	Standard deviation	Landings (tonnes)[2]	Discards (tonnes)	Weighted discard rate[3] (%)
Column	1	2	3	4	5	6	7	8	9 [8/(8+7)]
Coldwater shrimp, various (South America, North Sea)	44.0	7	0.34	44.0		0.34	77 060	123 125	61.5
Crangon (Belgium)	83.3	1							
Deepwater shrimp, various[4]	67.7	4	0.35	43.8	2	0.28	4 403	1 697	27.8
Deepwater shrimp, Mediterranean	39.2	3	0.09						
Nephrops	50.1	7	0.13	45.2	5	0.37	14 722	10 954	42.7
Nephrops and deepwater shrimp, Mediterranean	56.5	4	0.16	70.0	2	0.12	11 086	70 000	86.3
Nephrops and deepwater shrimp, not Mediterranean	31.0	4	0.13						
Pandalus	11.6	9	0.17	11.6	9	0.17	235 966	13 512	5.4
Aggregate coldwater and deepwater					**18**		**343 237**	**219 287**	**39.0**
Tropical shrimp[5]	55.8	58	0.27	58.2	52	0.25	783 030	1 645 777	67.8
All shrimp trawl fisheries		**97**			**77**		**1 126 267**	**1 865 064**	**62.3**

[1] Records used to compile this table exclude China as catches/landings attributable to targeted shrimp trawling could not be clearly identified.
[2] Landings include landings of bycatch.
[3] The weighted discard rate (column 9) is considered to be the most accurate and representative at a global level
[4] Includes deepwater non-penaeid trawl fisheries in tropical areas, e.g. Aristaeidae, Solenoceridae.
[5] Almost exclusively penaeid shrimp fisheries.

Source: FAO:

52. Capture fisheries for these stocks exist worldwide and are, apart from displaying the highest discard rates, usually conducted with smaller meshes. This means high levels of by-catch, and whatever the by-catch consists of besides the target species, a high potential for discards. Although the intermixture of other species will vary, e.g. tropical fisheries will typically contain a much wider range of species, a possible reduction in discards will depend on whether these by-catches can be commercialised, either for human consumption or be used for reduction purposes.

53. The North Sea shrimp trawl fisheries illustrate a case where discard rates demonstrate a combination of the specific realities on the fishing grounds, certain economic choices taken by the fishers as well as consequences of certain regulatory provisions. In the North Sea, current EU regulations permit a wide range of trawl nets in this fishery. However, regardless of the minimum size of the nets used, normally between 16-80 mm, the minimum percentage of target species (shrimps) is 30% or 35% for nets in the range of 70-79 mm. From a practical point of view, this means that the major part of the catch consists of other species than shrimp and that a part of this catch may be discarded for legal reasons. Additionally, a part of the catch may be discarded for other than legal reasons if it is not considered to have marketable value.

11. FAO Fishery and Aquaculture Statistics Yearbook 2009, p.50

54. Coldwater shrimp trawl fisheries have a weighted discard rate of 39%, varying between 81% in Peruvian shrimp fisheries and 5.4 % in the pandalidae shrimp fisheries (pandalus borealis) in the North Atlantic.

55. The FAO report describes the situation as follows.[12] "The discard database indicates that shrimp trawl fisheries in particular, are the single greatest source of discards, accounting for 27.3% (1.86 million tonnes) of estimated total discards. The aggregate or weighted discard rate for all shrimp trawl fisheries is 62.3%. These fisheries have consistently high discard rates deriving from a range of factors: Shrimp is often less than 20% of the demersal biomass on any shrimp fishing grounds. The relative small mesh size required to capture shrimp inevitably results in large quantities of bycatch. Transhipment at sea is often discouraged by vessel owners because of concerns about theft, or illegal/ unrecorded transhipment. The shrimp grounds are often at a considerable distance from the markets for bycatch, rendering its retention and transport to market uneconomical. Bycatch species are often of small size and their relative low value makes bycatch retention uneconomical. Enforcement of regulations on minimum landings of bycatch and on discard reduction may be deficient."

4.3 Finfish trawl fisheries

Table 4. Discards in selected trawl fisheries

Non-shrimp trawl fisheries[1]	Discard rate for set of all records with a discard rate			Discard rate and discards for set of complete records(records with landings, discards, discard rate)					
	Average discard rate (%)	No. records	Standard deviation	Average discard rate (%)	No. records	Standard deviation	Landings (tonnes)[2]	Discards (tonnes)	Weighted discard rate[2] (%)
Column	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9 [8/(8+7)]**
Demersal finfish[3]	20.80	102	0.17	18.60	63	0.16	3 182 715	775 396	19.60
Flatfish[4]	39.30	24	0.22	36.10	19	0.21	355 048	401 268	53.1
Other trawl fisheries		8	n.a.		7		900 628	258 570	n.a.
Midwater[5]	8.60	45	0.13	10.00	34	0.15	4 165 807	152 959	3.50
Demersal multispecies[6]	11.30	19	0.21	6.90	16	0.18	12 149 328	131 682	1.10
Deepwater[7]	33.80	9	0.29	32.50	6	0.37	56 899	37 276	39.60
Cephalopod	24.80	6	0.16	18.50	4	0.16	117 404	34 612	22.80
Fishmeal[8]	0.80	8	0.01	0.80	8	0.01	1 244 300	9 296	0.70
Total	**19.1**	**221**		**16.9**	**157**	**0.20**	**22 172 129**	**1 801 059**	**7.5**
Hake trawlers (ice and freezer)[9]				20.4	14	0.17	1 008 201	144 423	12.5
Factory trawlers				28.8	16	0.19	845 863	90 328	9.6
Beam trawl				34.6	5	0.35	173 290	399 068	69.7

[1] The fisheries are sorted on the basis of the primary target species. Additional details are provided in Annex A.
[2] The weighted discard rate is considered to be the most accurate and representative at a global level.
[3] Demersal finfish are fisheries primarily targeting roundfish for human consumption.
[4] Flatfish fisheries include beam trawl fisheries.
[5] Midwater trawl fisheries include some fisheries that harvest for both fishmeal and human consumption and include a large proportion of the Alaska pollock fishery.
[6] Demersal multispecies means that both finfish and shellfish are targeted. The reason for the low discard rate is because of the inclusion of Chinese and Southeast Asian trawl fisheries in this group.
[7] Deepwater fisheries include those targeting orange roughy, Coryphaenoides and Molva species.
[8] Fishmeal fisheries are those specifically targeting small pelagics for fishmeal.
[9] The hake, factory trawler and beam trawl values are presented separately. The reported landings and discards from these fisheries are already weighted in the total in the preceding line.

Source: FAO Discards in the World's Marine Fisheries, FAO Fisheries Technical Papers 470

12. Discards in the World's Marine Fisheries, FAO Fisheries Technical Papers 470, p.36

4.4 Tuna fisheries

Table 5. Discards in fisheries for tuna and HMS

Fishery	Longline	Purse seine	Pole and line	Midwater trawl	Traps
Number of records	37	12	11	4	2
Average discard rate	22.0%	4.85%	0.1%	–	–
Standard deviation	0.16	0.02	0.003	–	–
Total tonnage of records	1 403 591	2 673 378	818 505	60 050	4 693
Total discards of records	560 481	144 152	3 121	26 532	0
Weighted discard rate	22.0%	5.1%	0.4%	30.0%	<1%

Source: FAO Discards in the World's Marine Fisheries, FAO Fisheries Technical Papers 470

4.5. A note on the FAO Guidelines on Discards

56. As indicated above, international consensus on the regulatory aspect of reducing discards has gradually developed from general principles to the formulation of extensive and detailed guidelines, most recently adopted by the FAO in 2011, c.f. "International Guidelines On Bycatch Management and Reduction of Discards".

57. The Guidelines are comprehensive and detailed. The discussion here will focus on the elements that are mainly of importance from an economic point of view. Basically, this relates to sub-optimal use of the available resources. In this context the discarding of juveniles is particularly serious, as such discards exacerbates problems relating to stock composition and future recruitment. Catches of increasing numbers of juveniles will normally lead to a worsening situation in the future where even more juveniles will be caught in a particular fishery.

58. An important aspect of the FAO Guidelines relates to by-catch management planning involving identification and assessment of fisheries where by-catch and discards occur. This involves, inter alia, *…."(ii) a risk assessment to identify the specific nature and extent of bycatch and discard problems in the fishery as a basis for prioritisation and planning; (iii) a review of the effectiveness of alternative methods to address the bycatch and discard problems identified in the risk assessment; (iv) a review of the potential effectiveness of alternative methods to address the bycatch and discard problems identified in the risk assessment."* Furthermore, the involvement of stakeholders is highlighted in the process for elaboration of bycatch and discards planning and best practices, including ….."*review of the social and economic context, drivers and objectives that are associated with bycatch and discard problem(s)*". (extract 4.1.2 and 4.1.4 (ii) of Guidelines).

59. The Guidelines also contain a separate paragraph on "Economic incentives": "*States should take into consideration the fact that fishers are more likely to comply with management measures and adopt fishing techniques that are designed to manage bycatch and reduce discards if such measures improve their revenue, the quality of their catch, their operational efficiency and/or safety. Furthermore, the following points could also be considered: (i) access to or restriction from fishing opportunities can be a strong economic incentive for compliance with bycatch mitigation measures; and (ii) in accordance with international rules on subsidies and duties, the cost to fishers for installation of bycatch mitigation technologies could be lessened, where appropriate, through the application of grants/ loans and preferential treatment on duties and taxes for investment in such technologies*" (7.8 of Guidelines).

Next steps

60. This version is a first, and preliminary draft. The next version will contain a much broader scope, including expanding and elaborating upon the sources cited. The factual content will be further elaborated , and a more comprehensive analysis based upon that content will be expanded. The next draft will also address the issue of current utilisation or lack thereof of regular waste-products, such as fish-heads, cut-offs, trimmings, offal, etc that requires further empirical research to clarify actual use (or non use). Finally, the next draft will include a section on policy action and recommendations.

61. This is important both with respect to how discards and other forms of waste are handled, but also with respect to the food security aspect raised in the scoping paper, which states "*Better use of seafood and reduction of waste will contribute to increased economic and sustainable efficiency in the sector as well as responding to food security needs.*[13] *Tentatively, the material available indicates that increases of 10 million tonnes could be made from improved management alone. If we add discards in world fisheries which amount to about 10 million tonnes annually, a simple calculation would indicate that further availabilities of 20 million tonnes can be made.*"

62. Leaving aside the question of whether sub-optimal management is a wasteful practice, this simple example of the theoretical potential for an additional 20 million tonnes of fish for consumption, does not necessarily mean that this is actually possible or feasible. That is why more information on how waste is actually utilised is important. One objective of this report is to clarify the potential for improvement in the utilisation of fisheries resources. To do this, it is important to find out more about actual use of waste today. If regular waste(i.e. discards and/ or cut offs, trimmings, etc.) is utilised to a large extent, then the potential for further improvement or increase, e.g. for food security purposes, will similarly be reduced. More explicitly, if we determine that current waste levels are 20 million tonnes, does this mean that all of this can be utilised?

63. Questions of food security and development are intimately linked. In addition to a possible need for a consultancy report[14] to improve our knowledge, we have chosen to focus on developing countries, in particular the Enhanced Engagement Countries. These are Brazil, China, India, Indonesia and South Africa.

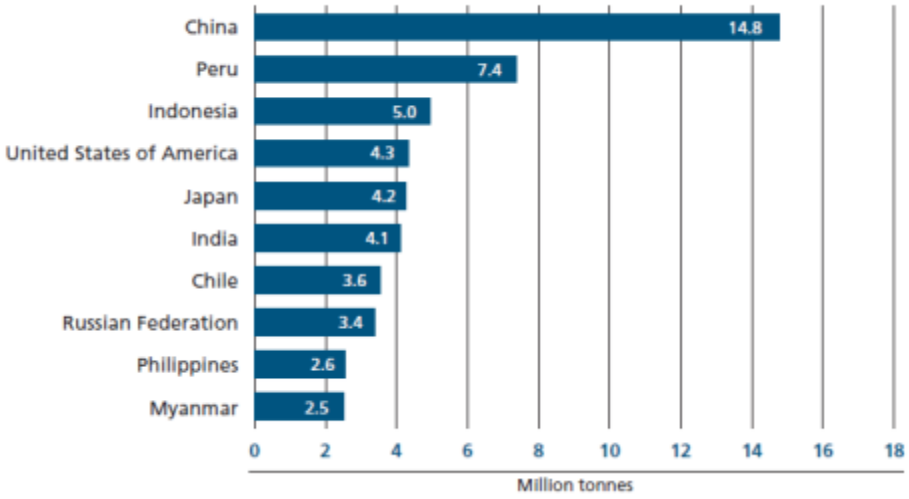
64. In addition to being the subject of enhanced co-operation with the OECD, the Enhanced Engagement countries are major fishing countries in their own right. According to the latest available FAO statistics, China ranks as the world's largest capture fisheries producer while Indonesia ranks 3rd, India 5th, Brazil 23rd and South Africa as the 29th largest producer, each with annual catches exceeding 500 000 tonnes.

13. With a projected world population growth to 9 billion by 2050, it is assumed that (given current rates of consumption of seafood) at least 120 million tonnes of seafood is needed to meet food security needs.

14. Cf Scoping paper.

Figure 3. World catches by country

Top ten producers in 2008



65. Lastly, as regards emerging economies and developmental aspects, different patterns of waste compared to the more affluent developed countries will be revisited in much greater detail. This is already envisaged in the introductory parts of the present draft.

66. Regarding aquaculture, although some preliminary aspects of waste issues in aquaculture are highlighted, this will be more completely addressed in the next version. The link between improved utilisation of waste in the capture sector and the possibility for using this waste for feed purposes has already been indicated in a preliminary way, but not elaborated in the present draft.

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Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **23-Mar-2012**

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TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

TAD/FI(2012)4
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A GREEN GROWTH PERSPECTIVE ON FISHERIES GOVERNANCE

This document is submitted to COFI for DISCUSSION and GUIDANCE at its 109th Session under draft Agenda item 3 iii).

Please note that delegates are asked to confirm their willingness to submit the requested information (see paragraph 10) for the Study.

Contact person: Gunnar Haraldsson (Email: gunnar.haraldsson@oecd.org)

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TABLE OF CONTENTS

Figure

Box

Introduction

1. The OECD Green Growth Strategy seeks to identify an economic growth path that is consistent with long—run environmental protection, using natural resources within their carrying capacity while providing acceptable living standards for all. For the fisheries sector green growth and governance are closely linked. The aim is to steer economic growth on a path that addresses environmental concerns while applying a comprehensive approach towards eco-system considerations. This report is a first attempt to outline and analyse a green growth perspective on fisheries governance.

2. Central for the fisheries sector is a governance structure that can produce economic growth while taking full account of the potential ecosystem services of the environment. This is against a background that the current "brown" growth is likely to produce unsustainable outcomes for the fisheries sector. Different governance structures and fisheries management policies lead to different socio-economic and environmental outcomes and it is important to gain further insights into the interplay between fisheries governance and green growth.

3. It is recalled that the OECD Ministers *Interim Report on Green Growth* (page 11) states:

> *"Experience gained through both country reviews and general policy assessment could lead to the development of an analytical tool that would identify country-specific policy priorities on the basis of a cross-country analysis and understanding of what is good practice…"*

4. Furthermore, the OECD Secretary General has observed:

> *"Our Green Growth strategy should now move to country chapters, advancing the key indicators and strengthening assessment and monitoring."*[1]

5. This report intends to advance our knowledge in this direction as applied to the fisheries sector. It is a contribution to the overall work of the Organisation on green growth.

6. The objective of the work is to study how different governance structures and policies affect green growth in fisheries. The outcome will highlight coherences and incoherencies in governance systems with regards to delivering green growth in fisheries. The project will also provide valuable lessons for policymakers on how fisheries governance can be adapted to get fisheries on a green growth path.

Scope and Methods

7. In order to evaluate how governance, the institutional setting and specific fisheries policy, reinforces or hinders green growth in fisheries it is necessary to:

- Clarify the framework and concepts of green growth and fisheries governance
- Based on a questionnaire collect and synthesise empirical evidence on how different fisheries governance structures affect green growth. An example of the requested information is provided in Annex A.

1. Guidance from the Secretary-General to Directors and Heads of Programmes concerning preparations for the PWB 2013-14.

8. The scope of the study is OECD and enhanced engagement countries' capture fisheries. Although green growth and governance issues abound in aquaculture those are often different than in capture fisheries and in order to limit the scope of the exercise, aquaculture is not included in this study.

9. This study is based on empirical input from participating countries. The basic information requested will be in the form of a filled-out template or questionnaire. The questionnaire follows a pre-determined format based on the framework discussed below. An example of a filled out questionnaire is provided in Annex A.

10. In order for this study to ensure the high quality standards of the OECD and provide outputs of policy relevance, the active participation of countries and national experts is called for. This may require inter-sessional work, for example an expert meeting for the design and testing of the questionnaire to ensure the quality and policy relevance of the project. Commitment by Delegates to contribute to this exercise is important; participants at the 109th Session are asked to confirm their willingness and interest in contributing to this exercise.

Outcome and relevance

11. The outcome of the study, scheduled to be finalised 2014, is a report based on the findings and lessons learned. The first part of the report will outline the main issues regarding the interplay between good governance and green growth. The second part will bring together material and lessons learned from the questionnaires.

12. This project will benefit individual participating countries in a number of ways. Going through the exercise will highlight how national governance structures promote or hinder green growth which will help in future policymaking. The work will identify practical steps and actions that can be taken by policy makers and fisheries managers for the design and implementation of green growth policies in fisheries. The final report will also provide other benefits as it will allow participating countries to learn how governance structures and policies in other countries work and exchange information on how to promote green growth through good governance.

The rationale for the project

13. The discussion on how improved governance structures and policies can help in achieving green growth goals is yet in its infancy. The lack of a general framework in which to address those issues is a challenge.

14. Green growth has been defined as[2], the quest to maximising economic growth and development while avoiding unsustainable pressure on the quality and quantity of natural assets. It is also about reaping the growth potential that arises from transiting towards a green economy.

15. According to the first part of this definition the OECD Committee for Fisheries (COFI) has already been dealing with green growth related issues for a long time. Many of the Committee's projects, including recent work on climate change, aquaculture and the economics of rebuilding fisheries have stressed sustainability and the need to take a long-term view to promote growth while at the same time securing biodiversity and other ecosystem considerations as well as contributing to food security.

2. *OECD Green Growth Studies: Food and Agriculture* (OECD, 2011) and *Towards Green Growth* (OECD, 2011).

16. The second part of the green growth definition, which deals with growth potentials that arise from placing more emphasis on green growth, has received less attention. The reaping of growth potential arising from a transition to GG includes at least two dimensions. First, there are issues related to the link between natural and environmental resources and economic growth. The fundamental idea is that a decoupling of growth and environmental resource impacts is the way forward towards green growth. Secondly, it is quite possible that a move towards green growth may foster other types of economic activity which may drive economic growth on their own through research and development/innovation.

Box 1. Minister's Interim Report on Green Growth

"Within this context, green growth can be seen as a way to pursue economic growth and development, while preventing environmental degradation, biodiversity loss and unsustainable natural resource use. It aims at maximising the chances of exploiting cleaner sources of growth, thereby leading to further "decoupling" between environmental and economic performance. This will involve seizing the opportunities for development of new green industries, jobs, and technologies, as well as managing the transition for greening the more traditional sectors and the potential associated employment or other distributional impacts. It will require adopting new technologies, developing new products and supporting new patterns of demand from households, companies as well as governments."

Source: *Interim Report of the Green Growth Strategy: Implementing our commitment for a sustainable future* Meeting of the OECD Council at Ministerial Level 27-28 May 2010.

17. The OECD has spelled out the issues to be addressed in relation to green growth, including; reframing growth, addressing tensions and systemic risks, productivity of the biosphere, climate change, biodiversity loss, possible tensions between local and global environmental and economic priorities, valuing natural assets, the role of uncertainty and seizing new opportunities. Thereby, the green growth agenda calls for a broader view to fisheries management. At present most countries' policies and management plans focus on fish stocks and fishing firms without explicitly taking into account the effect of those policies on other industries, user groups or the environment, except in an informal manner. Under the green growth agenda, consideration must be given to complicated interrelationships along the fisheries value-chain but also outside the fishing industry itself. Such an approach may challenge current governance structures.

18. Before much can be said about what governance structures and policies are best suited to achieve green growth in fisheries it is necessary to map and analyse the actual situation and the main challenges in real-world fisheries. Such information is necessary in order to provide relevant policy advice.

The need for a reform of fisheries governance to achieve green growth

19. Although green growth is high on the fisheries agenda there seems to be a lack of consensus on the analytical framework needed to address the most important policy issues. As stated in the Ministers declaration on green growth, it "[…] is not a replacement for sustainable development, but rather should be considered a subset of it. It is narrower in scope, entailing an operational policy agenda that can help achieve concrete, measurable progress at the interface between the economy and the environment. It focuses on the necessary conditions for innovation, investment and competition that can give rise to new sources of economic growth – consistent with resilient ecosystems."

20. In the OECD *Glossary of Statistical Terms* governance is defined as:

> *Governance is the exercise of political, economic and administrative authority necessary to manage a nation's affairs.*

The context is given as:

> *The process by which decisions are made and implemented (or not implemented). Within government, governance is the process by which public institutions conduct public affairs and manage public resources.*

21. According to this definition governance encompasses both the ***measures*** taken to govern public affairs and the ***structure*** of the decision making process. This means that policy advice concerning governance concerns both the set-up of the decision making process as well as policy choices.

22. It is important to keep in mind why governance is central to fisheries. In the absence of market failures there is, from a pure economic theory standpoint, little reason for the intervention of public authorities. That result depends on various assumptions that seldom hold in real world situations (Eggertsson, 2005).

23. The key role of the public authority is to provide public goods, which by definition are not provided through markets. Governance is needed to provide such goods. Which public goods are needed can differ among fisheries (Sutinen, 2008).

24. Examples of necessary public interventions in fisheries abound, such as the setting of total allowable catches, rules and regulations concerning gear, seasonal closures and safety, to name but few. Such measures are needed to provide public goods and to avoid harm due to market imperfections such as lack of functioning markets and informational asymmetries.

25. Another important role for public intervention is that in some cases there might be a long time-lag between costs incurred due to the greening of fisheries and the benefits received. Additionally some of the costs may be borne by those that do not directly reap the benefits. This may call for public intervention in the absence of well functioning markets and well defined property rights (Ayalew, Dercon and Gantan (2007). Distribution of benefits and costs of implementing green growth measures may also be called for.

26. Accordingly it becomes clear that the need for public intervention is different, not only from one fishery to the next, but also hinges upon the governance system and policies in place (de Vivero *et al*., 2008). For instance fisheries governance systems that rely on gear controls to restrain catches need efficient monitoring mechanisms to ensure that those controls are not circumvented, while fisheries governance systems that use vessel quotas need monitoring systems that track the catch levels of individual vessels, rather than observations on the gear they use. This means that although the aim of the two policies is the same, that is to control catches, the policy measures chosen to achieve it call for different types of public interventions, i.e. governance.

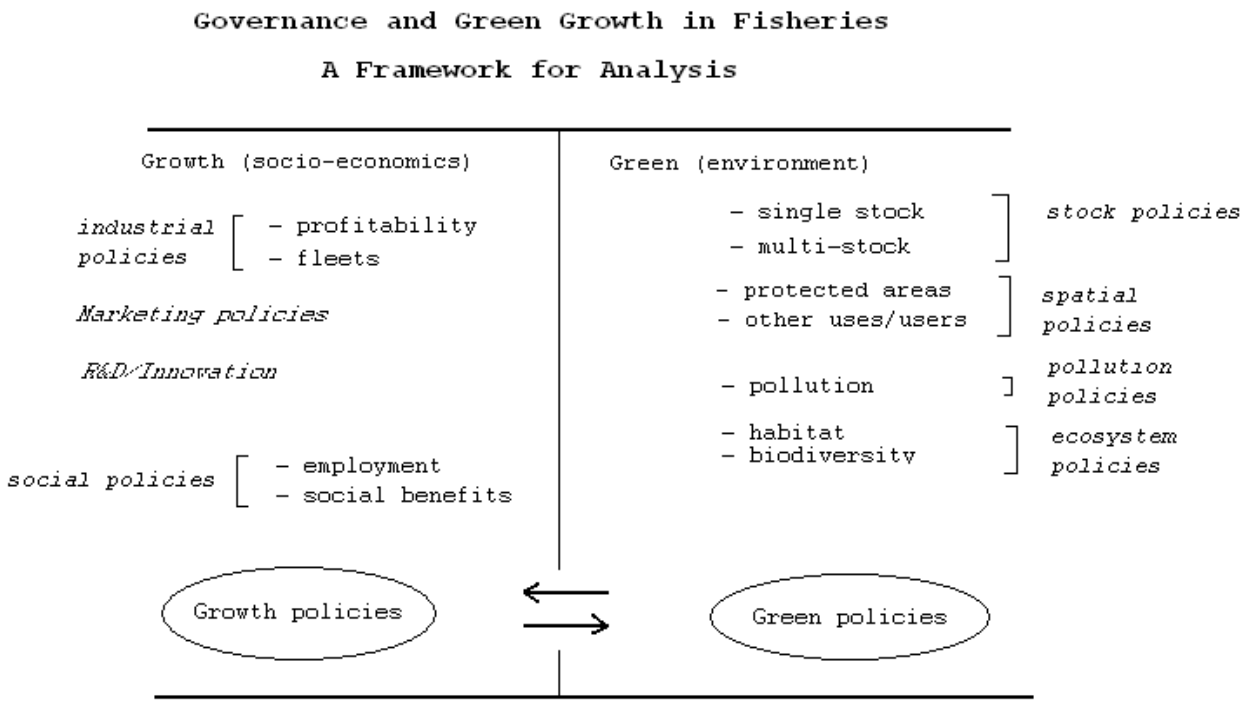
Proposal for a framework for analysing governance issues related to green growth in fisheries

27. According to the Green Growth Strategy Synthesis Report [C/MIN(2011)4]

> *"Ultimately, what matters for the success of a green growth strategy is a well-defined framework for action and a consistent set of economic and environmental policy criteria. It will need to build on a high degree of coordination among ministries and levels of government as well as stakeholders outside government, to identify a policy mix suitable to local conditions. In many cases, developing appropriate institutional capacity will be an essential condition for integrating green growth into core economic strategies and other government policies, and for ensuring a leading role for finance, economic and environment agencies."*

28. Keeping in mind the many issues that the OECD Green Growth Strategy calls for being addressed it is necessary to limit somewhat the scope of analysis and focus on specific issues related to fisheries to avoid the danger of addressing all issues at all times with limited success. It should also be noted that according to the definition of governance as used in the OECD it is both about structure and measures. With that in mind we propose focusing the analysis on green growth governance in fisheries by introducing a dual approach. In order to keep the analysis tractable we divide the issue in two, as depicted in Figure 1.

Figure 1. A Framework for analysing green growth in fisheries



29. In Figure 1, fisheries management measures and policies are divided in two categories. First there are growth measures and policies, which mainly have to do with economic and social considerations. Secondly there are green policies and measures, which are directly concerned with the environment.

30. This division and sub-groupings of specific policies makes it possible to analyse the major policy measures and how they affect growth and green respectively. From a governance perspective it is also important to consider which public authority is responsible for which policies. In order to keep the figure

simple the different public authorities are not explicitly shown in Figure 1. The role of stakeholders is also an important factor when considering issues related to green growth and fisheries governance. Green growth governance has to tackle issues of multiple uses and competing claims of different actors in the economy. Community management is one approach to tackling such challenges (Pomeroy and Berkes, 1997; Cox *et al.*, 2010). This brings up the legitimacy and stakeholder involvement in the governance system (van Hoof, 2012; Arnason, 2010; Ostrom, 1990, Hatcher, 1997). These considerations are explicitly taken into account in the template/questionnaire itself (Annex A).

31. Many important policies that, at least indirectly, affect the growth and greening of fisheries do not appear in this schematic overview. Examples include various monitoring, measuring and enforcement policies. The reason is that they are usually overarching and affect many other spheres of society, such as the judicial system and surveillance systems. Those are omitted both to simplify the analysis and because they are not exclusively directed to fisheries or related activities.

32. Figure 1 is a very simplistic representation of real-world fisheries governance. However it conveys the message that there is a feedback between different policies in the green growth framework. It also underlines the need for **coherent** strategies. This framework can be used to analyse some of the main challenges and opportunities in green growth fisheries governance. We will split the discussion along the two strands shown in Figure 1 incorporating some of the main strands of green growth in order to highlight the main issues in constructing a coherent green growth strategy for fisheries. Our intention is to highlight that the governance model as well as the policies used in either of the two "spheres" in many cases influences the other 'sphere'. Mapping out those interactions is the goal of the exercise.

33. The template/questionnaire will be constructed around this model. For each subgroup of policies or management measures there are standard questions regarding:

- **General discussion**: A short introduction, if needed.
- **Aim of policy**: What the stated aim of the policy is.
- **Public institutions involved**: Listing of which public institution involved in decision making and implementation.
- **Stakeholder involvement**: Listing of which stakeholders are involved and how (if any).
- **Effects on growth**: The expected effects of the policy on economic growth of the industry.
- **Effects on environment/ecosystem**: The expected effects of the policy on the environment/ecosystem.
- **Interaction with other policies**: Description of how this specific policy may interact with other policies.
- **Interaction with other institutions**: Discussion on whether and how other public or private institutions are affected by the policy or taking part in implementation.
- **Other considerations**: Reserved for comments or further clarification of the information submitted.

34. A pre-filled draft template is in Annex A (with the example of Iceland), giving an idea on how this template may look like and the level of detail required for the exercise. It serves only as an example and is not an official submission from Iceland.

Growth/socio-economic policies

35. According to the framework growth policies group together what may be called traditional fisheries management policies. These are usually industry or socially focused policies which are put in place to secure the sustainability of the fishing activity and ensure the livelihoods of those engaged in the fisheries and related industries. We have grouped these issues in four categories.

36. First there are various *industrial* policies, secondly, *marketing policies*, thirdly *R&D and innovation policies* and finally *employment and social policies*. Although these policies are all grouped under the general headline of growth policies they do not in all cases lead to sustainable growth in fisheries. The reason for them being classified under the growth heading is their intent, rather than their actual long-term effects.

Industrial policies

37. There are many policies which are directly aimed at controlling or supporting the fishing industry itself. Common among those are various fleet and capacity policies aimed at matching capacity and resource availability. Matching capacity with resource abundance is a clear green growth policy measure. Where fisheries are characterised by over-capacity, the OECD has already provided guidelines on how to implement decommissioning schemes to achieve this goal (OECD, 2009).

38. But other industrial policies may run counter to getting fisheries on a green path. Some industrial policies are used to secure a certain minimum level of profitability in the industry, e.g. with the use of input subsidies (the most common example being fuel subsidies). Such policies are clearly not making fisheries greener as they distort real prices and incite wasteful use of inputs. Getting the prices right is a fundamental issue in greening fisheries (Nielsen *et al*., 2012).

Marketing and trade policies

39. Many countries use various marketing policies to promote their fisheries on the global market. Examples include labelling and certification schemes. **Eco-labelling and certification** in the fisheries sector touch upon the roles and relationships between the public and private sectors in managing fisheries and the whole value-chain from the resource to the consumer. In some instances such policies might be classified as *green* policies rather than *growth* policies. Whether they are grouped under *growth* or *green* depends on their aims and possible effects. In 2009, the OECD and FAO organised a Round Table dedicated to ecosystem labelling and certification. The outcomes from the Round Table underscore the importance of such instruments for green growth in fisheries.

40. Various other policies may be put under this heading such as **trade policies** and **development policies**. Such policy may influence the fisheries sector and may also have an impact on trade patterns.

R&D and innovation policies

41. The OECD tool box for achieving green growth includes policies aimed at finding ways to increase output while decreasing the pressure on resources. Public authorities have various ways of supporting such research and innovation, for example through research funds and tax concessions. Stakeholders may also have an important role in research and innovation (Clement, Wells and Gallagher, 2008, Sobol and Craig, 2008).

Social policies

42. The fourth category of growth policies are those concerned with social issues. Many fisheries management laws state that one of their aims is providing fishers with stable employment and secure livelihoods. Those are policy choices and whether and how they affect the greening of the fisheries depends mostly on how such policies are implemented. Policies that aim to increase employment in the industry by easing access to the resource usually do not lead to sustainable harvests while at the same time dissipate possible rents in the fishery for a net loss to society.

43. Reforms in the fisheries sector often result in less use of human and physical capital. Therefore various flanking measures may be needed to ease the transition. The OECD has already done extensive work on how to ease the transition of employment from one sector to another (OECD *Reassessed Job Strategy*).

44. Various other policies and measures exist such as regional assistance and industrial policies which are often implemented through the tax system or other financial redistribution mechanisms. Such measures can have considerable effect on both the growth and greening of fisheries. Whether such policies lead to increased pressures on the ecosystem or not is a fundamental green growth question.

45. The increased use of devolutionary approaches as a governance tool has been widely studied (FAO, 2008). Community management, rights based approaches and other devolutionary measures should all be accounted for under this heading.

Green/environmental policies

46. Green or environmental policies aim at restoring or securing the environmental value of the biosphere. In Figure 1 we have grouped those roughly into four categories; stock policies, spatial policies, pollution policies, and ecosystem policies. As with the classification of growth policies this is neither comprehensive nor entirely clear-cut.

Stock policies

47. Policies for stocks are usually put in place to secure that there is a sufficient amount of fish in the sea to be harvested now and in the future. Such policies are often aimed at specific biological reference points such as aiming for Maximum Sustainable Yield (MSY) or maximising some other yield from the fish stocks. The use of biological reference points is common and specific policies have been adopted to deal with inherent uncertainty in stock measurements, such as the *precautionary principle*.

48. But policy actions regarding stocks are not limited to stock sizes, measured in tonnes. There are also various measures taken to influence the stock composition which can have considerable influence on the growth rates and thereby on the renewability of the resource. Most advanced fisheries use policies to this end, such as spatial measures, including area closures but also gear limitations (e.g. mesh sizes) and seasonal closures.

Spatial policies

49. Spatial policies deserve a special attention. They are a key to successful green growth in fisheries (van Hoof, 2012) as well as in ecosystem management (see below). Spatial policies are widely used (Makino, 2008) and are often an integral part of other policies, such as those aimed at enhancing stock structures, protecting habitat and/or in the implementation of more general ecosystem management approaches.

Pollution and emission policies

50. Most countries have incorporated pollution policies and standards for pollution emissions (including green house gases). Such policies are important in many fisheries where considerable offal and additives result from the production process and can cause considerable harm. In the absence of well defined property rights such problems cannot be solved through voluntary exchange in markets, calling for public intervention in the form of regulations.

51. Global efforts may be needed to tackle pollution issues as increased cost of polluting may result in a temporary loss of competitiveness if other countries do not apply similar measures. Some developing countries may find it difficult to apply strict pollution regulation due to the cost of such measures. Official Development Assistance (ODA) can play an important role in helping to clean up dirty industries in such countries while at the same time fostering green growth (Beslay, 1995).

52. Challenges stemming from climate change have called for various policies aimed to minimize the environmental impact of production. Many policies are aimed at increasing the energy efficiency of production through various measures such as taxes and quotas on fuel use to incite the use of more fuel efficient processes and thereby decrease the carbon footprint of production.

53. Many environmental externalities are under-priced or not priced at all. Taxes and quotas are tools that can help in getting the prices of externalities right. Tyedmers, Watson and Pauly (2005) estimate that the world's fishing fleets are using 1.2% of the global oil consumption, primarily as fuel, and by a rough estimate this number will increase to 2% if aquaculture is included. This must be looked at in a global perspective.

54. At the same time, using taxation to correct prices may have an effect on the competitiveness of the industry. The effect of green growth policies on competitiveness, at least in the short run, may call for international trade policy considerations.

Ecosystem policies

55. Ecosystems are complicated webs of interactions between habitat, environmental conditions and a multitude of living species of many trophic levels. Given that many ecosystem services are not priced at all or underpriced in the marketplace there is no wonder that many government policies are aimed at preserving or enhancing whole ecosystems.

56. Given the limitations and shortcomings of focusing on target-species, alternative fisheries management approaches have been designed. The ecosystem approach to fisheries has been proposed as a way forward. The ecosystem approach incorporates many 'best practices' of the standard fisheries management tool-box to which are added strategies that try to balance diverse objectives within ecological boundaries, given uncertainties (Garcia *et al*. 2003). This approach is consistent with the 1995 FAO Code of Conduct for Responsible Fisheries which imposes an obligation for states and resource users to conserve ecosystems and to apply the precautionary principle to fisheries management to achieve resilience.

57. An interesting feature of the ecosystem approach to fisheries is the emphasis it places on spatial management. Although spatial closures have a long history in fisheries management, this new approach aims at sustaining the productive capacity of ecosystem instead of simply creating safe-havens for spawning stock or vulnerable species.

58. Several countries have taken steps towards designing and implementing ecosystem management using a set of best practices while taking into account the different objectives within ecosystem boundaries, given uncertainties (Garcia *et al*., 2003).

Additional considerations

59. Fisheries governance is seldom an isolated but rather a part of more complicated governance networks (Slaughter, 2004). As previously emphasised the framework above does not attempt to capture but the important elements of what may be classified as growth or green policies. However it underlines the importance of coherent green and growth policies in order to establish a governance system for green growth.

60. This framework also shows that there are important interactions between growth and green policies. Sometimes different policies work together toward increasing growth and creating synergies, while at the same time making fisheries greener. Examples include various industrial policies that spur innovation that lead to less fuel use. **Green growth is to a large extent concerned with promoting such policies**.

61. Other industrial policies may increase profits of fishing firms, at least in the short-run, but lead to less greener fisheries, such as the use of fuel subsidies. Also, several policies may be beneficial due to their ability to promote a "greener" environment but may be unfeasible due to their economic and social consequences, such as a fisheries moratorium or total closures of fishing grounds. Addressing tensions and possible complementarities between policies is one of the key ingredients of a successful green growth strategy in fisheries. **This study is intended to highlight the coherence and possible incoherence of different policies and their effects on moving the fishing sector onto a green growth path**.

62. Although some efforts have been made in designing indicators for green growth in fisheries (OECD, 2011) this work is not advanced enough to yield meaningful and reliable indicators (Grafton *et al*., 2006). The project proposed here is a qualitative analysis based on material provided by participating countries and is a first step in collecting reliable information concerning the successes and challenges of different governance systems in promoting green growth in fisheries.

Conclusion

63. The Green Growth agenda calls for potential changes in fisheries governance although it is unclear with our current knowledge what changes are needed and how they can be implemented.

64. The proposed study on green growth and fisheries governance will be conducted as a desk study building on material provided by participating countries. The analysis of the qualitative data collected in a systematic way will then make it possible to draw lessons learned on the interaction between governance and green growth in fisheries as well as identify best practices useful for other countries considering a green growth strategy in fisheries. It will also provide guidance on future work on the subject.

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ANNEX A.

THE ICELANDIC CASE

Introduction

65. The template in Annex A brings together the main growth/economic policies and green/environmental policies in the Icelandic fisheries sector. This exercise is for illustration purposes only and has neither been verified nor accepted as a submission.

66. The goal of this example is to identify the main policies and where and when there is coherence and incoherence between different policies. It also underlines the roles and responsibilities of different public institutions and stakeholder involvement.

67. In Annex A, Table Part A summarises the main growth/economic policies while Part B summarises the main environmental/green policies.

Conclusions/lessons learned from the Icelandic example

68. The information underlines how different policies affect the greening and growth of the Icelandic fisheries. We split the main lessons learned from this exercise in two parts. First, lessons regarding the institutional arrangement and secondly, lessons learned with regards to specific policies.

69. **Lessons on institutional arrangements**: There are mainly three ministries that deal with green growth issues in fisheries; the Ministry of Fisheries, Ministry of the Environment and Ministry of Finance. Each ministry has a well-defined area of work, and while there is cooperation with regards to the overarching policies there is little cooperation when it comes to implementation or design of specific management measures. Stakeholders have a consultative role in relations to the distribution of regional quotas (A.1.3) and the Iceland Responsible Fisheries Label (A.2.1). Environmental policies regarding pollution are under the auspice of the Ministry of the Environment.

Lessons on specific economic growth policies

70. The ITQ system (along with the TAC) creates incentives for a sustainable use of marine resources. Exemptions from the system, such as; the coastal fisheries (A.1.2), regional quotas (A.1.3) and the line-increase (A.1.4) all lower economic efficiency. This is however a policy choice. These policies do not seem to have a negative effect when it comes to greening the fishery. Taken together, such policies are not in the green growth spirit.

71. Various innovation policies are general in nature and seem to be aimed at increasing economic efficiency and competitiveness of the industry with no specific aim for greening the fishery. Policymakers might want to change the emphasis of these programs to advance the green growth agenda.

72. The tax rebate on fishermen increases profits of the fishing firms, *ceteris paribus* without affecting the greening of the fishery.

Lessons on specific green policies

73. The TAC (B.1.1) ensures a sustainable fishery. The decision on the TAC rests with the Minister of Fisheries but is based on consultations with the Marine Research Institute. The catch-rule for cod helps in keeping the fish stocks at sustainable levels while at the same time shielding the industry from big fluctuations in allowable catches. The catch rule is a way to balance green with growth objectives.

74. Various measures, primarily spatial and seasonal/periodic restrictions (B.1.3), aimed at stock composition through regulations regarding allowable gear (B.1.2) are mostly aimed at excluding juveniles from the catch. Such measures may be constraining for firms in the short run but should have long run beneficial effects.

75. The carbon tax policy (B.3.3) has positive environmental effects but may weaken the competitiveness of the industry in the global marketplace if other countries do not apply similar approaches (see possible link with straddling stock measures (B.1.3).

76. Pollution policies are under the auspice of the Ministry of the Environment and do, as such, not directly affect the design or implementation of fisheries management.

77. The ministries of fisheries, environment and foreign affairs, work together on a common integrated ocean environmental policy. The implementation of this policy, describing roles and responsibilities, has not been formalised yet. Therefore it is difficult to evaluate its effect on greening or growing the fisheries.

The template

	Growth/economic policies		
	General note The main economic/growth policies listed in this section are: A.1 Industrial policies A.1.1 The ITQ system A.1.2 Coastal fisheries A.1.3 Regional quotas A.1.4 Line-increase A.2 Marketing policies A.2.1 Iceland Responsible Fisheries A.3 Innovation policies A.3.1 Matís A.3.2 RANNIS A.3.3 Project funding for the fishing industry A.4 Social Policies A.4.1 Employment and social policies A.4.2 Tax rebate		
A.1	***Industry policies***		
A.1.1	ITQ system	General discussion	Before the introduction of the Individual transferable quota system (1984-1990) for most Icelandic fisheries there were government funds for decommissioning vessels to hinder and reduce overinvestment. Since the introduction of the ITQ system there has been no direct policy with regards to the size or composition of fleets. Therefore there can be said to be no specific policy regarding fleet size or composition.
		Aim of policy	None.
		Public institutions involved	The Fisheries Directorate (under the auspice of the Ministry of Fisheries) collects data and information on fishing vessels, their catches and gear. The Icelandic Maritime Organisation is responsible for implementation of regulations regarding registration and safety.
		Stakeholder involvement	None.
		Effects on growth	None.
		Effects on environment	None.
		Interaction with other policies	None.
		Interaction with other public institutions	None.

A.1.2	*Coastal fisheries*	General discussion	Since 2009 a special exemption from the general ITQ system has been in place called 'Coastal fisheries'. A special law allows the Minister of Fisheries to allot a certain pre-determined amount of the TAC for certain demersal species to be fished by small boats using hand-line only during the summer months (May, June, July, August). A special license is needed to participate in this fishery. Holders of such licenses may not be engaged in other fisheries.
		Aim of policy	To help small boat owners that do not hold quota to engage in coastal fisheries and thereby increase employment in rural areas. The coast line is divided into areas. When the total catch of this fleet has reached the TAC limit the fishery is closed.
		Public institutions involved	Ministry of Fisheries.
		Stakeholder involvement	No direct involvement.
		Effects on growth	The profitability of this fleet is generally estimated to be lower than in the general system.
		Effects on environment	The only fishing method allowed is hand-line, which probably has a smaller environmental effect than trawl gear and nets.
		Interaction with other policies	The coastal fishery policy is linked to other programs of rural support and the specific line-increase (see. A.1.4) and Regional quotas.
		Interaction with other public institutions	Icelandic Regional Development Institute.
A.1.3	*Regional quotas*	General discussion	The Ministry of Fisheries allocates a specific amount of TAC of some species to specific rural areas.
		Aim of policy	To support employment and economic activities in rural areas.
		Public institutions involved	Ministry of Fisheries. Municipal authorities.
		Stakeholder involvement	Municipalities make recommendations to the minister on how to allocate the regional quota within each region.
		Effects on growth	Lowers the economic profitability of the industry as a whole but strengthens local economies.
		Effects on environment	None.
		Interaction with other policies	The regional quota policy is linked to other programs of rural support and the specific line-increase (see A.1.4) and coastal fisheries (A.1.2).
		Interaction with other institutions	Municipalities. Icelandic Institute of Regional Development.

A.1.4	*Line-increase*	General discussion	Boats on day-fishing tours which use line that has been baited ashore can land 20% in excess of quota (quantity, given limitations) of cod, haddock and catfish. This allowance is limited in quantity for each species and specific parts of the fishing year. Ekki mega önnur veiðarfæri vera um borð í bátnum.
		Aim of policy	To increase employment ashore.
		Public institutions involved	Ministry of Fisheries. Fisheries Directorate.
		Stakeholder involvement	None.
		Effects on growth	Incentives for increasing employment ashore while at the same time creating incentives for use of machinery for baiting.
		Effects on environment	None.
		Interaction with other policies	Other policies aimed at securing the livelihoods of rural areas (see A.1.2 and A.5.1).
		Interaction with other institutions	Icelandic Institute of Rural Development.
A.2	***Marketing policies***		
A.2.1	**Iceland Responsible Fisheries**	General discussion	Public authorities in Iceland have joined forces with the industry to create and promote a certification system and a label called Iceland Responsible Fisheries (IRF). In 2007, the Statement on Responsible Fisheries in Iceland was released. The statement was a response to market demands for sustainable utilization of marine resources and was designed to inform buyers on how fisheries management is conducted in Iceland and that controls would be based on the best scientific knowledge. It also stated that the Government undertakes to obey international law and agreements on access to marine resources, which they have signed. *Label of origin* The Iceland Responsible Fisheries logo that indicates product origin of wild catch fish in Icelandic waters was released in 2009. The logo indicates Icelandic origin of fish catches in Icelandic waters and responsible fisheries management. The logo provides opportunities for stakeholders in the value chain of Icelandic seafood to highlight Icelandic origin. Icelandic fishing vessel owners, processing plants as well as other stakeholders in the value chain of Icelandic seafood products can apply for a permit to use the logo. *Third party certification* The FAO-ISO based Iceland Responsible Fisheries Management Programme is based on the Articles and minimum substantive criteria described in the FAO Code of Conduct for Responsible Fisheries and FAO Guidelines for the Eco-labelling of Fish and Fishery Products. These documents have been translated into a straightforward assessment specification by the IRF's Technical Committee and incorporated in an ISO 65 based certification programme, administered by Global Trust Certification Ltd. Further information can be found at: www.responsiblefisheries.is

		Aim of policy	Meeting demands of seafood buyers for sustainable use of marine resources with Iceland Responsible Fisheries programme, developed on the basis of commitments made through national law and international agreements.
		Public institutions involved	Ministry of Fisheries, Marine Resource Institute, Directorate of Fisheries.
		Stakeholder involvement	Fisheries Association of Iceland which is a common venue for organisations within the fisheries and seafood sector in Iceland
		Effects on growth	The label should help Icelandic fishing companies in promoting their products in foreign markets.
		Effects on environment	Supports a move towards sustainable and responsible fisheries.
		Interaction with other policies	Little, except in enhancing the overall image of the country using its resources in a sustainable way.
		Interaction with other institutions	As this policy action has partly to do with the country's image other public institutions might include the Tourist Board.
A.3	***R&D/Innovation policies***		
A.3.1	**Matís**	General discussion	Icelandic public authorities are directly engaged in R&D through a public company. Matis Ltd. is an Icelandic Food and Biotech R&D institute founded in 2007 following the merger of three former public food research institutes: The Icelandic Fisheries Laboratories (IFL), an independent food research institute; MATRA, a joint venture of IceTec and the Agricultural Research Institute and the research division of the Environment and Food Agency. Matis is an independent research institute with 100% governmental ownership. The total turnover in 2010 was about USD 10.4 million working capital, of which 38% is coming from the Icelandic Government. Matis is located in 9 cities or towns around Iceland. Matís has about 100 employees and about 21 has a PhD degree. Matis employees are many of Iceland‘s most competent scientists in the field of food technology, food research and biotechnology; food scientists, chemists, biologists, engineers and fisheries scientists. Several of Matís employees have a part-time position at universities in Iceland and about 14 PhD students and many M.Sc students are doing their research at Matis and working on their theses in cooperation with the industry in Iceland and abroad.
		Aim of policy	Matis is working in research and development for the food industry, fisheries and aquaculture. Matis focuses on innovation in food and biotechnology, various services in the food industry in Iceland and abroad and to increase safety and quality of food products. Matis‘ vision is to increase the value of food processing and food production, through research, development, dissemination of knowledge and consultancy, as well as to ensure the safety and quality of food and feed products. Matis specialised fields include traceability, genotyping, biotechnology, processing technology, enzyme, physical and chemical properties of food, quality and safety of aquatic and marine catches, feed technology for aquaculture and environmental research.
		Public institutions involved	Matís is under the auspice of the Ministry of Food and Aquaculture (Law No. 26, 2006).

		Stakeholder involvement	The Minister of Fisheries and Aquaculture assigns the Board of Matís Ltd. Although not stipulated in the law and regulation the current board includes representatives from the industry. Furthermore, Matvís employees work closely with other research institutes, researchers as well as private companies.
		Effects on growth	Provides R&D services to the fishing and aquaculture industry.
		Effects on environment	Environmental research is one of the key research areas of Matís and is likely to have a positive effect on the environmental performance of fisheries and aquaculture. Such effects have not been measured, neither qualitatively nor quantitatively.
		Interaction with other public policies	RANNÍS (see below).
		Interaction with other public institutions	Ministry of Fisheries, Ministry of Environment.
		Other considerations	None.
A.3.2	*RANNIS*	General discussion	The Icelandic Centre for Research (RANNIS) supports research, research studies, technical development and innovation in Iceland.
		Aim of policy	RANNIS administers competitive funds and strategic research programmes, coordinates and promotes Icelandic participation in collaborative international projects in science and technology, monitors resources and performance in R&D and promotes public awareness of research and innovation in Iceland.
		Public institutions involved	RANNIS reports to the Ministry of Education, Science and Culture and operates according to the Act on Public Support for Scientific Research (No. 3/2003).
		Stakeholder involvement	None.
		Effects on growth	Positive.
		Effects on environment	Positive.
		Interaction with other public policies	EU Research Funding as well as Verkefnasjóður sjávarútvegsins (A.4.3).
		Interaction with other public institutions	RANNIS cooperates closely with the Icelandic Science and Technology Policy Council and provides professional assistance the preparation and implementation of science and technology policy in Iceland.
		Other consideration	Through RANNIS the Icelandic government provides tax rebates for R&D activities.
A.3.3	Project funding for the fishing industry	General discussion	Publicly funded research.
		Aim of policy	Increase the economic efficiency and international competiveness of Iceland fishing firms.
		Public institutions involved	Ministry of Fisheries.
		Stakeholder involvement	Not available.
		Effects on growth	Not measured.

		Effects on environment	Not measured.
		Interaction with other policies	RANNIS, Matís.
		Interaction with other institutions	
A.4	***Social policies***		
A.4.1	**Employ-ment**	General discussion	No specific policies, laws or regulations apply to employment in fisheries or aquaculture. However, the line-increase (A.2.2) affects labor use in fisheries.
		Aim of policy	None.
		Public institutions involved	None.
		Stakeholder involvement	None.
		Effects on growth	Not applicable.
		Effects on environment	Not applicable.
		Interaction with other public policies	None.
		Interaction with other public institutions	None.
		Other considerations	None.
A.4.2	**Social benefits – tax rebate**	General discussion	People working in fisheries and aquaculture do not receive different benefits from people working in other industries or services with one notable exception which is a special income tax rebate for fishers. This tax rebate is planned to be abolished in 2011 (check).
		Aim of policy	
		Public institutions involved	Ministry of Finance, Icelandic Tax Authority.
		Stakeholder involvement	None.
		Effects on growth	Increases profitability of firms in harvesting.
		Effects on environment	None.
		Interaction with other public policies	Tax laws and their application.
		Interaction with other public institutions	None.
		Other considerations	Originally the rationale for this tax rebate was to help fishing firms to find suitable labour and at the same time compensate for difficult working conditions and long absences of fishers from families.
		Other considerations	

	Green/environmental policies		
	General note	**General note** The main green/environmental policies listed in this section are: B.1. Stock policies B.1.1 TAC B.1.2 Stock composition B.1.3 Straddling stocks B.2 Spatial policies B.2.1 Area closures B.3 Pollution policies B.3.1 General pollution policies B.3.2 Integrated ocean pollution policy B.3.3 Carbon tax B.4 Ecosystem policies	
B.1	***Stock policies***		
B.1.1	**TAC**	General discussion	All commercially exploited stocks are managed by an annual total allowable catch (TAC). The system is intended to limit the total catch and to prevent more fishing from the fish stocks than the authorities allow at any given time. The TAC for each stock is decided by the Minister of Fisheries (yearly regulation) based on scientific advice from the Marine Resource Institute. A specific catch rule for cod is an important landmark in the precautionary approach to cod stock management. This rule, based on scientific recommendations, was adopted by a government decision and became effective in 1995. It states that the annual TAC for cod is to be set at 25% of the fishable biomass. This implies that the TAC is automatically set after the annual stock assessment. Following the recommendations of the Marine Research Institute, the government decided in July 2007 that the TAC for cod in the fishing year 2007/08 should be set at 20% of the fishable biomass.
		Aim of policy	To ensure the sustainability of the resource and the fishing industry.
		Public institutions involved	Ministry of Fisheries. Marine Resource Institute.
		Stakeholder involvement	The TAC for each species is based on scientific evidence and analysis. There is no direct stakeholder involvement in the decision. The Marine Resource Institute consults regularly with industry participants.
		Effects on growth	The TAC secures the sustainability of the resource and the on-going concern of the fishing industry. An increase in the TAC would lead to temporary gains in growth of the industry but would have negative long-term effects.
		Effects on environment	Aims to secure the sustainability of the marine resources.
		Interaction with other policies	None.
		Interaction with other public institutions	None.

B.1.2	**Stock compo-sition**	General discussion	There are several selectivity measures in place in Icelandic fisheries, such as a mesh size of 135 mm or equivalent. A sorting grid is mandatory to avoid by-catch of juvenile fish in the shrimp fisheries and devices for excluding juveniles in the groundfish fisheries are also mandatory in certain areas.
		Aim of policy	To secure the growth of the stocks by protecting juveniles.
		Public institutions involved	Marine Resource Institute. The Icelandic Coast Guard is responsible for surveillance and enforcement.
		Stakeholder involvement	None.
		Effects on growth	Positive.
		Effects on environment	None.
		Interaction with other policies	Linked to spatial policies (see below).
		Interaction with other public institutions	
B.1.3	**Strad-dling stocks**	General discussion	Straddling stocks are managed under international agreements. **Blue Whiting**: Icelandic ships are allowed to fish 6 507 tonnes of blue whiting in 2011 in the international area administered by the Northeast Atlantic Fisheries Commission (NEAFC). **Atlantic mackerel**: Icelandic ships are allowed to fish 154.825 tonnes of Atlantic mackerel in 2011, thereof 20.000 tonnes in international area administrated by NEAFC. **Barent Sea cod**: Icelandic ships are allowed to fish within the EEZs of Norway and Russia in the Barents Sea. The TAC for Barents Sea cod in 2011 is close to 11,000 tonnes, in addition around 30% bycatch of other species is allowed. **Atlanto-Scandian herring** : Fishing of Atlanto-Scandian herring (Norwegian spring spawning herring) is subject to regulation. The TAC for Icelandic ships is 144.842 tonnes in 2011. **Oceanic redfish**: Icelandic vessels are allowed to fish 11,788 tonnes of oceanic redfish in 2011 in the international area administered by NEAFC. **Blue fin tuna:** By decision of the International Convention for the Conservation of Atlantic Tunas (ICCAT), Iceland has been allocated 78 tonnes of bluefin tuna from the East Atlantic and the Mediterranean Seas in 2011. **Dhorn Bank shrimp**: Deepwater shrimp fishing in the Dohrnbank area is not subject to a TAC but vessels fishing in the area must nevertheless report their daily catch in their log book and report their fishing to the Directorate of Fisheries. **Flemish Cap shrimp**: By regulation, Icelandic ships are allowed to fish 213 tonnes northern shrimp in 2011 in the international area of the "Flemish Cap" administrated by the Northwest Atlantic Fisheries Organization (NAFO).
		Aim of policy	Secure the sustainability in shared fish resources.
		Public institutions involved	Ministry of Fisheries, Ministry of Foreign Affairs.
		Stakeholder involvement	

		Effects on growth	
		Effects on environment	
		Interaction with other policies	
		Interaction with other public institutions	
General note			
B.2	*Spatial policies*		
B.2.1	**Area closures**	General discussion	The most important spatial policies are closures. There are three types of closures; permanent closures, seasonal closures and temporary closures.
			Permanent closures Off Northwest and North coast of Iceland, fishing by bottom trawl, midwater trawl and Danish seine is not allowed within 12 miles from a line drawn across the mouth of fjords and bays. Off the East, South and West coast, bottom trawling is permitted according to vessel size and engine power, with larger vessels (over 42 m) not having access within 12 miles, but the smaller vessels (less than 29 m) in some areas up to 4 miles. There are also extensive nursery areas outside these boundaries permanently closed for fishing. *Seasonal closures* Many areas along the south shore are seasonally closed to trawlers and/or Danish seiners. Fjords and bays in other areas are as well, these seasonal closures usually last about half a year each, but are of course variable. The most extensive seasonal closure is the spawning time closures. All fisheries are closed within 12 miles along the south and west shore and within 6 miles along the north and east shore for two weeks during Easter to protect the spawning of cod. *Temporary closures* A temporary closure system has been in force since 1976 with the objective to protect juvenile fish and reduce the incentives to discard. Fishing is prohibited for at least two weeks in areas where the number of undersized fish in the catches has been observed by inspectors to exceed a certain percentage. If, in a given area, there are several consecutive quick closures the Minister of Fisheries can with regulations close the area for longer time, forcing the fleet to operate in other areas. Inspectors from the Directorate of Fisheries supervise these closures in collaboration with the Marine Research Institute, sometimes the Coast Guard raises the alert. In the past 27 years, about 2000 temporary closures have come into effect, mostly off the Westfjords. Most of the closures concern cod fishing (63%) and often they have been limited to bans on bottom trawling or longlining. The Icelandic fisheries management system has many supporting measures designed for specific fisheries. There are extensive nursery areas permanently closed for fishing. Spawning areas of cod are closed for a few weeks in late winter during the spawning period and the Marine Research Institute has the right of immediate, temporary closure of areas with excess juveniles. There is a 12 mile limit for large trawlers in most areas.
		Aim of policy	Secure breeding by closing nursery areas

		Public institutions involved	Ministry of Fisheries. Marine Resource Institute.
		Stakeholder involvement	None.
		Effects on growth	Those measures are aimed at saving juveniles which may have a short-term negative effect on profitability of the firms in the industry but a long-term positive effect.
		Effects on environment	
		Interaction with other policies	Spatial closures are linked to measures that affect stock composition (see B.1.2).
		Interaction with other public institutions	None.
B.3	***Pollution and emission policies***		
B.3.1	**General pollution policies**	General discussion	Pollution of the ocean and water is under the auspice of the Ministry of Environment.
		Aim of policy	To ensure that amount and strength of pollutants from human activities in the ocean do not exceed given maxima. Also the aim is to stop discharges of pollutants at sea and on land. Finally Iceland would like to be among the leaders in combating pollution of oceans.
		Public institutions involved	Ministry of the Environment, Environment Agency of Iceland, Icelandic National Planning Agency.
		Stakeholder involvement	None.
		Effects on growth	Uncertain.
		Effects on environment	Uncertain.
		Interaction with other policies	Fisheries management. Environmental policies. International efforts.
		Interaction with other public institutions	None.
B.3.2	**Integrated ocean environ-mental policy**	General discussion	In 2004 the Ministry of Fisheries, the Ministry of the Environment and the Ministry of Foreign Affairs designed a common policy for issues related to the oceans.
		Aim of policy	The aim of the policy is to ensure ´healthy´ oceans, biological diversity and productivity so the ocean may continue to function as a cornerstone of the well being of the country. Furthermore, Iceland´s role in the international fora is further defined.
		Public institutions involved	Ministry of the Environment, Ministry of Fisheries, Ministry of Foreign Affairs.
		Stakeholder involvement	None.
		Effects on growth	Unclear.

		Effects on environment	Unclear.
		Interaction with other policies	Interaction with fisheries management in general and environmental policies.
		Interaction with other public institutions	Auxiliary institutions in fisheries and environment.
		Interaction with other policies	
		Interaction with other public institutions	
B.3.3	**Carbon tax**	General discussion	A special carbon tax is levied on all carbon fuel in Iceland, including fuel for the fishing fleet..
B.4		Aim of policy	The aim of the policy is incite the fuel efficient fishing methods and machinery.
		Public institutions involved	Ministry of Finance.
		Stakeholder involvement	None.
		Effects on growth	As the tax is levied on all fuel use in Iceland it does not affect the profitability of the industry when compared to other industries in the country. However, it does reduce the competitiveness of Icelandic fishing companies when competing on the international markets where such fuel taxes are not levied or where fuel is subsidised.
		Effects on environment	Reduces GHG emissions.
		Interaction with other policies	None.
		Interaction with other public institutions	None.
		Interaction with other policies	Part of Iceland's engagements to lower GHG emissions according to international treaties.
		Interaction with other public institutions	None.

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Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **23-Mar-2012**

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TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

A GREEN GROWTH PERSPECTIVE ON AQUACULTURE

23-25 April 2012

Delegates will find attached a revised version of the project on "A Green Growth Perspective on Aquaculture", as discussed at the 108th COFI Session. The document is distributed for DISCUSSION and GUIDANCE.

Contact: Dongsik WOO (e-mail: Dongsik.WOO@oecd.org)

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TABLE OF CONTENTS

Figures

Boxes

A GREEN GROWTH PERSPECTIVE ON AQUACULTURE

Proposal for a project on Green Growth Perspective on Aquaculture

1. At the 108th Session, the COFI asked the Secretariat to revisit the proposal for the Study "Green Growth Perspective on Aquaculture" [TAD/FI(2011)8/PART4] and to produce a revised version for the 109th Session. Following consultations with a number of delegations this paper refocuses the work on OECD's comparative advantage in economic and policy analysis. The revised proposal is now submitted for the COFI's consideration at the 109th Session, 23-25 April 2012.

2. Aquaculture[1] has been one of the fastest growing food producing sectors in the world and has an important potential to contribute to the global food supply. Aquaculture production will play a central role in meeting any future increase in demand for fish and fish products in light of a growing population and wealth and stable capture fisheries production (Garcia and Rosenberg, 2010).

3. However, there have been concerns about environmental externalities (e.g. pollution, fish diseases and escapees) and competition for space arising from aquaculture production. In order for the aquaculture industry to meet the needs and grow sustainably in the future those concerns should be addressed. Green growth means "fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies" (OECD, 2011a). For the aquaculture industry this means finding a way to accommodate increasing production while addressing externalities - in particular discharges of organic material, nitrogen and phosphorus (local impacts), diseases on fish farms which may be transferred to other farms or the natural environment and escapements (impacts on wild stocks). In addition, aquaculture competes for space with other users, both recreational and commercial. In terms of pathways towards green growth in aquaculture the areas to be addressed includes issues related to use of space, i.e. planning (including user conflicts), sanitary issues, licence system, site allocation and importantly cooperation among the various stakeholders in aquaculture, e.g. farmers, consumers, authorities, etc. Within such a framework a number of green growth challenges and their associated policy framework can be identified (Box 1).

4. Aquaculture takes on many different forms in different parts of the globe - inland water vs. marine, cage culture vs. ponds, carnivorous vs. herbivorous species, extensive vs. intensive etc. Concurrently, some emerging economies are very important export-oriented producers, e.g. Vietnam, of fish from aquaculture while others mainly supply domestic markets, e.g. China. This situation makes it challenging to identify common features that make aquaculture green. Incorporating green growth principles in aquaculture calls for more efficient regulation of externalities and a better understanding of local impacts, but what this means in specific cases will depend on individual production systems and local and regional factors.

5. Growth in aquaculture production in OECD countries has been slow over the past decades (Advancing the Aquaculture Agenda, OECD, 2010) (Figure 2). This is in stark contrast to the situation in emerging economies where aquaculture continues to grow rapidly. Hence, there must be some critical factors for success in building an aquaculture industry. These may be related to governance, technologies, environmental regulations or resource availability, e.g. space.

[1] Aquaculture is the farming of aquatic organisms in inland and coastal areas, involving intervention in the rearing process to enhance production and the individual or corporate ownership of the stock being cultivated (FAO, 2008).

Box 1. Green growth issues and aquaculture

Green Growth Challenges	Variables to control	Policy framework	Measures(examples)
Discharges	Feed, Feed conversion, Feed Components	Regulations, Innovations, Good management practices	Feed quotas, Fallowing, Cleaning
Diseases	Density	Regulations, Good management practices	Distance, Vaccine Fallowing
Escapees	Storms, Accidents	Regulations, Good management practices	Stronger cages, Sterilization, Paying local fishermen to catch the escapees
Space	User conflicts/conflicting uses	Coastal zone/ocean management	Reserved areas
Regional development	Development Planning	Permits and zoning, Environmental approvals, Investment aids, Coastal zone/ ocean management	Establishment of pre-approved zones for aquaculture development
GDP contribution	Growth of sector, marketing of product	Marketing and promotion, research and development, infrastructure investments	Support private certification schemes
Development	Capital, Skills	Education and training, labour standards	Continuing education for local populations

6. Many countries have already incorporated some green growth components in their regulatory frameworks responding to sustainability needs, though there are still concerns regarding the negative impacts of aquaculture production. However, little is known about the driving forces and the effects of adopting green growth policies and to what extent such policies have fostered or hindered the competitiveness of the industry in the global market for fish and fish products. A basic question to consider is if the implementation of green growth policies/measures induces costs on the industry and to what extent this will influence competitiveness in a global market for fish and fish products.

Aim

7. The purpose of the proposed work is to identify green growth policies for aquaculture and to understand the critical success factors for aquaculture development across the participating countries. Such an analysis can help develop advice and best practices that may be used as a roadmap for national aquaculture planning. The work will also discuss the effects of incorporating green growth principles into policy on the competitiveness of aquaculture.

Scope

8. Participating countries will be asked to submit relevant economic data for the sector. This will include data on production, industry turnover, costs (if it exists) and employment as well as information on how externalities are addressed (policy checklist). This information will be complemented with case studies on policy initiatives taken to enhance the sustainability of aquaculture. Such case studies would

analyse the economic impacts of these policies and also discuss the drivers of policy change. Information on factors for aquaculture growth may include research and development, framework conditions, cooperation between the industry, the authorities and research institutions, infrastructure, use of space and interaction with other user groups. Close co-operation with the Secretariat in the selection of particular aspects to be addressed in case studies is encouraged. The goal is to ensure that case studies cover a sufficient wide range of cases that address green growth policy applications recognising the fragmented and heterogeneous nature of the industry. Based on the analysis of the submitted information the work will identify common success factors.

Outcome and Policy Relevance

9. The outcome of this proposed work would identify success factors and understand the economic implications of green growth measures and analyse how green growth principles will impact the aquaculture sector. If feasible a set of recommendations for key features of national aquaculture policies will be developed.

10. The proposed work will be an opportunity for the OECD Fisheries Committee to reach out to enhanced engagement countries and emerging economies more generally by providing a roadmap to green growth in aquaculture and by sharing technologies and expertise in production, environmental mitigation and governance, improving food security and reducing poverty.

11. This work can benefit from a workshop on sustainable aquaculture and green growth by bringing expertise and best practices together from a variety of countries – developed and developing – and would be a timely contribution to a better understating of policy coherence for development in aquaculture. Aquaculture production is an important and growing part of the fisheries economy in many developing countries; in this regard a workshop could be a way to introduce green growth principles to policy makers in those countries.

Timing

12. This proposed work is scheduled to be implemented in 2012 and 2013. Initial information provided by participating countries could be presented for discussion and further direction to the 110th Session of COFI. In-depth analysis and discussion of results will then proceed over the 111th and 112th Session with a final draft to be submitted for the 113th COFI meeting. A commitment by participating countries to review submitted material (or submit anew) and to provide case studies on their particular systems of aquaculture governance and green growth initiatives would be necessary. The work would benefit from the hosting of a workshop on "Green Growth and Aquaculture" bringing together key people involved in aquaculture knowledge systems (science, research, government and industry) to discuss how to further innovation in aquaculture with a view to contribute to green growth and food security. A workshop could be hosted in April 2013 back to back with the 111th COFI Session.

Background

13. The Committee for Fisheries hosted a workshop on aquaculture which took place in April 2010. Key outcomes of this workshop, i.e. the Chair's Key Messages are reproduced in Box 1. A key conclusion of the Workshop was that the aquaculture sector has a high potential for contributing to green growth and food security. This is because in aquaculture, through good management practices, it is possible to limit and reduce environmental harmful effects while concurrently increase production. And, compared to the rearing of terrestrial animals, aquaculture offers much better feed conversion ratios.

Box 2. Chair's key messages from "Advancing the Aquaculture Agenda", April 2010 Workshop

The aquaculture sector is an important contributor to the Green Growth Agenda, but political will needs to be harnessed to further support Green Growth in aquaculture, which calls among others for:

- Risk reduction to encourage sustainable long-term investment in the capital intensive aquaculture sector in OECD countries
  - Support adaptive innovation (e.g. improved water use, selective breeding, feed formulation)
- Improve the image of the industry

How to translate lessons from best practices into specific policy action?

- Galvanize political will
  - Develop clear and realistic national or regional plans for aquaculture development;
  - Develop flexible regulatory frameworks with coordination across government agencies and levels of government (e.g. agriculture, fish, urbanization);
  - Use of green technologies and promotion of sustainable aquaculture species (*e.g.* in terms of feed, nutritional value, GMO);
  - Market-oriented production; benefiting from changing consumption patterns (*e.g.* healthy diet, preference for Omega3-rich food).

Timely and effective dialogue between all stakeholders: how can it be achieved?

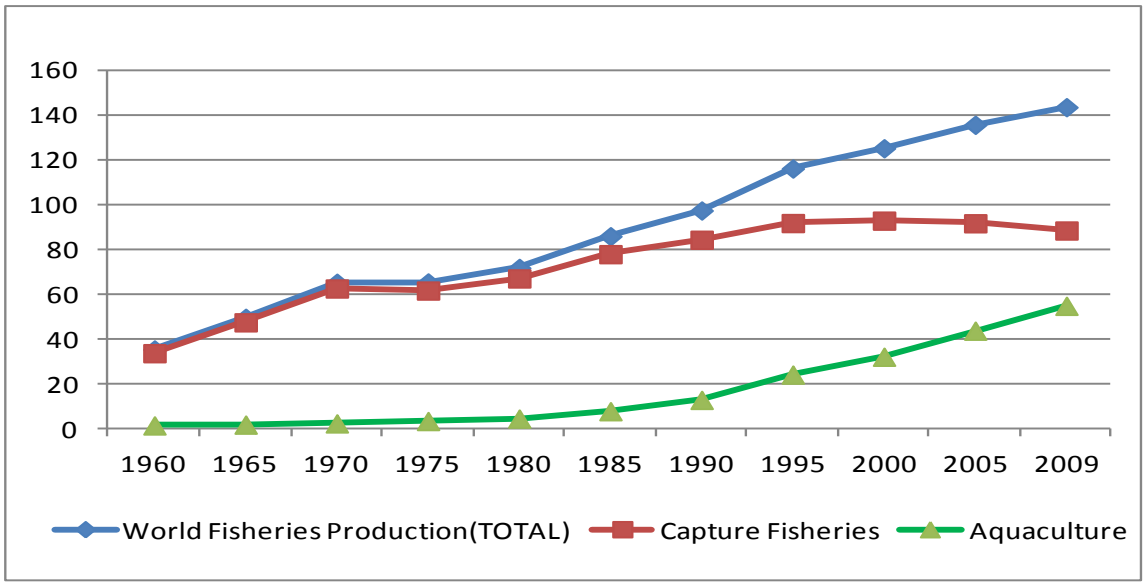
- Ensure that stakeholders are involved in developing aquaculture plans and their implementation.

14. Global demand for fisheries products has increased over the last decades and the trend is expected to continue due to growing population and increasing wealth, and a growing preference for healthy foods (Garcia and Rosenberg, 2010). However, taking into account stagnating capture fisheries production (see Figure 1) aquaculture will have to meet any[2] increase in demand for fish in the future (Bostock *et al.*, 2010).

15. Since 1970 aquaculture has grown at an average annual rate of 8.4% and has been one of the fastest growing food sectors for decades. In 2009, it contributed 38% of the world's fisheries production (excluding aquatic plants) (Figure 1) and contributed about half of human consumption (FAO, 2011) of seafood. Excluding aquatic plants, in 2008 FAO recorded 310 species as being cultured of which the top 10 species accounted for 53% of the world production by volume (the top 20 species accounted for 74% of the world production) (Bostock *et al.*, 2010) suggesting a concentration on few species. This implies that there is still ample room for growth.

[2] Other sources of additional fish for food can come from a reduction in discards and a better utilisation of already caught fish; these are subjects another Study.

Figure 1. World fisheries production (Unit: Million tonnes)



1. Aquatic plants are excluded.

Source: FAO.

16. Aquaculture also has a major potential to help reducing poverty and increase foreign currency earnings. Increased production together with innovation[3] in aquaculture has lowered the production price significantly and has provided benefits to consumers as well as producers. For example, shrimp production increased 43 times (72 thousand tonnes to 3.1 million tonnes) between 1984 and 2007. Concurrently, the price decreased to less than half (from USD 16.40 per kilo to USD 7 per kilo) (Asche, 2008).

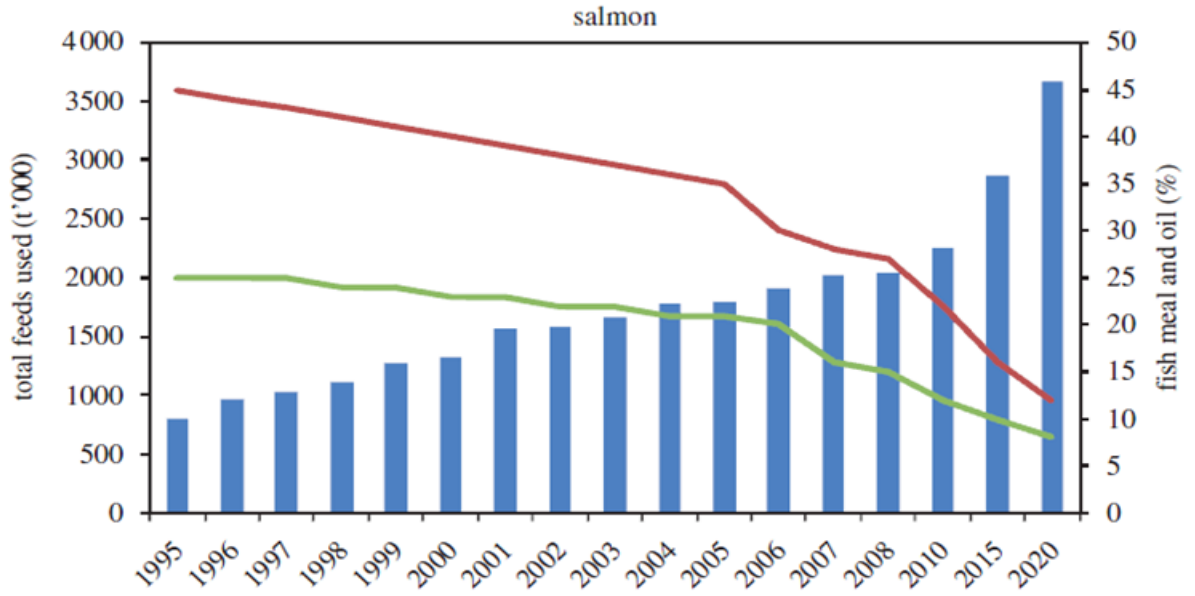
17. On the other hand, there are constraints and challenges including negative environmental impacts (e.g. pollution, fish diseases and escapees), climate change, fishmeal supply, anti-biotic use, and competition for land and water resources. For example, many shrimp aquaculture farms in Southeast Asia have been set up at the cost of mangrove destruction and later many of them were abandoned because of contamination (Allison, 2011). Escaped fish or disease transfer from aquaculture to wild population is also a concern (Bostock *et al.* 2010). Such constraints and challenges should be addressed in order for aquaculture to grow sustainably.

3 The characteristic of "production controllability" coupled with a demand from global markets provide incentives for innovation.

Box 3. Innovation in feed use

Aquaculture is the biggest **fishmeal and fish oil** consumer and it is estimated that aquaculture consumes more than 50 % and 80% respectively of the world fishmeal and fish oil production (Hasan and Halwart, 2011). As the aquaculture industry grows the pressure on fishmeal and fish oil may increase, or alternatives to fishmeal/oil need to be developed. Ingredient substitution and improved feeding systems may be part of the solution, but more research and innovation are required in this field. It should however be noted that, for example in the salmon industry, major achievements in feed use have been made. The following figure demonstrates that the relative importance in feed compounds has decreased considerably over the past decades as fishmeal and oil are seen as expensive ingredients (Bostock *et al.* 2010).

Estimated global use of fish meal and oil by the salmon farming industry projected to 2020

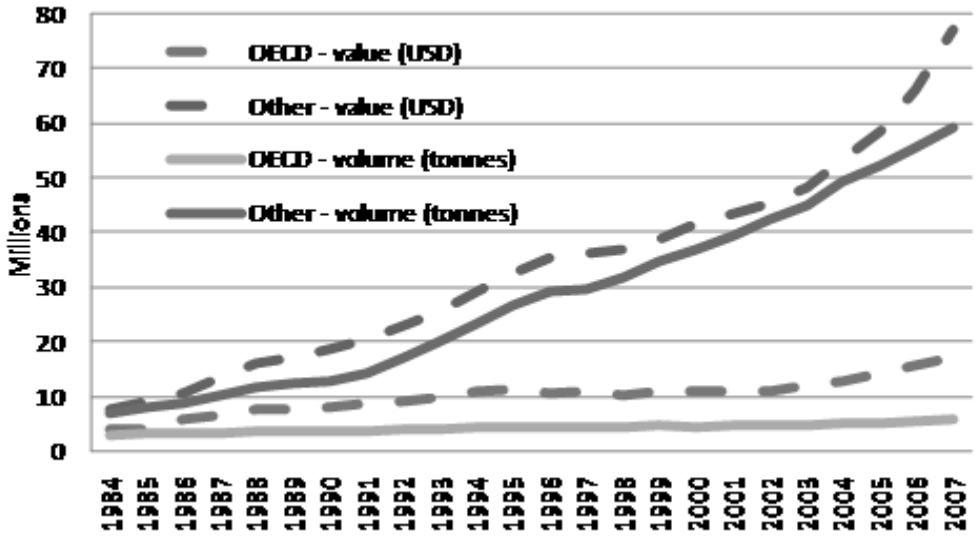


Blue, total feeds used; red, mean % fish meal; green, mean % fish oil

Source : Tacon & Metian (recited from Bostock et al.)

18. In many developed countries there is a tendency to focusing on the negative externalities of aquaculture. As a consequence aquaculture has had difficulties to establish itself as a growth sector in many developed countries. After the rapid growth in 1980s-1990s, aquaculture in Europe and North America has stagnated, mainly due to regulatory restrictions on sites and other inputs (Bostock *et al.* 2010). For example, unlike the trend of the world aquaculture production, there has been no meaningful growth in the aquaculture production from the OECD countries with a few exceptions. OECD economies accounted for 35% of the value and 30% of the volume of the total aquaculture production in 1984. These figures decreased to 18% and 9% respectively in 2007, underscoring the increasing importance of developing countries in aquaculture production (See Figure 2).

Figure 2. Total Aquaculture Production



Source: FAO (recited from OECD 2010)

Common Success Factors in Aquaculture and Green Growth

19. Owing to increasing concerns with respect to food security, this situation has called for a rethink of aquaculture policies, national development plans and governance of the aquaculture industry. Against this background, the aquaculture sector needs to adopt a Green Growth strategy, i.e. provide more seafood to meet the demands of a growing population while mitigating the environmentally negative effects of production.

20. Aquaculture fit well into the overall OECD green growth agenda. This encompasses growth potential, contribution to food security and poverty reduction, requiring a government role in creating a stable and predictable governance framework while ensuring policy coherence and increasing innovation in production and environmental mitigation.

21. Many countries have already incorporated some green growth components in one way or the other in their regulatory frameworks responding to sustainability needs. For example, Norway also made it possible for farmers to transfer and mortgage aquaculture licence rights, which increased economic profitability and environmental sustainability (OECD, 2010). Denmark has strict environmental regulations on aquaculture farms such as fixed feed quota system though they are readjusted towards the documentation of environmental effects to avoid unnecessary production restriction and thus provide more flexibility for farmers, which may create more rooms for innovations and green growth (OECD, 2010).

22. However, little is known about the effects of adopting green growth components in aquaculture policies and whether they have fostered or hindered the competitiveness of the industry in the global market for fish and fish products. Since about 40% of fish and fish products in the world are traded, the impact on the competitiveness can have important implications.

23. Further, aquaculture industry has fragmented and heterogeneous nature, which makes it difficult to develop one set of best practices applicable to any particular aquaculture production system and stage of

development. There are also great differences in productivity: for example, Norwegian farmers produce an annual average of 172 tonnes per person, while Chilean farmers do 72 tonnes, Chinese farmers do 6 tonnes and Indian farmers do 2 tonnes (FAO, 2010).

24. There may be, however, common success factors in play, which may have created differences between the OECD countries and non-OECD countries and among certain OECD countries as well. There has been a substantial increase in the aquaculture production in Southeast Asian countries including Vietnam, Cambodia, Thailand, Myanmar, Indonesia, Malaysia and Philippines since mid 1970s. Governmental interventions such as stable licence scheme, provision of seed and financial incentives are regarded as some of the factors that contributed to this growth together with global market demand (FAO, 2011).

25. Aquaculture would also be an excellent subject for the OECD's Fisheries Committee to **reach out** to enhanced engagement countries and, more generally, to developing countries. More than 90% of world's aquaculture production takes place in developing countries and China alone contributes more than 60% of world production. Hence, when developing a study on green growth and aquaculture it would be useful to also incorporate the developing country aspects in terms of knowledge and technology sharing. In fact, central to this is policy coherence for development.

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OECD (2011c), Summary Record of the 108th Session of the Committee for Fisheries. TAD/FI/M(2011)2.

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Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **09-Mar-2012**

English - Or. English

TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

GUIDELINES FOR COUNTRY NOTES

This document is submitted for INFORMATION to the 109th Session of the Committee for Fisheries, 23-25 April 2012, under item 4 i). The deadline for receiving Country Chapters is 31 July 2012.

For futher information, please contact:
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JT03317488

TAD/FI(2012)5
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NOTE FROM THE SECRETARIAT

This paper sets out draft guidelines for preparing country chapters for the *Review of Fisheries Policies*[1] (hereafter "the Review"). The major change from the draft guidelines issued for the 2011 edition of the Review relates to the years to be covered by the Review, which should be 2010 and 2011 (and 2012 when appropriate). Delegates will note the addition of Annex B which provides the OECD Style Guide Rules. The Secretariat urges delegates to follow this guide as much as possible as it will help subsequent editing.

Country chapters should be sent to the Secretariat **no later than 31 July 2012**. Using this information, and other relevant sources, the Secretariat will prepare a summary document ("General Survey") for consideration at the 110th Session (scheduled for 29-31 October 2012). Experience shows that some countries are very late in submitting the required information. The Secretariat underscores the importance of timely submissions which will help on our internal planning for the production of the *Review*.

Delegates should send to the Secretariat the full coordinates of a designated contact person.

1. Since the 2011 version, the title of this publication has been changed to *Review of Fisheries Policies* ("in OECD Countries" is dropped from the title in order to better represent the fact that there is information on both OECD countries and some non-OECD countries).

TABLE OF CONTENTS

GUIDELINES TO THE REVIEW OF FISHERIES 2013 EDITION: POLICIES AND SUMMARY STATISTICS

SUMMARY

1. This document has been written to help guide national correspondents in preparing their contributions to the *Review of Fisheries Policies*. Correspondents are requested to:

- Follow these guidelines as closely as possible when preparing their country chapters.
- Submissions should be **no longer than 10 pages; in exceptional cases, a maximum of 15 pages** will be accepted.
- Send their material by the due date (**31 July 2012**) in a compatible electronic format (preferably by e-mail).

Content

2. The country chapters should cover the whole of 2010 and 2011, including decisions taken in 2011 that will affect 2012. In preparing their chapters, countries are requested to follow the outline contained in these guidelines as closely as possible. It is understood, however, that some sections may be considered more important by some countries than by others, or simply not applicable. Country notes should not exceed ten pages.

3. When participating countries refer to statistics in their contributions to the *Review*, the Secretariat would appreciate efforts to ensure consistency with statistics submitted for the most recent *Review of Fisheries (Statistics)*.

Reporting procedures

4. All material should be sent to the Secretariat by e-mail. In order to ensure that the *Review* is completed in a timely manner, **it is essential that the Secretariat receive country contributions in compatible electronic format**.

5. The country chapters should be saved either as a Microsoft Word 97 for Windows document (preferred), or as a RTF (rich text formatted) file.

6. Submissions should be sent to Dongsik Woo (Dongsik.woo@oecd.org) and copied to Stefanie Milowski (Stefanie.milowski@oecd.org). Any queries should also be directed to Mr. Woo (+33 1 45 24 95 39).

Deadline

7. Material should reach the Secretariat **by 31 July 2012**.

DETAILED GUIDELINES

Objectives

8. The major objective of the *Review* is to describe major policy developments in the fisheries sector. The *Review* is intended to be a document of record, providing comprehensive information on major changes in the fisheries environment of participating countries. As such, when used in conjunction with the *Review of Fisheries (Statistics)*, it serves as a valuable and practical reference book for people involved with and interested in fisheries.

Content

9. Country chapters should focus on policy changes in 2010 and 2011 and, if appropriate, 2012. Material describing the historical background to current policies should be kept to a bare minimum. Descriptive statistics should be used only to illustrate a specific point. For presenting facts, tables are easier to read than long sentences filled with numbers. The text should include explanations for significant developments.

10. To the extent possible, countries are requested to follow the recommended outline shown in Box 1 and described below in detail. Obviously, not all elements of the outline will be applicable to all countries. But countries are asked to be as complete as possible in providing information on changes in resource management in capture fisheries, government financial transfers, trade regimes and the management of fishing capacity.

11. When there are any graphs, charts or tables in excel in the country notes, countries are requested to provide the original Excel files with the background data to the Secretariat. This is necessary for publication and translation purposes. *Please note that sources must be indicated for all graphs and tables*.

DETAILED OUTLINE

SUMMARY

12. The summary section should contain a few paragraphs on major policy initiatives during the years under review. An appropriate length for the summary is around one-half of a page. Preferably, this should be presented as a series of bullet points from which the Secretariat can highlight key changes that countries wish to have highlighted in the "General Survey."

Suggested outline for country chapters

- SUMMARY (bullet point style, with a maximum of ten points)
- LEGAL AND INSTITUTIONAL FRAMEWORK
- CAPTURE FISHERIES
  - Performance
  - Status of fish stocks
  - Management of commercial fisheries
    - — Management instruments
    - — Access arrangements for foreign fleets
  - Management of recreational fisheries
  - Aboriginal fisheries
  - Monitoring and enforcement
  - Multilateral agreements and arrangements
- AQUACULTURE
  - Policy changes
  - Production facilities, values and volumes
- FISHERIES AND THE ENVIRONMENT
  - Environmental policy changes
  - Sustainable development initiatives
- GOVERNMENT FINANCIAL TRANSFERS
  - Transfer policies
  - Social assistance
  - Structural adjustment
- POST HARVESTING POLICIES AND PRACTICES
  - Policy changes, in particular with respect to:
    - — Food safety
    - — Information and labelling
    - — Structures
  - Processing and handling facilities
- MARKETS AND TRADE
  - Markets
    - — Trends in domestic consumption
    - — Promotional efforts
  - Trade
    - — Volumes and values
    - — Policy changes
- OUTLOOK

LEGAL AND INSTITUTIONAL FRAMEWORK

13. This section should provide an overview, or snapshot picture, of the framework of each country's fishery policies, and the structure of the decision-making process in fisheries and aquaculture management. It is suggested that the section comprise one or two concise paragraphs. These paragraphs should describe:

- Which level(s) of government have jurisdiction over fisheries.
- The legal source of their authority.
- The principal management instruments used.
- General conditions regarding foreign access, and restrictions on foreign investment.

14. A suggested format (for the hypothetical country of "Fishland") in relation to the legal and institutional follows:

> Management of marine fisheries resources is the responsibility of both federal and state governments. The primary legal source of authority for fisheries management at the federal level is the Fisheries Act 2009. Catch levels are controlled mainly through TACs, which are set annually by regional councils and cover approximately 80% of the landed value of fish. ITQs are used in ten fisheries, notably cod and jellyfish. Foreign ownership of quota is prohibited and no vessel owned or operated by a foreign entity may engage in fishing or fish processing, apart from those covered by bilateral fishing agreements.

15. Special Note for EU Member States: With regard to the Common Fisheries Policy, it is not necessary for EU Member States to say more than policies are implemented within the context of the CFP. A general description of the CFP will be provided in the chapter on the European Union; ***repetition of this information in EU country chapters is therefore not necessary.*** Additional ***national*** measures should be mentioned, however.

CAPTURE FISHERIES

16. This section of the report should focus on new or redefined government policy initiatives and actions that affect the management of the fishing industry in 2010 and 2011. Particular attention should be given to any new developments that may have a wider application. The following organisation of this section is suggested:

Performance

17. Countries should provide, for 2010 and 2011, a short summary of information on:

- Landings, by value and quantity.
- Economic performance (total revenues, profitability, by fleet/fisheries). In absence of quantitative information, available qualitative information should be provided.
- Key fisheries management measures in place (see typology developed for the study on the use of market-based economic instruments (AGR/FI(2005)14, Table 1.1 as well as Table 1 below) and their relative distribution across fisheries.
- Main species harvested.
- Employment levels by sector (harvesting, processing and aquaculture).
- Fleet structure (number of vessels by GRT/GT category).

Status of fish stocks

18. Describe any significant changes in the status of commercially important fish stocks (e.g. biomass size relative to management objectives) over the period covered by the *Review*. Countries are encouraged to submit such information in tabular form and to provide a brief summary of the reasons for the observed changes. Countries are also encouraged to report on efforts to rebuild fisheries, e.g. objectives of rebuilding programmes, a description of measures taken to rebuild fisheries, and outcomes.

Management of commercial fisheries

19. Two topics should be covered in this sub-section: (a) changes in management instruments and settings; and (b) conditions of access. Countries are asked to report on measures pertaining to both fish stocks under national jurisdiction and jointly managed stocks, and to note which changes to national laws and regulations were implemented as a consequence of decisions taken within the context of international or regional fisheries conservation arrangements. Specific information needs are described below.

Management instruments

20. Countries are requested to report on changes to management instruments and their settings, including allocations of quota (to both domestic and foreign fleets) and corresponding catches, for major species. Examples of commonly used management instruments are given in Table 1, below. Both instruments that control output and input levels directly and those that control then indirectly (e.g. regulations specifying minimum mesh sizes for nets, and maximum lengths for long-lines) should be reported. Measures to limit by-catch of non-target commercial species (e.g. by-catch trade-off schemes associated with ITQ managed fisheries) should be mentioned under this section; measures to limit by-catch of non-commercial species (e.g. marine mammals) should be described under the section on "Fisheries and the Environment".

21. Policy changes involving the devolution of responsibility for management from government to fishers or other user groups (e.g. new co-management arrangements), or changes in the reverse direction, are also of interest to the Committee.

> **Special note for EU member states:** Only changes to national regimes and information on special circumstances applying to, impacts from or exceptions to the application of the Common Fisheries Policy in EU Member States should be described here. General descriptions of CFP management instruments will be described in the chapter on the European Union; ***EU Member States need not provide this same information themselves***.

Table 1. Examples of management instruments

Output controls and supporting technical measures[a]	Input controls and supporting technical measures[b]
Total allowable catch (TAC)	Limits on the number of vessel licences
Individual quota (IQ)	Individual effort quotas
Individual transferable quota (ITQ)	Gear and vessel restrictions
Vessel catch limits	
Restrictions on size or sex of caught or landed fish	
Area closures	
Time closures	

a. Output controls refer to restrictions on the output (i.e., catch, landings or both) of the fleet as a whole, on individual fishing units, or both.

b Input controls refer to restrictions placed on factors of production used in production — especially labour and capital — and on intermediate inputs, such as fuel.

Access

22. Countries are asked to report on arrangements for access of foreign fleets to their country's fisheries, and of their country's fleet(s) to foreign waters (including joint ventures). The Committee is particularly interested in the following information:

- The name of the country with which the agreement has been signed.
- The period that the agreement covers.
- The species of fish and the volume (or number) allowed to be caught or landed.
- The amount of money or other benefits provided in exchange for access.
- Other aspects of the agreement, such as technology transfer or restrictions on ownership and crew nationality, and access to port facilities.

23. Countries are encouraged to provide this information in tabular form.

Management of recreational fisheries

24. Describe changes in management objectives and actions pertaining to recreational fisheries with respect to: *(a)* rules regulating access to resources; *(b)* gear restrictions; and *(c)* catch limits. Subject to data availability, countries may also report estimates of recreational catches, in marine and inland waters.

> **Note:** Given that the meaning of recreational fishing differs considerably among countries, countries are asked to provide information on the criteria used to distinguish recreational from commercial fishing in their countries, e.g. daily catch limits, contribution to income, or other definitions used. The Committee is interested, in particular, in what gear restrictions apply to recreational fishers, and whether recreational fishers are allowed to sell their catch (and, if so, whether there is a limit on how much they can sell).

Aboriginal fisheries

25. Aboriginal or indigenous fishing activities are an issue in some countries. Special arrangements may be necessary to provide for the interests of these people. Countries should supply information on the fishing rights of aborigines, and report on any major changes in the institutional arrangements set up to regulate aboriginal fishing activities.

Monitoring and enforcement

26. Countries should describe any major new regulations or programmes, or changes to existing programmes, to assist fisheries managers in monitoring and enforcing fisheries laws. Examples of such programmes are rules that require the reporting of catches at sea, or that allow vessels to unload only at designated landing points. Results of evaluations of monitoring and enforcement efforts are also of interest to the Committee.

Multilateral agreements and arrangements

27. Countries should note any actions taken with respect to international conventions, treaties or agreements that relate to fisheries - for example, treaties signed, conventions ratified, etc.

28. With regard to regional fisheries management organisations and other multilateral and international organisations with competence in fisheries matters, the purpose of this section is merely to

register changes in countries' participation status. Decisions of these organisations and the implications for countries will be discussed in both the General Survey and in the section on management instruments above.

29. In past years, some countries have provided details on their participation in meetings they attended during the year under review. Such information is not necessary, as a table will appear in the General Survey showing the status of membership in relevant organisations, and it may be assumed that membership or observership involves participation.

AQUACULTURE

Policy changes

30. Countries should report on any changes to aquaculture policies. Mention should also be made of significant changes in other laws, regulations, and programmes affecting aquaculture (such as new Coastal Zone Acts).

Production facilities, values and volumes

31. Please report on changes in the number of production facilities - differentiated by species farmed, if possible - and in the number of persons employed by such facilities. Please also provide a brief description of the total production (volume and value) and main species. Countries are encouraged, if detailed information is available, to report such information in tabular form.

FISHERIES AND THE ENVIRONMENT

32. Countries are asked to report on policy changes in response to environmental concerns that have affected fisheries management and fishers' behaviour. Such changes would include:

- Responses to external environmental threats to aquatic ecosystems (e.g. damming of salmon runs).
- Responses to adverse impacts of capture fisheries and aquaculture on non-targeted species and the environment (e.g. by-catch of seabirds, sharks and marine mammals; pollution from fish farm effluents).

In each case, countries are asked to report on the environmental problem being addressed and the policy change to address it.

33. Countries are also requested to report on sustainable development/green growth initiatives in relation to fisheries and aquaculture. This could include a description of national sustainable development strategies and green growth initiatives and on how progress is being measured.

GOVERNMENT FINANCIAL TRANSFERS

34. This section should describe transfers to all three sectors covered by the *Review* - the harvesting sector, aquaculture and fish processing sectors - that result from government policies. For new policies and programmes, information on their main features should be provided:

- The form of assistance, the amount of money transferred, and its duration and timing.
- Eligibility criteria and the conditions under which the assistance is being provided.
- Administrative procedures to carry out the measure.

35. Delegates will recall that detailed information on government financial transfers is included in the *Review of Fisheries (Statistics).* When making submissions, countries should therefore not replicate those data, but rather provide summary information. Most of the information provided should, in effect, be a summary of that provided for the *Review of Fisheries (Statistics).* In this section countries should first describe overall total transfers and then comment on how such support relates to specific policy areas.

Transfer policies

36. This section should summarise trends in total levels of transfers to the marine capture, aquaculture and processing sectors. Totals should be provided for each sub-sector for transfers in the form of:

- Revenue enhancing market price support.
- Revenue enhancing direct payments.
- Cost reducing transfers.
- General Services.

37. Annex 1 provides more detail on this classification system and suggested table outline that can be used as a way of presenting the information. Countries are asked to include transfers for 2010 and 2011, as well as updating any incomplete information that may have been provided for 2009. When providing information on general services, countries may also wish to report on any recovery of the government costs of those services.

Social assistance

38. Social assistance refers to programmes established by statutes that transfer money directly to individuals in order to ensure some minimum level of welfare. For the purposes of the *Review*, the main types of programmes of interest are those that provide special forms of unemployment insurance, income support and retirement pensions to people employed in the fisheries sector. An example is an income support programme intended to help maintain fishers' income levels during periods when fishing grounds are closed. Countries are asked to describe each year any new policies or programmes, and significant changes in existing policies or programmes.

Structural adjustment

39. Measures intended to facilitate structural adjustment are mainly those that attempt to reduce fishing capacity and effort so as to bring them into line with the productivity of fish stocks. Such measures include programmes involving the buying back of vessel licences, or that pay for the permanent withdrawal of fleet capacity, and that help people employed in the fishing industry find employment elsewhere. Countries are asked to report on new programmes and changes to existing programmes.

POST-HARVESTING POLICIES AND PRACTICES

Policy changes

Food Safety

40. All countries have rules and regulations to ensure the safety of fisheries products for human consumption. In this section, information on changes in food safety rules and regulations in the years under review (e.g. introduction of Hazard Analysis and Critical Control Point (HACCP) procedures) should be included.

Information and Labelling

41. Most countries have requirements on the minimum level of information that should accompany a product when it is made available for sale to consumers. Normally this information relates to the content and origin of the product. In recent years, consumers have sought information on how the product was produced. In the case of fisheries this may relate to information on the methods of harvest or the state of the stock being exploited (e.g. eco-labels). Countries are requested to provide material on changes to policies relating to the provision of information to consumers. They should also provide information on labelling initiatives, both governmental and private, that are being developed or have been implemented.

Structures

42. Countries are asked to provide information on structural or institutional reforms aimed at increasing the efficiency of distribution and marketing (e.g. regulations that control marketing channels).

Processing and handling facilities

43. This section should be used to report on changes in the structure of processing (including preservation, processing and handling onboard ships), handling and distribution industries. Explanations for significant changes in number, size, and type of facilities in use, and on the utilisation of the catch would be relevant to this section.

MARKETS AND TRADE

Markets

Trends in domestic consumption

44. Please provide information on recent trends in domestic consumption of fish and fish products, by major product category, and estimates of per-capita consumption. Such information helps to show how consumer preferences for fish are evolving. Countries may also wish to comment on the state of competition between farmed and capture products.

Promotional efforts

45. Describe briefly any significant new initiatives designed to increase sales in domestic markets and export markets.

Trade

Volumes and values

46. Countries should briefly report on the volumes and values of fish products traded in 2010 and 2011, and comment on reasons for any significant changes in recent trends.

Policy changes

47. Correspondents are asked to report on new developments or changes in their ***trade regimes*** affecting fisheries products - for both processed and unprocessed products. The types of trade measures that the Committee is interested in include, but are not limited to:

- Bilateral and regional trade agreements affecting fish and fish products.
- Tariffs and tariff quotas.
- Export subsidies and credit.
- Licensing requirements and other administrative measures (e.g. labelling regulations).
- Technical trade measures (e.g. sanitary and phytosanitary requirements).

48. With regard to the last bullet point, countries are asked to describe significant changes in national legislation concerning sanitary requirements applicable to traded products. Sanitary measures in this context include both product standards and process and production methods (PPMs), such as policies that require importers to certify that products have come from plants applying Hazard Analysis and Critical Control Point (HACCP) systems.

OUTLOOK

49. Countries are asked to use this section mainly to describe new policies and proposed legislation. ***Countries should endeavour to put greater emphasis on future developments.*** Furthermore, mention of political issues should be limited to decisions already taken.

Annex A.

Government Financial Transfers

Table A1. Government financial transfers associated with fishery policies

(Classification agreed at the 80th Session of the Committee for Fisheries)

	2010	2011
Market Price Support (providing this information is optional)		
Direct Payments		
Cost Reducing Transfers		
General Services		
Cost Recovery Charges		

Table notes

Market price support occurs when, as a result of government policy, the domestic price of a product is greater than the world price. It is normally measured as the difference between the world price for a particular fish product and the domestic price for that fish product. In the absence of a suitable world "reference" price, the applied tariff rate may be used as an estimate of market price support. The government (e.g. through export subsidies) may also finance part of market price support. When providing this information please indicate how it was calculated.

Revenue-enhancing transfers in the form of ***direct payments*** from Government involve payments to fishers, including payments based on the level of catches, sales or per vessel; overall fishing income; fishers' historical interest.

Cost-reducing transfers are those that reduce fishers' operating costs such as those that reduce the costs of fixed capital and variable inputs. These include those related to productive capital (e.g. capital grants, interest concessions, loan guarantees and special tax treatment for capital used in fisheries) and intermediate inputs (e.g. bait services, harbour services, insurance support, interest concessions for operating credit). It is of particular importance to include tax exemptions, for example fuel rebates and unpaid social contributions.

General services are those such as transfers paid by central, regional or local governments for fisheries management and research costs. These transfers are not received directly by fishers, but they reduce the costs faced by fishers and an implicit transfer thus occurs. While the level of the transfers is not contingent on fishers' behaviour, it does represent a transfer to the extent that a service for which they are the primary beneficiaries.

Annex B.

OECD Style Guide Rules

Please find below a general information guide to OECD rules that must be applied to all publications. We would be grateful if you would follow these as closely as possible so to allow us to prepare the final publication in a timely manner.

Layout

Font: Times New Roman, 11 point (For tables and graphs, please use Arial)

Paragraphs: justified and single spacing only. use only Authoring Environment (AE) for paragraph numbering. If AE is not available, please do not number paragraphs manually.

To be avoided

- Titles and subtitles should not be automatically numbered, nor should tables and figures.
- Tables and figures should not be linked to references within the text. In general, no bookmarks should be used.
- Lists and bullet points should not be automatically numbered.
- Underlining should never be used.

Tables and figures

- As a general rule, please ensure that all graphs and tables print well in black and white, even if the choice is made for a two- or four-colour publication. It is best to choose shades of blue, grey and black.
- If tables do not require any formulae, it is preferable to create them in WORD.
- All EXCEL files, including input data, related to the Word document must be supplied to OECD.
- It is preferable to have only one table or figure per excel sheet, and this sheet should be labelled by the table or figure number (e.g. Table 1.1) to avoid errors of insertion.
- Do not insert titles into tables and graphs, please use a heading in the Word document.
- Only the first word of the table title is capitalised: Table 1.2. How to choose a title.
- Arial (minimum point of 7) typeface should be used.
- **All tables and figures must state the source** if they are not created by the author of the text.
- Sources are placed below the Notes to the tables and graphs.
- Numbers containing four or more digits should be separated by hard spaces. For example: 50 000 and 1 000 000. Excel should be properly formatted for this to occur automatically.

- Decimal points should be represented by a full stop: 3.5%.
- When inserting EXCEL tables and figures into a WORD document select: edit > paste special > picture. When necessary, always deactivate the "float over text" option.
- In the text of the document itself, place references to tables and graphs in parentheses at the end of the sentence: Text (Annex Table B.1).

Legends in tables and graphs

l	Break in series	..	Not available
c	Confidential data	n.c.	Not calculated
e	Estimated value	x	Not applicable
n	Nil	p	Provisional
		s	Strike

Body text

- *Titles*: these should be brief and should contain key words.
- All country names when used as nouns must be spelt out in full.
- Numbers one to ten must be spelt out when used as adjectives in the text.
- UK spelling should be used.
- Bold should be used sparingly, as overuse can be distracting to the reader.
- In principal, italics should be used only for foreign words or titles of publications/journals.
- Underlining should never be used.
- All punctuation marks should be followed by a single space only.
- i.e. and e.g. are not italicised. They should be followed by a hard space only.

Dates

- 20^December 2010
- 1986-87: time period
- 1986/87: overlapping

Numbers

- As a rule, whole numbers from one to ten should be expressed in words except when used with an ISO code (e.g. USD 10) and for numbers over 1 million.
- Indicate percentages with numerals: 1% (never write out per cent).
- For numbers bigger than 1 million, please write million or billion, etc.

Currency units for OECD countries
(please do not use any other currency code)

Australia	AUD	Japan	JPY
Austria	EUR	Korea	KRW
Belgium	EUR	Luxembourg	EUR
Canada	CAD	Mexico	MXN
Chile	CLP	Netherlands	EUR
Czech Republic	CZK	New Zealand	NZD
Denmark	DKK	Norway	NOK
Estonia	EUR	Poland	PLN
European Union	EUR	Portugal	EUR
Finland	EUR	Slovak Republic	EUR
France	EUR	Slovenia	EUR
Germany	EUR	Spain	EUR
Greece	EUR	Sweden	SEK
Hungary	HUF	Switzerland	CHF
Iceland	ISK	Turkey	TRL
Ireland	EUR	United Kingdom	GBP
Israel	ILS	United States	USD
Italy	EUR		

Bibliography

- **Please take the time to consult the *Style Guide***. Much time is lost in reformatting the bibliography for publications or trying to find a publication incorrectly cited by the author. It is also important to be consistent.
- To cite references, the OECD uses the alphabetical (Harvard) system. In addition, the following order should be adopted:
- Author's surname, comma, initial(s) or first name.
- Year of publication (in parentheses) *Title of the work* (in italics) and, where applicable, volume number. Publisher; place of publication; relevant pages (if appropriate).

  Desrochers, P.J. (2000), *Eco-Industrial Parks: The Case for Private Planning*, Political Economy Research Center, Bozeman, Montana.

  Hodges, R., D.D. Whitehouse and P.J. Desrouchers (1998), *Mohammed, Charlemagne and the Origins of Europe*, Duckworth, London.

  Nicoletti, G. *et al*. (2001), "Product and Labour Market Interactions in OECD Countries", *Economics Department Working Papers*, No. 312, OECD, Paris.

  Bahmani-Oskooee, M. and R. Mitra (2008), "Exchange rate risk and commodity trade between the US and India", *Open Economies Review*, Vol. 19, pp. 71-80

- Within the text, please cite references in the following style (author, year):

  … nutrition and pollutant exposure (Davis *et al*., 2000).

For Official Use **TAD/FI(2012)6**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **09-Mar-2012**

English - Or. English

TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

TAD/FI(2012)6
For Official Use

REVIEW OF FISHERIES

Revised Guidelines for Template on Fisheries Statistics (2009-11), 2013 Edition

This document on the call for data for the Review of Fisheries - Statistics is presented to the 109th Session of the Committee for Fisheries, 23-25 April 2012, under item 4ii) for information and discussion. Please note that the deadline for the submission of statistics has been set at 31 August 2012. The revised template for the statistics collection will be sent to delegates and posted on Delegates Corner after the 109th Session.

Contact persons: Alexandra de Matos Nunes (alexandra.matos@oecd.org); Carl-Christian Schmidt (carl-christian.schmidt@oecd.org); Dongsik WOO (dongsik.woo@oecd.org)

JT03317489

Complete document available on OLIS in its original format

English - Or. English

NOTE BY THE SECRETARIAT

This document contains the draft guidelines for the *Review of Fisheries: Country Statistics 2009-11*.[1]

The Secretariat would appreciate if delegates could send their country submissions **no later than 31 August 2012**.

Delegates should send to the Secretariat the full coordinates of a designated contact person.

1. Since the 2011 version, the title of this publication has been changed to *Review of Fisheries* ("in OECD Countries" is dropped from the title in order to better represent the fact that there is information on both OECD countries and some non-OECD countries).

TABLE OF CONTENTS

GUIDELINES FOR REVIEW OF FISHERIES STATISTICS

2009-2011

Introduction

1. This document contains the draft guidelines for the *Review of Fisheries: Country Statistics 2009–11*.

General comments

2. The quality of the statistics provided by countries and published by the OECD is a key area in which there is a need for continuous improvement. Ensuring the high quality and timeliness of statistics is a shared responsibility between the Secretariat and participating countries. To assist in this, the Secretariat requests contact names and details for the person(s) responsible for collating national statistics for the review process. Direct contact between that person and the Secretariat will help to address problems as they arise. Countries should ensure that these contact details are provided in their country submissions.

3. In order to facilitate the data management, the Secretariat is moving the statistics to a more efficient system (StatWorks[2]). The uploading of data into this data base requires the use of an electronic questionnaire. The overall structure of the questionnaire has not changed compared to the previous version, but there are some minor adjustments.

- Blocked sheets
  - Excel sheets will be "blocked" – row/column names can no longer be changed. However, some sheets will provide an option to add rows with the respective headings (Tables 1, 3, 10).
  - The addition of rows can be enabled through specific "buttons" placed on an "Information" sheet included in the file (if too many rows have been added they should just be kept blank).
  - Only numbers are accepted in the data sections – any other format will be marked as "Invalid data" in red.
  - If necessary, countries can add footnotes and/or comments in the reserved space under each table.

  Totals/subtotals

  - Sub-totals/totals will be automatically calculated in some sheets and are identified as light blue-shaded cells (Tables 2 – 7).
  - Where not calculated automatically, sub-totals/totals have a build-in coherence control which marks invalid sub-totals/totals in pink as "Invalid total" (Table 8 – 10).

2. The *StatWorks* software provides a common, SQL-based repository for statistical data and a set of tools for data management that covers Data Importing, Validation, Calculations, Querying and Exporting. The application is designed to be fully integrated with other components in the OECD' s Statistical Information System (SIS) such as the *OECD.Stat* data warehouse, the *MetaStore* metadata management system and *PubStat* for production of paper and electronic publications.

- GFT

  – The GFT file has three sub-categories; the marine capture, aquaculture, and marketing/processing sections. An explanation is provided below.

  – The "other" categories in the GFT table (Table 2) will need to be specified on a separate sheet (GFT-Other-Specifications – Table 3). The data from the GFT-Other-Specifications (Table 3) will be automatically transferred in the respective categories in the GFT file (Table 2).

- Data verification

  – StatWorks will allow for the automatic identification of incoherent data. Countries will therefore no longer be asked to validate their data on Delegate's Corner but will on a case by case basis be contacted by the Secretariat each time new data is uploaded to the system.

Content of country submissions

General

4. Countries are requested to complete tables on the following.

- Table 1 TACs, allocations and catches
- Table 2 Government financial transfers
- Table 3 Government financial transfers – other specifications
- Table 4 National landings in domestic ports
- Table 5 National landings in foreign ports
- Table 6 Foreign landings in domestic ports
- Table 7 Production from Aquaculture
- Table 8 Employment in harvesting and post-harvesting
- Table 9 Fleet capacity
- Table 10 Recreational fisheries
- Table 11 Inland/freshwater capture fisheries

5. For most tables, we are seeking (*revised) 2010 and (preliminary) 2011 data*. Data for 2009 can be filled in. Where data or information to cover the closing month(s) of 2011 are lacking, countries can estimate performance for the missing month(s) — e.g. based on results for the corresponding month(s) of the previous year.

6. Countries should provide footnote information on the period covered by the data (especially if it does not correspond to a calendar year), on geographic coverage (e.g do the data include landings in overseas territories?), and omissions. Precisions on the definition of the data used as well as national sources would be highly appreciated.

7. In all tables in which volumes (weight) and values are reported, ***the requested units are***:

- **Weight:** metric tonnes. Please specify whether live weight, landed weight, green weight or round weight has been used or equivalents of those units.

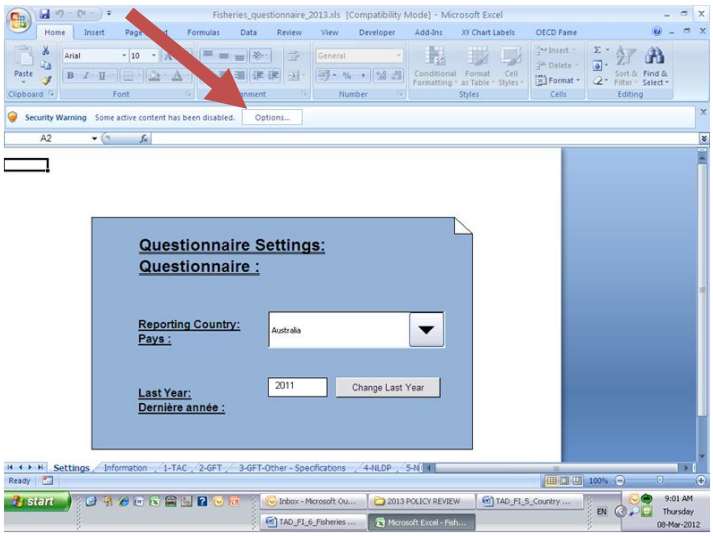
- **Value:** ***full figures in national currency***. (Any conversion of monetary values into another currency or unit, e.g. millions, thousands, will be done by the Secretariat.)

8. Rather than delay the submission of any report unduly, ***provisional data or estimates should be used***. If more accurate and updated figures become available later, the Secretariat will update the data on its web site. It is therefore imperative that correspondents note the status of the figures (i.e. final, provisional etc.).

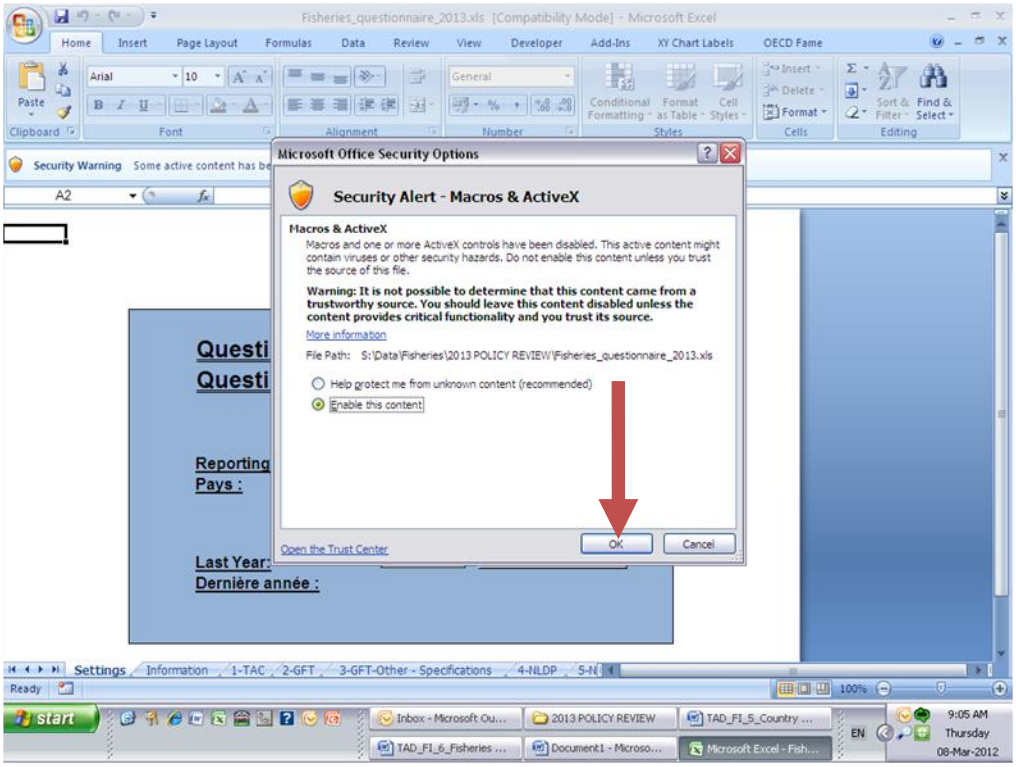
Specific Guidelines for the Tables

9. Once you open the excel file, the **macros need to be enabled** as follows to be able to fill in the tables.

- Click on "Options"



- **Tick "Enable the content" and click on "OK"**



- **Select your country from the drop-down menu**

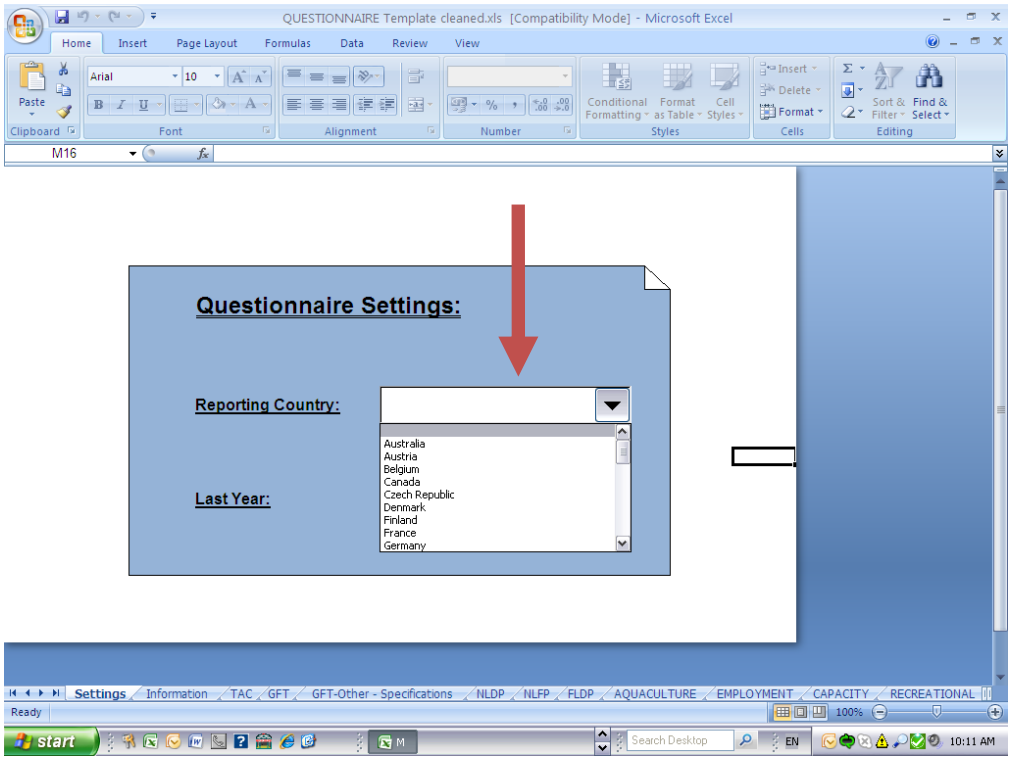
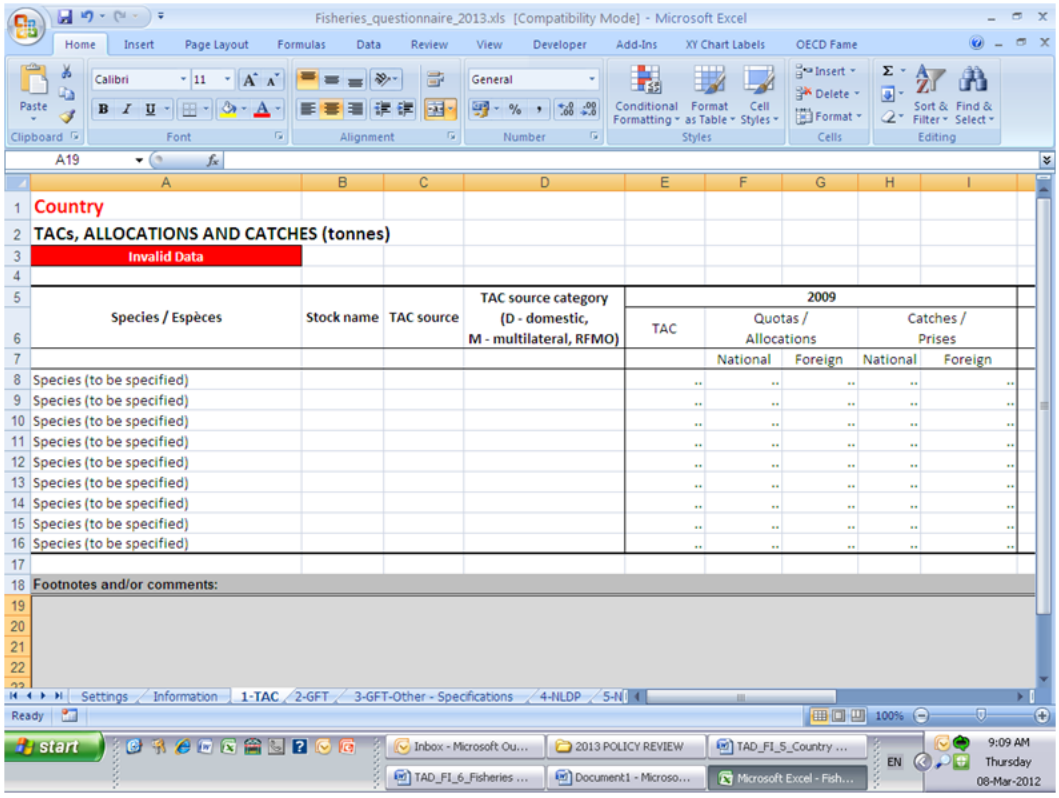


Table 1 – TACs, allocations and catches

10. This table captures information on TAC-managed species.



11. The "TAC source" should indicate the agreement or policy that provides the basis for the TAC (e.g. domestic fisheries policy, EU Common Fisheries Policy, Canada-United States Pacific Salmon Treaty).

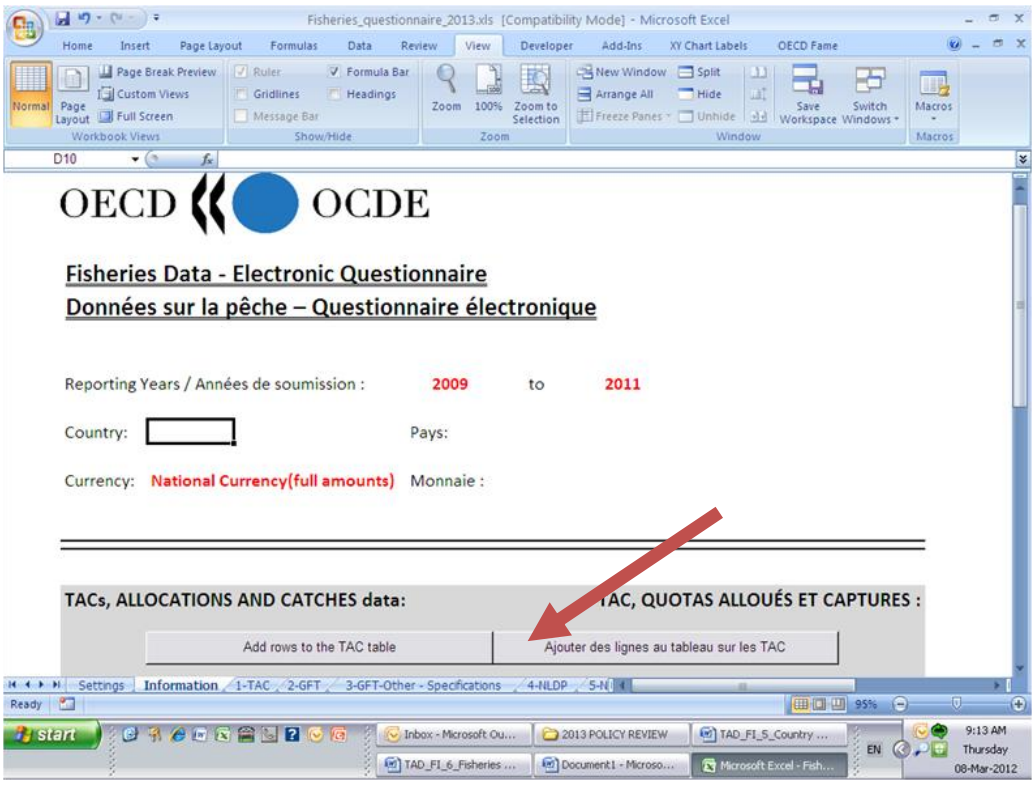
12. The "TAC source category" classifies the source as follows:

- D – domestic regulation
- M – multilateral agreement (including bilateral agreements)
- RFMO – Regional Fisheries Management Organisation.

13. The TAC refers to the overall TAC. If applicable, quotas and catch data should be reported separately for the national share and for the foreign share. The foreign share refers only to the share **out of the overall national quota** that has been transferred to a foreign country. The total national allocation would in that case be given by the sum of the national allocation and the foreign allocation.

14. For European Union countries, the European Commission will provide this information.

15. In case you need to add rows, please go to the "Information" sheet and click on the bar placed under the heading 'TACs. Allocations and Catches data'.



16. Insert the number of rows you would like to add in the little box that pops up. You can repeat this as often as you want to. In case you added too many rows leave them blank.

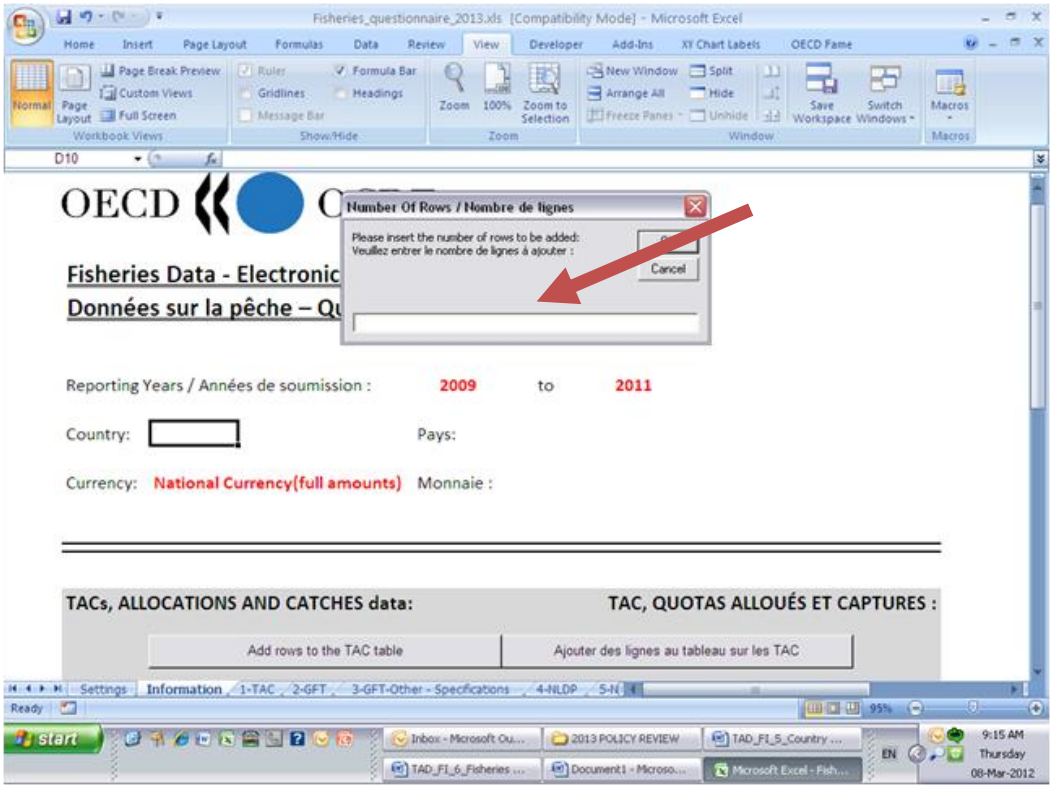
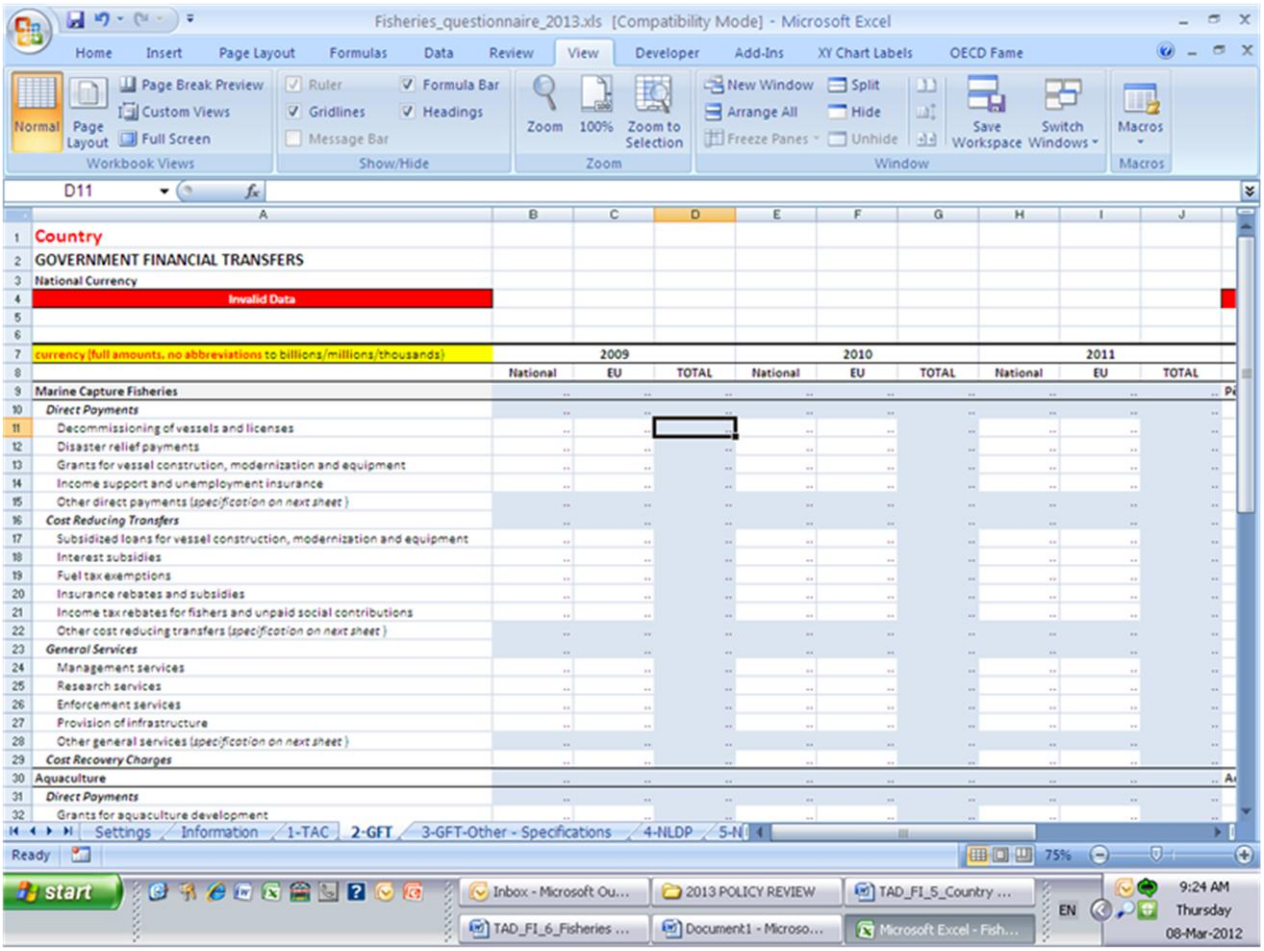


Table 2 – Government financial transfers

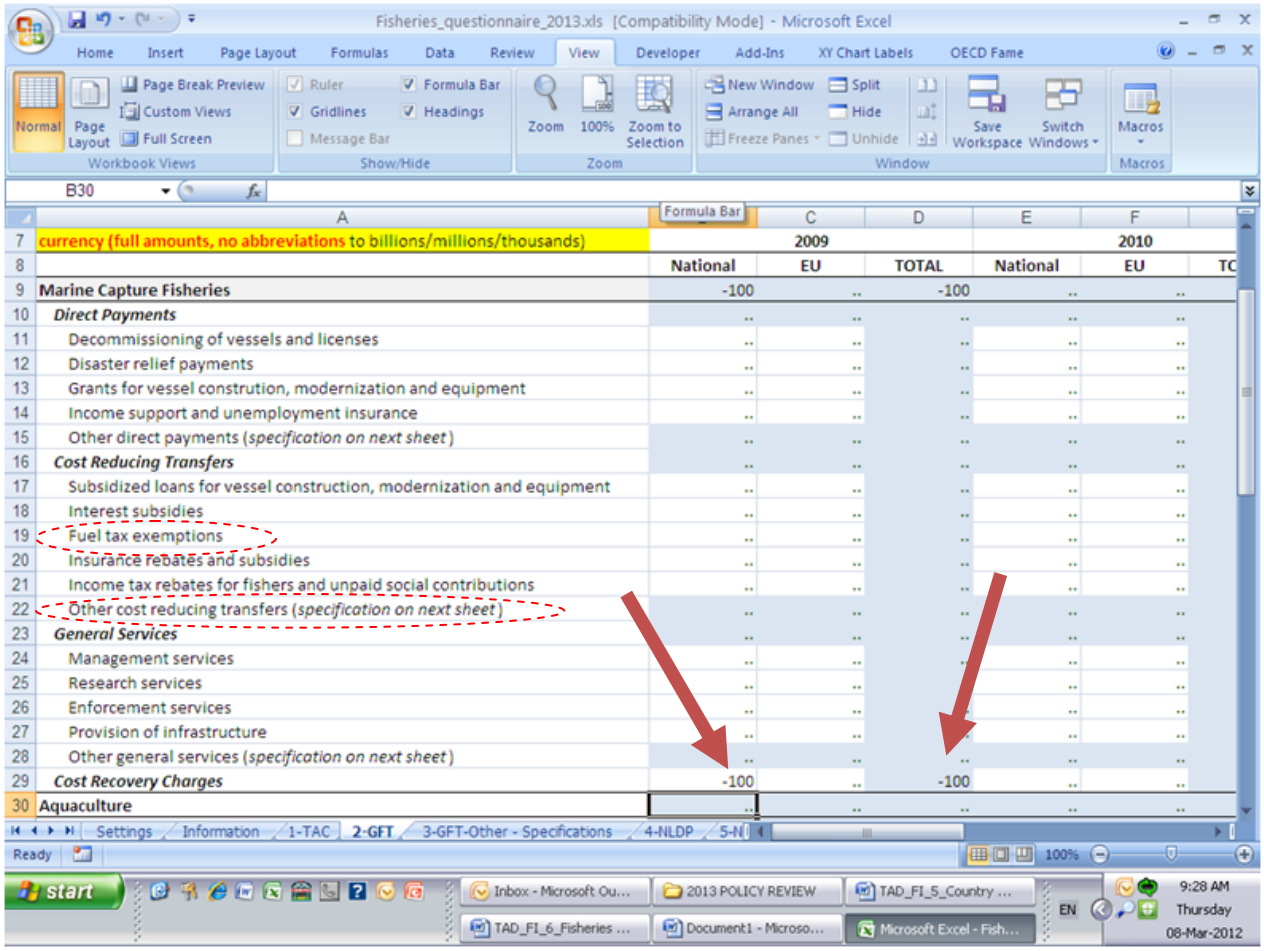
17. Government financial transfers should be presented according to the classification in the following box. Delegates are requested to provide details of the programmes under each category in the footnotes/comment space or separately in Table 3 (GFT – Other – Specifications) as appropriate.

18. Subtotals and grand totals (light-blue shaded cells) will be automatically calculated and cannot be modified manually.

19. In addition, any value in the rows labelled as "**Others**" will automatically be filled with the respective values inserted in Table 3 (GFT – Other – Specifications).



20. Values inserted in the rows labelled "**Cost Recovery Charges**" **must** be preceded by a negative sign ("-") as they will be deducted from the totals (otherwise they will be signalled in red as invalid data).



21. In view of the G20's call upon the OECD to look into the issue of fossil fuel subsidies, it is particularly important to submit information about fuel tax exemptions and income tax rebates for fishers and unpaid social contributions in this category (see circled row headings in the picture above).

A. Revenue enhancing transfers (from Consumers)

Market Price Support (optional) — Market price support (MPS) is normally measured as the difference between the border price for a particular product and the domestic price for that product. In the absence of a suitable reference price, the applied tariff rate may be used in estimating MPS.

B. Revenue Enhancing Transfers (from Government budgets)

Direct payments

Payments based on the level of production or sales. Examples: withdrawals, payments for the purchase of fishing quotas and for vessel construction, modernization and/or equipment,, payments to compensate for a reduction in TACs, payments for aquaculture development and marketing and processing facilities.

Per-vessel payments. Examples: direct payments per vessel, and payments for the temporary or permanent withdrawal of vessels or vessel licenses, including decommissioning schemes

Income-based direct payments. Examples: deferred taxation on fishing income, income tax averaging, income supplement schemes (income support and unemployment insurance), and payments (including tax concessions) based on income.

Other direct payments. Direct payments that do not fall into the above categories

C. Cost reducing transfers

Transfers related to productive capital. Examples: subsidized loans, interest subsidies and special tax treatment for capital used in fisheries.

Transfers related to intermediate inputs. Examples: fuel tax exemptions and rebates; wage subsidies for hired help; bait, ice or water provided at below cost-price; harbour services; insurance subsidies; and interest concessions for operating credit.

Other cost reducing transfers. Cost reducing transfers that do not fall into the above categories for example unpaid social contributions.

D. General services

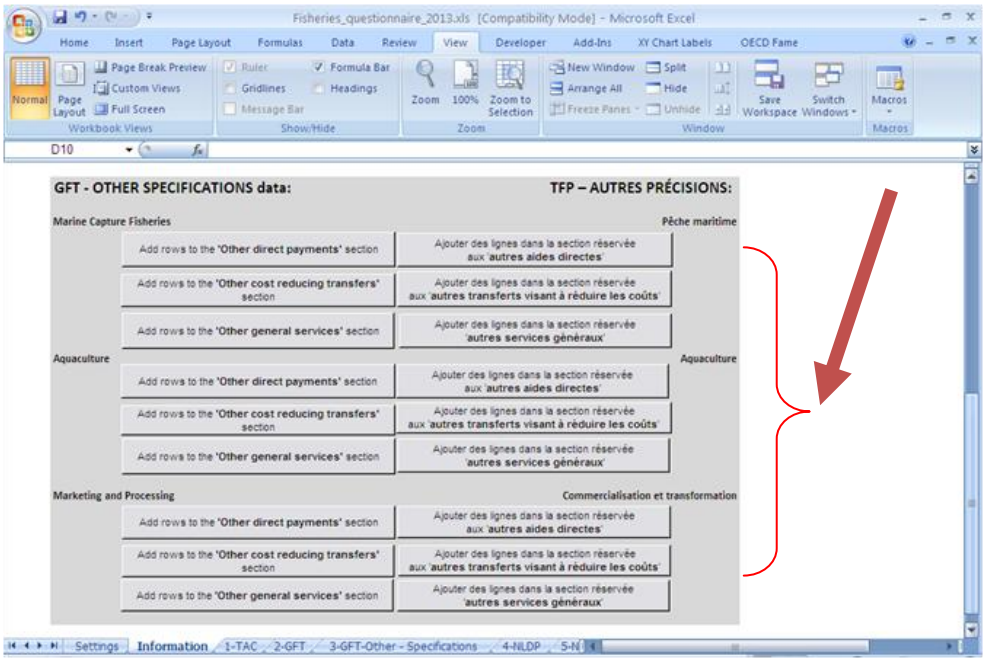
Examples: production and post-harvest infrastructure expenditure; fisheries management and enforcement costs paid by central, regional or local governments; fisheries research costs paid by central, regional or local governments; marketing and promotion campaign services

Other general services. Services not covered in the above categories.

Table 3 – Government financial transfers – Other - Specifications

22. Table 3 allows each country to provide a break-down of government financial transfer categories which do not fit into the pre-filled categories listed in Table 2.

23. To fill **any** data in this sheet, go to the "Introduction" sheet and click on the respective "button" under "GFT – Other Specifications data" section. Once the pop-up box appears in the window, insert the number of rows you wish to add. Please add the heading of the rows you insert in Table 3 (GFT-Other-Specifications) to explain the type of GFT.



24. Any value inserted in Table 3 will automatically be transferred to the respective cells in Table 2.

Tables 4 to 6 - Statistics on landings

25. These tables are self-explanatory. If necessary, correspondents may reflect the relevant fish stocks and the respective landing data which are not included in the footnote/comment space. The data reported should exclude aquaculture. To assist correspondents in choosing whether to record an activity as capture fisheries or as aquaculture, Annex I contains the relevant guidelines used by the FAO.

26. Sub-totals and the grand total will be calculated automatically and cannot be modified manually.

Table 7 - Aquaculture

27. This table is self-explanatory. The FAO defines aquaculture as the farming of aquatic organisms. including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding and protection from predators. Farming also implies individual or corporate ownership of, or rights resulting from contractual arrangements to, the stock being cultivated. For statistical purposes, aquatic organisms which are harvested by an individual or corporate body which has owned them throughout their rearing period contribute to aquaculture, while aquatic organisms which are exploited by the public as a common property resource, with or without appropriate licences, are the harvest of fisheries.

28. The data recorded should exclude capture fisheries. To assist correspondents in choosing whether to record an activity as capture fisheries or as aquaculture, Annex I contains the relevant guidelines used by the FAO.

29. Sub-totals and grand totals will be calculated automatically and cannot be modified manually.

Table 8 - Employment

30. There are three main categories of employment status (according to FAO[3]).

- *Full-time:* fishers who derive 90% or more of their (earned) livelihood from fishing, or spend at least 90% of their working time in that occupation.
- *Part-time:* fishers who derive between 30% and 89% of their livelihood from fishing, or spend between 30% and 89% of their working time in that occupation.
- *Occasional:* fishers who derive less than 30% of their livelihood from fishing, or spend less than 30% of their working time in that occupation.

31. Subtotals and grand totals are not calculated automatically in this sheet. Any value that is inserted and contributes to a subtotal/total will cause cells to marked "Invalid Total". The values in those cells must be adjusted manually and will only appear with a white background if they correctly reflect the sub-values in the cells.

32. Few OECD countries have occasional fishers, as defined above. In filling out their table, correspondents should distinguish between full-time and part-time. They should also indicate whether "part time" also includes "occasional" fishers.

33. It is possible, however, to manually insert subtotal/total values in this sheet if no data is available by type of employment (part-time, full-time) or gender.

Table 9 – Fishing fleet

34. To maintain consistency with the FAO approach, information is presented in length, rather than tonnage, classes. For each length class, Member countries should report fleet capacity in Gross Tonnage (GT). EU Member States need not fill out this table; the Secretariat will receive the data directly from EUROSTAT.

35. Subtotals and grand totals are not calculated automatically in this sheet. Any value that is inserted and contributes to a subtotal/total will cause cells to be marked "Invalid Total". The values in those cells must be adjusted manually and will only appear with a white background if they correctly reflect the sub-values in the cells.

Table 10 - Recreational fisheries

36. Correspondents are asked to provide data on the number of recreational fishers and their take by main species. Lines for fish and shellfish species can be added via the "Information" page. Please specify in the footnote/comment space whether weight or number of fish is used as a unit of measurement.

3. See *Number of Fishers - 1970-1995*, FAO Fisheries Circular No.929, FAO, Rome 1997.

37. It is possible to add rows to specify fish and shellfish species. To do so, go to the "Information" sheet and click on the bar below the respective section under the "Recreational Fisheries data" heading. When the pop-up box appears in the window, insert the number of rows you wish to add. Please add the heading of the rows to specify the species in the "Recreation" sheet.

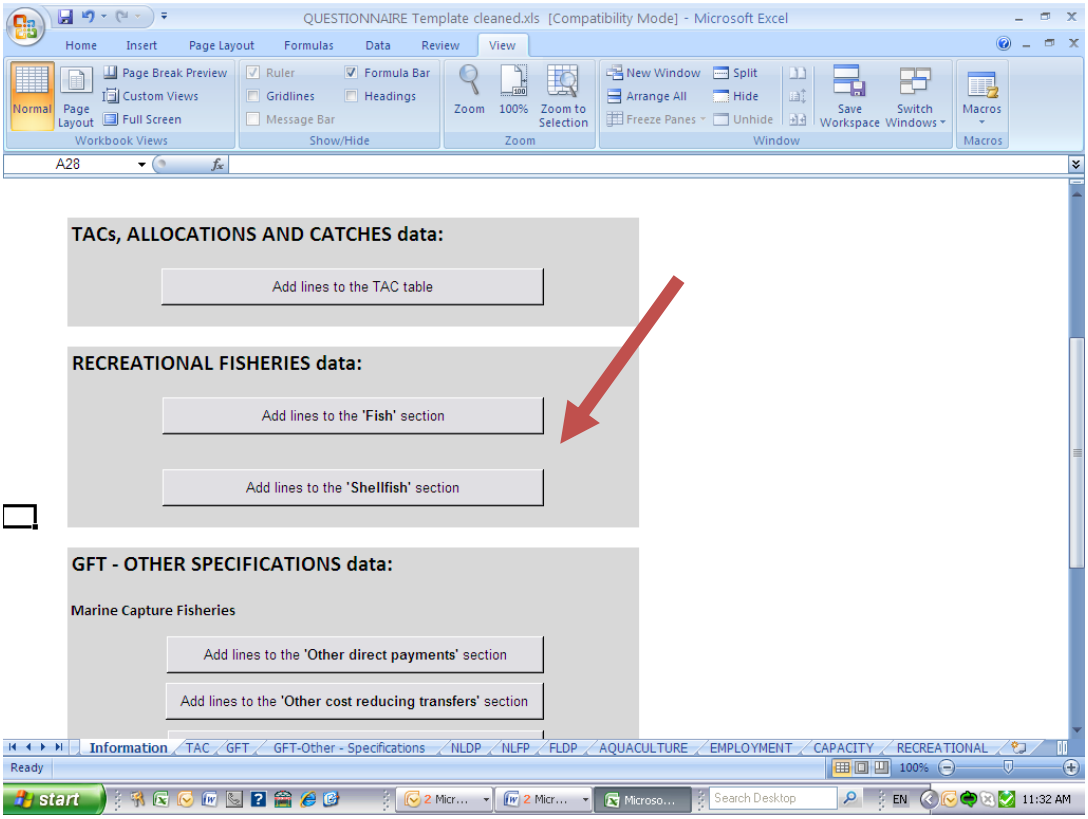


Table 11 – Inland/freshwater capture fisheries

38. The table is self-explanatory. If necessary, correspondents may reflect their relevant fish stocks and the respective landing data which are not included in the table in the footnote/comment space. The data reported should exclude aquaculture. To assist correspondents in choosing whether to record an activity as inland/freshwater capture fisheries or as aquaculture, Annex I contains the relevant guidelines used by the FAO.

39. Sub-totals and the grand total will be calculated automatically and cannot be modified manually.

Reporting procedures and format

40. As has been practice for a number of years, the Secretariat will provide formatted tables (in Excel 97-2003 for Windows format) that are to be filled in. These can be found on the fisheries website (under **Blank Templates for 2009-11 to download on left hand side of first page of Delegates Corner**).

41. To facilitate editing, statistics should be submitted electronically to the Secretariat. The Secretariat uses Microsoft Excel as its software and therefore prefers that submissions be prepared in a way that is compatible with that software. Submissions can be made by e-mail via the Internet (to Alexandra.MATOS@oecd.org and Dongsik.woo@oecd.org, and copied to stephanie.milowski@oecd.org.

Submissions can also be sent by post. Questions related to statistics should be directed to Alexandra de Matos Nunes (Alexandra.MATOS@oecd.org, Tel. 33 1 45 24 92 17). Compact discs should be posted to:

OECD / Fisheries Policies Division
2, rue André-Pascal
75775 Paris, Cedex 16
FRANCE

42. Countries should not submit paper copies (e.g. fax) of their tables and expect the Secretariat to prepare electronic versions of them; the Secretariat's resources are too limited to provide such a service. Hence, in order to ensure that the *Review* is completed in a timely manner, *it is essential that the Secretariat receive the statistical tables in compatible electronic format.*

Due date

43. The Secretariat would appreciate receiving the country tables by **31 August 2012.**

****

Annex I.

Classification for various aquaculture and capture fisheries practices[4]

Production from	Designation		
	Aquaculture	Capture Fisheries	
		Enhanced	Traditional
Hatcheries	●		
Managed grow-out sites for organisms reared from fry, spat and juveniles			
- Ponds	●		
- Tanks	●		
- Raceways	●		
- Cages	●		
- Pens	●		
- Barrages	●		
- Integrated vallicoltura production	●		
- Private, tidal ponds (tambaks)	●		
- Poles, ropes and net bags for molluscs	●		
- Aquatic plants from planted or suspended facilities	●		
Stocked lakes, dams, reservoirs and rivers			
- with additional enhancement (predator control, engineering and/or fertilisation etc.)		●	
- modifications, with exploitation rights		●	
- no other intervention, without exploitation rights		●	
Unstocked lakes, dams, reservoirs and rivers			
- with enhancement (fertilisation and/or predator control, habitat modification), exploitation with or without rights		●	
Rice-fish practice:			
- from stocked rice-paddy	●		
- from unstocked rice-paddy			●
Brush parks			
- managed over time and with other enhancement rights		●	
- harvested on an install-and-harvest basis			●
Fish aggregating devices			●
Holding facilities for live captured organisms of marketable size held for a few months (e.g. tuna, lobsters, crabs)			●
Ranching		●	
Artificial reefs with or without exploitation rights		●	
Recreational fisheries			
- privately owned recreational riverine fisheries			●
- public water bodies			●
Open access waters with or without exploitation rights			●

4. Based on guidelines used for statistics collected by the FAO for its publication: FAO (various years), *Aquaculture Production Statistics*, FAO Fisheries Circular, Rome.

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Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

06-Apr-2012

English - Or. English

TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

FISHERIES MANAGERS HANDBOOK

23-25 April 2012

This document is presented for DISCUSSION and GUIDANCE to the 109th Session of the Committee for Fisheries

Contact: Roger Martini (roger.MARTINI@oecd.org)

JT03319333

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NOTE BY THE SECRETARIAT

This report is largely based on OECD publications. However, its content is on the responsibility of the authors and may not necessarily reflect the views of the OECD. Also, data provided in this report are those of the OECD publications. These have not been subject to an update for this specific report and may hence not fully reflect the current situation.

This Handbook has been prepared by OECD Secretariat staff and has benefited from input from Thomas Binet, CEMARE, University of Portsmouth, UK.

TABLE OF CONTENTS

Tables

Figures

Boxes

FISHERIES MANAGERS' HANDBOOK

Foreword

1. The fisheries and aquaculture sectors are receiving increasing policy attention. The sector's contribution to food security, their impacts and linkages to the environment - both marine and inland water - biodiversity and climate change are factors that make the management of these resources crucial. Concurrently, in the mind of the public, the same sectors have a mixed image and are open for criticism due to overfishing and environmental impacts.

2. The intent of this report, based on work already carried out by the OECD's Fisheries Committee, is to present a more diverse story of a number of central policy issues in the fisheries and aquaculture sectors and to do so in a way that is readily digestible by fisheries managers. In most parts of the world fisheries managers are highly professional skilled in marine biology, oceanography, law and administration but rarely in economics and political economy issues. This explains why the economic factors are rarely considered in fisheries management decisions.

3. While there exists a rich body of research with respect to improved management techniques, the results of this research often fails to reach the fisheries managers who could benefit from it. There are many reasons for this. Researchers may resort to jargon that can make their work inaccessible to audiences outside the scientific community. Work conducted by researchers is often concerned with theory or using artificial scenarios that do not translate well to the pragmatic needs of the fisheries manager. Scientists are most concerned with speaking to others in the scientific community and so their work does not appear in media or other channels easily accessible to fisheries managers. In sum, a new channel of communication between scientists and managers is needed. The intentions is that this Handbook fills that role by providing accessible, available and relevant information to fisheries managers based on existing scientific research.

4. The OECD Committee of Fisheries has over many years guided the development of a large body of research relevant to fisheries policy and fisheries management. This document, revisiting OECD material on fisheries economics and management, combines this past work into a comprehensive volume designed to help fisheries managers maximise the economic and social value of the fisheries resource while also conserving it for the long term.

5. There have been several reference texts produced that target fisheries managers. The FAO technical paper: *Fishery Manager's Guidebook* (FAO, 2002) is a good example. Rather than try to replicate those efforts, this Handbook is intended to complement the more technical nature of books like the FAO Guidebook by focusing more on matters of good policy design. This is an area of particular competence for the OECD and the research undertaken by the Committee for Fisheries of the OECD reflects this. As such, this Handbook will be of most use to those involved in policy design and development in fisheries, while remaining helpful to those directly in charge of management at a local, national or regional scale. It should also be of interest to those interested in the design of good fisheries policy more generally such as industry representatives, members of environmental organisations or other NGOs.

6. The content of this Handbook is based on recent OECD publications in fisheries. Its structure follows from this, working through different topics on which the Fisheries Committee has worked and by summarising the content of different documents. Chapter one provides an introduction to the fisheries management, its objectives, the instruments of management and the identified benefits and beneficiaries. Chapter 2 is concerned with the economics of fisheries management. It reviews the main economic concepts and theories relevant to fisheries management. Chapter 3 deals with the problem of excess fishing capacity and how it may be addressed. Chapter 4 covers management tools, especially market mechanisms

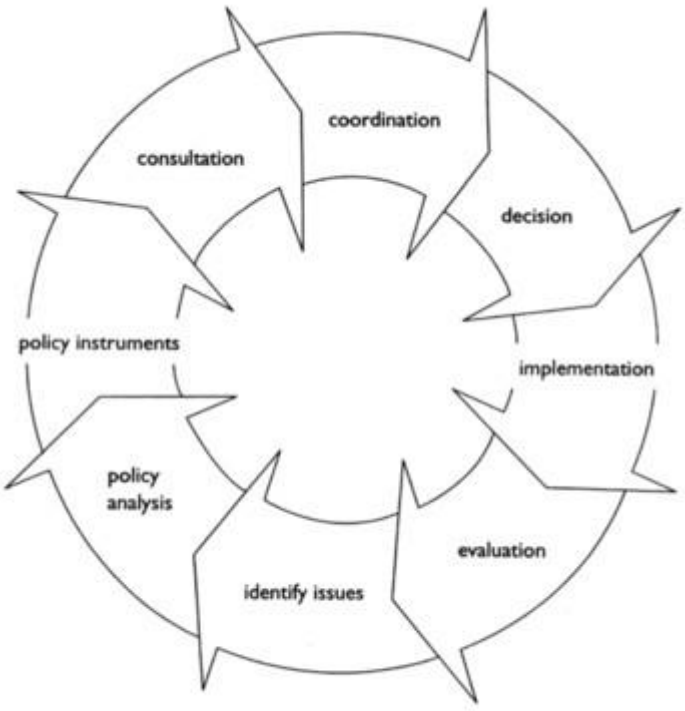
such as individual transferable quotas. Chapter 5 covers the economics of rebuilding fisheries, presenting approaches used to restore fisheries to safe biological, economical and social limits. Chapter 6 discusses the human dimension of fisheries management and especially the problem of adjustment of fishers in response to long-run changes in the fishery. Chapter 7 presents the issue of policy coherence for fisheries development, covering the main issues and some practical applications. Chapter 8 discusses certification in fisheries and aquaculture. Chapter 9 covers the growing importance and issues of the aquaculture sector. Chapter 10 concludes by reviewing the key issues developed by the manual. It provides a policy checklist for sound fisheries management.

CHAPTER 1: INTRODUCTION TO FISHERIES MANAGEMENT

7. This chapter introduces the idea of fisheries management and the role of the fisheries manager. It sets out the basic requirements for good fisheries management and some of the elements that must be in place to achieve it. In this chapter, the importance of good policy design is emphasised, setting the stage for the chapters to follow which concern the specifics of policies in different domains.

8. Policy is made in a policy cycle composed of several steps. The process is cyclical because the process of policy development never stops; there is always room to improve the performance of policies, and the need to adjust policies to conform to emerging needs and developments (Figure 1.1). In practice, policies are subject to continuous development as policy makers respond to stakeholders, evolving circumstances and technological advancements.

Figure 1.1. The policy development cycle



9. Figure 1 highlights some of the typical elements of policy development in practice, including activities such as consultation and coordination. The process has five main steps:

1. **Formulation of objectives**. Identify policy issues, through consultations, feedback, political pressure, and advice from experts and bureaucracies.

2. **Evaluate the performance of current policies**. Assess the success of current approaches achieve the objectives identified in step 1. Good information on costs and benefits are required.

3. **Establish the characteristics of a new policy set**. Define the operational characteristics of new polices and approaches to fisheries management. For example, use of market-based approaches, harvest control rules, and modes of financial transfers.

4. **Implement new policies**. Putting into place new policies involves learning and feedback that may lead to needed adjustments. Stakeholder involvement can help.

5. **Monitor and evaluate**. Develop monitoring, control and information systems to produce and evaluate the performance of the fishery with respect to the objectives set out in step 1. Match information systems to the design of the policy set.

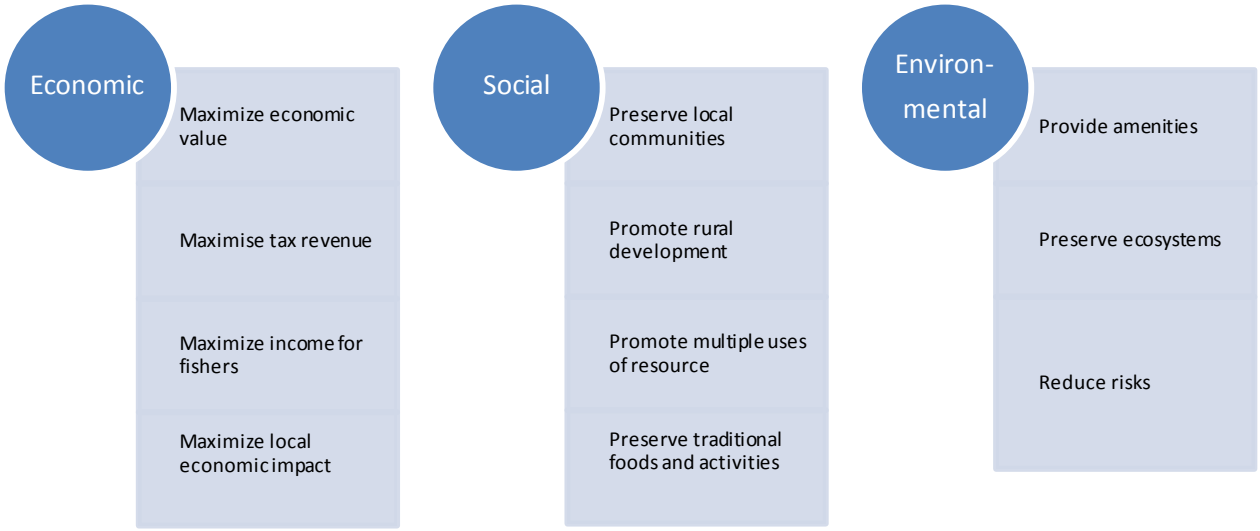
10. Alongside the policy development cycle comes the need to prepare the sector for reforms and removing the obstacles to change. Obtaining effective fisheries policy reform can be difficult, even when the problems of the current system are acknowledged by all. Stakeholders have to trust the process and see a role for themselves in it. They need to feel that the sacrifices they are called to make will lead to benefits for them and not others. They need to see that the risks that come with changing to a new and unfamiliar system are balanced by the benefits that will result. In some cases, losers will need to be compensated and help for adjustment (i.e. flanking measures) given to those who chose to leave and those who chose to continue in the fisheries sector.

Setting Policy Objectives

11. Objectives describe the overall aims of fisheries policy, and good policy design begins with clearly defined objectives. The objectives of fisheries policies cover a broad range of issues, but can generally be categorised into economic, social, and environmental objectives (Figure 1.2).

12. When people think about fisheries management, the first thing that comes to mind is the stock level as expressed by available fishable biomass. However, stock management is mainly important as a means to ensure that more fundamental economic and social objectives are met. While fish stocks and ecosystems do have intrinsic value to many, this value is subject to debate and difficult to measure. Moreover, such non-market valuation of the resource often has more to do with the health of the ecosystem in general, and the size of commercial fish stocks is only a component of this.

Figure 1.2. Some Possible Objectives of Fisheries Management



Source: OECD.

13. That said, stock management is often the most important task of the fisheries manager. If the stock is not maintained at a healthy, sustainable level, eventually the fishery will collapse and no longer be able to contribute positively to the government's objectives[1]. Responsible policy makers set objectives for the stock that are sustainable, scientifically-based, and prudent.

14. In many cases, the objectives of fisheries management policies are often unclearly defined, poorly understood by involved parties and stakeholders, or hidden behind stated objectives. This can be due to a poorly designed policy development process, a consequence of policy being developed in response to political pressures, or from longstanding policies continuing after the objectives have changed. In particular, path dependence hinders good policy design. Without clearly stated and transparent objectives, the success of fisheries management cannot be gauged.

15. Not all objectives are compatible with one another, which is another reason why good policy thinking starts with a focus on objective setting (Box 1.1). It is not uncommon to hear the goals expressed together that the fishery should maximise its contribution to the economy and that small-scale artisanal fishing should be preserved, notwithstanding the fact that these objectives frequently are at odds. In this situation, the fisheries manager has little chance of success. They can work towards one or the other, but trying to achieve both at once will inevitably lead to unsatisfactory results. Identifying objectives also

1. The assumption here is that the fisheries manager would not have the objective of exhausting the resource.

identifies potential conflicts and areas where compromise is required. This contributes to overall *policy coherence*, an important characteristic of good policy design.

Box 1.1. Dealing with Multiple Fisheries Management Objectives

"The necessity of a broad perspective that encompasses the full range of objectives is inherent in the concept of 'objectives-based' decision making in policy and management (not only in fisheries but across many sectors). Objectives-based approaches focus on linking the actions taken to the objectives being pursued, typically within a hierarchy of objectives (see figure below). While this is in a sense simply a logical decision-making arrangement, and reflects a standard approach utilised in planning and operations management, its new-found popularity is useful in reminding us of the importance of having policy and management decisions responsive to societal objectives (…).

[Also], two realities must be noted in relation to the pursuit of multiple objectives in the fishery. First, with multiple objectives, there will always be some degree of trade-off among them. As Hersoug (2006) notes "…there are obvious contradictions between the goals, and goal attainment can only be measured as some form of compromise. Greater attention to profitability will for example lead to less employment and most probably to legitimacy problems."

Second, in pursuing a multiple set of objectives (…), there is a need for efficiency in policy implementation. To this end, a broad view of efficiency is required, i.e., seeking to obtain the greatest benefits (in terms of meeting objectives, within a long-term perspective) at the least cost. Such a perspective can be used to determine the preferred fishery configuration – i.e., what the fishery should look like in terms of a desired 'mix' among multiple user groups (such as commercial, recreational, and subsistence fishers), scales of operation (notably small-scale versus large-scale, or artisanal versus industrial), and gear types. Also, within any single user group or gear type in the fishery, there is a need to decide on the balance among a variety of inputs that combine to produce fishing effort (labour, capital, technology, management and enforcement activity, etc.). These decisions all depend on the blend of societal objectives pursued, and the capability of the various fishery players to meet those objectives."

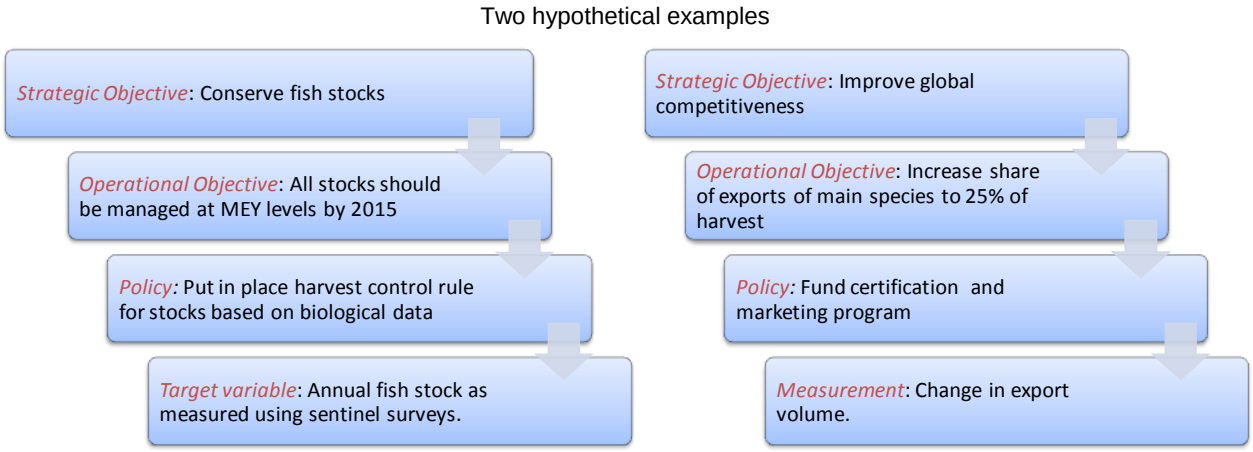
Sources: Charles, 2007; Hersoug, 2006

16. The objective-setting process is fundamentally a political one. It is an expression of social choice, which means in practice that elected officials set policy objectives (in consultation with or drawing on the advice and expertise of fisheries managers and stakeholders), and fisheries managers devise the best tools to achieve those objectives. While objectives can be evaluated in terms of their practicality and consistency with a set of agreed principles, different countries can have different priorities and will choose the objectives that suit them. That said, when setting objectives governments should pay due regard to relevant rules of international law and in particular the Code of Conduct for Responsible Fisheries. This Handbook is intended to help fisheries managers ensuring that objectives are met in the most efficient and effective manner possible.

- ***Define objectives clearly at the start***
- ***Make sure multiple objectives do not conflict***
- ***Set deadlines and measureable criteria for success***

17. Good objectives are explicit, quantifiable and time-bound. Starting from a general statement of principle, objectives should be made operational in a way that available measurement tools can evaluate their achievement. Such objectives reference the policies designed to reach them and their means of evaluation (Figure 1.3). Broad objectives such as "improving competitiveness" can never be seen to be reached or missed. Putting it in more precise terms is essential to determining progress. Adding some kind of time-based target to the objective stating by when it should be achieved is also required to indicate the urgency of the objective and to ensure that policies make effective progress towards reaching them. An objective with no time frame need never be reached.

Figure 1.3. Objective-setting hierarchy



Source: OECD

Targeting and tailoring of policies

18. Clear objectives strongly facilitate the development of policies to achieve them. Without that connection, policies can endure for a long time without a serious evaluation of whether they bring desired and cost-effective benefits. For example, fuel tax concessions are a part of the policy set in a majority of OECD countries. Are these concessions designed to improve the income of fishers? To increase fishing effort? To preserve small fishers? Many of these types of objectives are alluded to, but the genesis of these policies seems to come from the observation that fuel is expensive and forms a large part of the overall cost of fishing. This, perhaps with some lobbying from the sector, leads to the granting of concessions. Such an approach gets the policy development process backwards by being reactive to a situation without thinking about the goals of the policy.

19. In some cases, a policy has a direct relation with the operational objective, such as with setting of TACs and objectives regarding stock levels. Other times, the policy can have only an indirect influence on the objective. While policies that directly address objectives are preferred, this is not always possible. Examples of indirect policies are structural adjustment policies such as early retirement schemes, or technical restrictions on vessel length or power.

Measuring Progress

20. If good objectives are needed to guide fisheries management and gauge its success, then useful metrics related to those objectives are also required to evaluate progress. Measuring progress toward objectives is a critical element of the policy design process. When the results of a set of fisheries management policies can be evaluated, it is more likely for positive reforms to be possible when policies are seen to be falling short. This is the core element of adaptive management.

Setting priorities and policies

21. It was said earlier that objectives related to stock management exist to enable more fundamental economic and social objectives. Despite this, stock management is the issue that will occupy the greatest amount of time and effort on the part of the fisheries manager. That is because most policy objectives depend on maintaining a healthy and productive fish stock. Fail at that, and all other policy objectives are unreachable.

22. The fisheries management system's role in stock management will also tend to dominate all other policies in terms of impact. The management system sets the context in which all other policies operate. In particular, the choice to use input- or output-based control as the main tool to regulate harvest has strong implications regarding the types of incentives the fisher faces. Input controls change the relative rates of return on inputs such as time, energy, capital, as fishers try to maximise revenue given the constraints of the system. The evolution of output-based controls, in particular tradable rights has come about from a recognition that aligning the interests of the fisher with the objectives of the management system makes many aspects of the system more effective and efficient.

The benefits of fisheries management

23. Fisheries management exist because fisheries when left unregulated tend to do poorly. The reason for this is what is termed the "tragedy of the commons" - the tendency for common resources to be overexploited. Garrett Hardin (1968) famously described this phenomenon in chronically overgrazed communal pastures. In an open access fishery, fishers have little incentive to conserve the fish stock when the benefits of doing so are likely to be enjoyed by others. The problem of the commons is that since nobody can be assured of gaining the benefits from conservation, nobody has an incentive to conserve the resource for the future.

24. The unmanaged, open-access fishery tends to have too many fishers and a depleted stock of fish and it is up to the fisheries manager to put controls in place to address these problems. Open-access problems are failures of co-operation - fishers are unable to coordinate to share the benefits of conservation - so the fisheries manager must put policies in place that either enable cooperation or replace it with effective controls.

25. There are few truly open access fisheries left in the world and the benefits of good fisheries management are clear. That doesn't mean that all regulated fisheries are doing well. In fact, most of the statistics related to fisheries are alarming, with more fisheries doing poorly in terms of stock management than those that are doing well (FAO, 2009). Fisheries management is complicated and difficult, the difficulty compounded by uncertainty, perverse incentives, incompatible objectives, imperfect enforcement and lack of data and information.

26. Managing fisheries in a sustainable way means taking actions to ensure the resource will be available in abundance for the future and is harvested in a way that does not damage the long-term availability of the stock or its ability to withstand natural variations in the environment. To do so requires a combination of good policy design that targets clearly understood objectives and effective administration and enforcement, supported by sound research on the biological characteristics of the fishery.

Table1.1. Key features of fisheries management frameworks in OECD countries

		Responsibilitiy for delivery of…			
Country	**Policy setting**	**Research services**	**Management services**	**Enforcement services**	**Stakeholder participation**
Predominantly output controls					
Iceland	Ministry of fisheries	Marine Research Institute; Directorate of Fisheries (for statistics)	Ministry of Fisheries (TAC setting); Directorate of Fisheries	Directorate of Fisheries; Icelandic Coast Guard	Institutionalised consultation with Icelandic Fishermen's Association and Federation of Icelandic Fishing Industry
New Zealand	Ministry of fisheries	Ministry of Fisheries contracts research organisations to carry out research services	Ministry of Fisheries contracts out some management system services (*e.g.* fishing vessel registrations)	Ministry of fisheries	Consultation with all stakeholders (commercial, recreational, environmental, Maori) compulsory under fisheries law. Consultation occurs in Ministry planning, stock assessment and advice to the Minister of Fisheries on management controls. For some fisheries, stakeholders prepare fisheries plans that are then assessed and, if agreed to by the Minister, implemented by the Ministry.
Norway	Ministry of fisheries	Institute of Marine Research; Norwegian Institute of Marine and Aquaculture Research	Ministry of Fisheries; Directorate of Fisheries	Directorate of Fisheries; Coast Guard; Sales Organisations	Institutionalised consultation with Norwegian Fishermen's Association and Federation of Norwegian Fishing Industry
Australia	Central ministry, with advice from Australian Fisheries Management Authority (AFMA)	Independent statutory authority (Fisheries Research and Development Corporation), contracting out research to institutions	Independent statutory authority (AFMA)	Independent statutory authority (AFMA)	Through AFMA Management Advisory Committees and Stock Assessment Groups
Canada	Central government (Dept of Fisheries and Oceans (DFO))	Government laboratories and universities; priority setting by DFO, with advice from Fisheries and Oceans Science Advisory Council, Fisheries Resource Conservation Councils	DFO	DFO is the primary provider of enforcement services. Industry sponsored dockside monitoring programmes and cost-sharing of at-sea observers	Industry participation on advisory committees; some comanagement and Joint Project Agreements
European Community	Centrally through European Commission	EC through framework programs	Rule setting at EC level; Implementation by EU member states	EU member states	Limited at EC level to advisory committee on fisheries (industry and consumers) and Economic and Social Committee. Varies widely between states
United States of America	Broad goals in Magnuson-Stevens Act, objectives set regionally through Regional Fisheries Management Councils (RFMC)	National Marine Fisheries Service (NMFS); Science Centres; universities; RFMCs	NMFS	NMFS for dockside enforcement; US Coast Guard for at-sea enforcement	High degree through RFMCs, Marine Fisheries Commissions
Japan	Centrally through Fisheries Agency	Through Fisheries Research Agency (independent but attached to central government)	Fisheries Agency through regional Fisheries Coordination Offices	Fisheries Agency through regional Fisheries Coordination Offices	Limited, through Fisheries Cooperative Associations
Korea	Centrally through Ministry of Maritime Affairs and Fisheries (MOMAF)	MOMAF through National Fisheries Research and Development Institute	MOMAF through Fisheries Administration Bureau and Fisheries Resource Bureau	MOMAF through Fisheries Resource Bureau; Fishing Vessels Management Office and National Marine Police Agency	None
Mexico	Centrally through Secretariat of Agriculture, Rural Development, Cattle Raising, Fisheries and Food	National Fisheries Institute	Secretariat of Agriculture, Rural Development, Cattle Raising, Fisheries and Food	Federal Bureau for Environmental Protection and National Commission for Aquaculture and Fisheries	National Chamber of Fisheries Industry and Aquaculture; Fisheries Cooperatives
Turkey	Centrally through Ministry of Agriculture and Rural Affairs (MARA)	MARA through four research institutes as well as universities	MARA	MARA	Through producers organisations

Source: OECD, 2003; OECD countries submissions, 2003

27. Sound fisheries management creates benefits for commercial fishers, consumers, recreational fishers and the broader community. These beneficiaries are often described as the stakeholders in the fishery.

28. Commercial fishers benefit from the increased output that potentially results from good stock management, and from controls that limit the dissipation of rents from the fishery. By optimising fleet and stock size, costs per unit of effort by the fisher can be reduced. Management that leads to larger average fish sizes can increase the value and marketability of the harvests. Recreational fishers share these benefits, and can also benefit from management of the sharing of the fishery between commercial and sport fishers.

29. Consumers benefit from a larger and more stable supply of fish. A larger supply can often mean lower prices in the supermarket as well. Consumers can see improved quality of seafood through post-harvest management measures including improved quality control, sanitary and phyto-sanitary requirements and the recognition of sound management through eco-labels and product certification (See Chapter 8).

30. Fisheries management decisions that maximise the social and economic benefits of the fishery while protecting other non-use values of fisheries (such as amenity and existence values) benefit user groups and the wider community. In addition, cultural minorities and indigenous people benefit where fisheries management provide for the interests and customs of those groups.

31. Chapter 2 deals with the economics of fisheries management and will discuss in more detail the issues of the benefits of fisheries management to fishers, stakeholders and society at large.

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CHAPTER 2: THE ECONOMICS OF FISHERIES MANAGEMENT

The open-access problem

32. The fisheries management system is a legal and institutional framework for managing the harvest and stock levels of a fishery or fisheries, possibly combined with a set of programmes related to objectives related to the fishery. As discussed in the previous chapter, fisheries management systems have come about due to the tendency of fisheries, when left unregulated, to become victim of the "tragedy of the commons" where the commonly available stock is overused and depleted.

33. The tragedy of the commons reflects a fundamental feature of public resources. Each individual, acting in their own best interest, will take actions that result in a net outcome that is sub-optimal in a welfare sense. That is, there are different ways to use the resource that would lead to greater benefits for all involved. Contrast this with the neoclassical economic view of market competition, where individual self interest leads to a welfare-maximising outcome. This standard neoclassical view underpins modern market capitalism and the OECD view of market mechanisms and market discipline as fundamental to sustainable economic growth.

34. It is generally recognised that totally unmanaged fisheries run the risk of biological and economic overexploitation. In such a situation (often called "open access") fishers have little incentive to conserve the fish stock as the benefits of doing so are likely to be derived by others. The potential benefits that could be obtained by harvesting the resource in a coordinated manner are thereby lost.

35. This chapter discusses fisheries from an economic perspective in order to better understand how fisheries management policies are shaped, and what makes them successful or not at achieving their objectives. It will cover the basics of the bioeconomic model of the fishery, and discuss the factors that make the market for fish and fishing different from classical competitive markets, and how that influences policy. The public good nature of fisheries resources has already been mentioned as a differentiator between fisheries and classical markets, but this is not the only difference of importance, and these will be discussed as well.

36. As a basis of reference, consider the standard competitive market as described in neoclassical economics.[2] These assumptions, taken together, ensure that prices are "right" such that resources are used efficiently and profits and benefits to the consumer are maximised (Henderson and Quandt 1980):

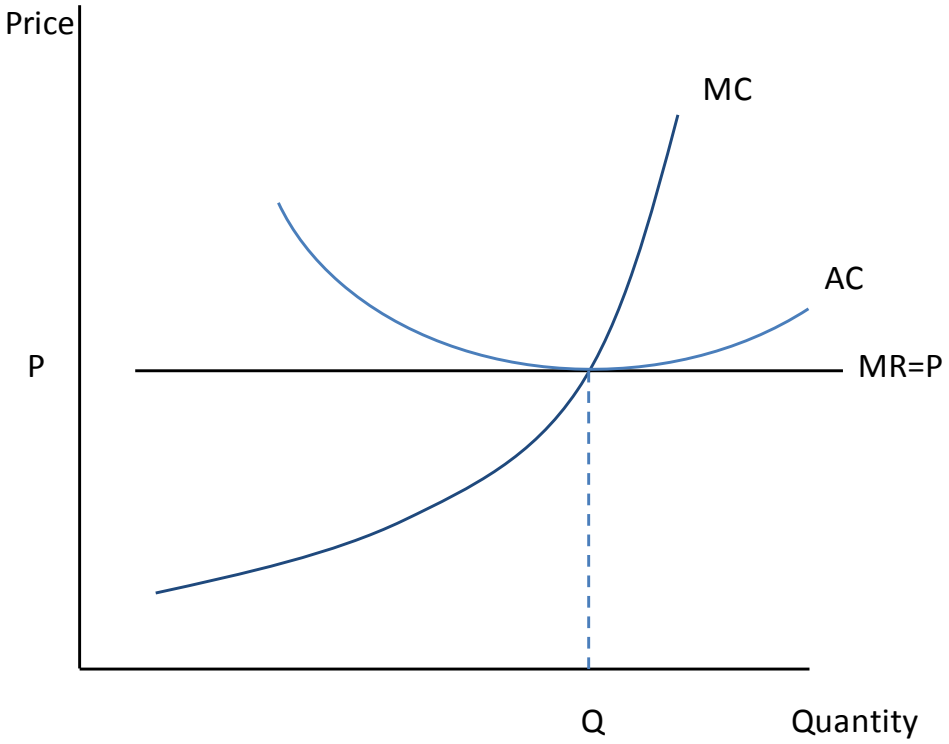
- Firms produce identical products and customers are identical, such that there is no benefit from selling to any particular one.
- Firms and customers are numerous, such that the sales and purchases of each are small in relation to the total market.
- Both firms and consumers possess perfect information and act to maximise profits and benefits.
- Entry and exit from the market is free in the long run.

2. These assumptions are frequently challenged as being unrealistic, and it is true that they are rarely observed in their strict definition in reality. This has not prevented the ideas derived from model from being very useful in practice.

37. The standard market equilibrium is defined by the condition where the marginal cost of the seller is equal to the marginal benefit of the buyer. If this is not the case, it would be possible to increase profits or benefits by changing the price or amount sold in the market (Figure 2.1).

Figure 2.1. Perfect competition

Market equilibrium at MR=MC



38. At the equilibrium point (Q, P), economic profits are zero as average cost also equals marginal cost and marginal benefit. If this were not the case, firms would enter (exit) the market to capture profits (avoid losses), and the resulting change in supply changes the prevailing market price, shifting the MR curve.[3]

39. Compare this to the standard analysis of a fishery; the Gordon-Schaefer model. This model starts with some assumptions about the way the fish stock grows at different population levels (the growth function) and combines this with the costs facing fishers to define the long-run equilibrium of a single-species fishery. In this model, the equilibrium point is one where effort is too high and stocks are too low relative to the economic optimum; unlike the case of the competitive market, the optimum and the equilibrium points are different.

The Gordon-Schaefer Model of a fishery

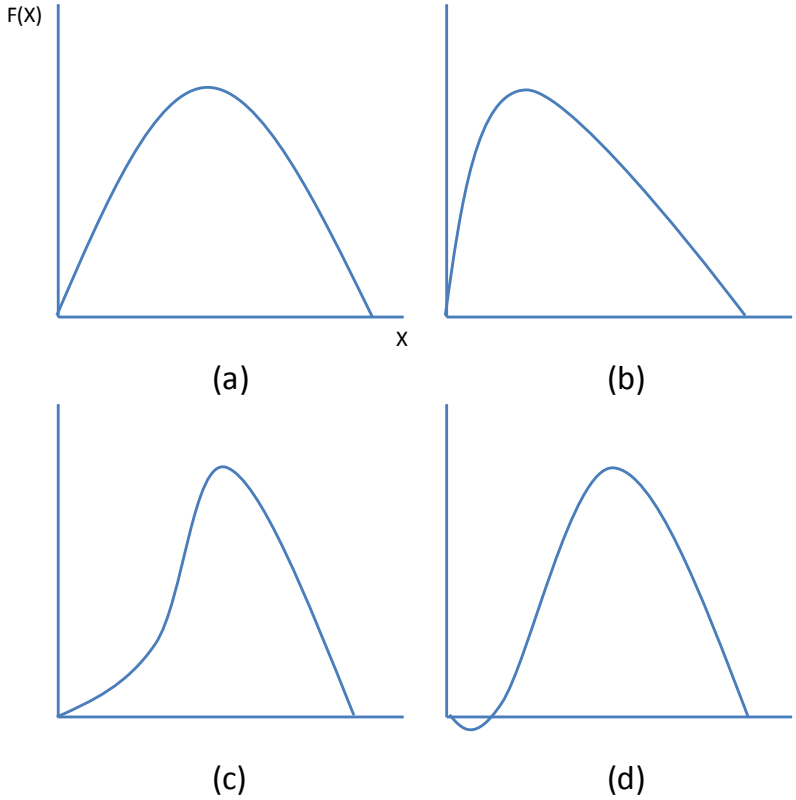
40. The Gordon-Schaefer (G-S) model starts with defining a growth function. Different fish species can exhibit vastly different growth patterns, so many different forms of growth function are possible (Figure 2.2). One of the simplest growth functions is the logistic growth function, depicted in panel (a) in Figure 2.2. This defines a stock with a high rate of growth at low levels, then less and less so as the stock

3. For a fuller discussion of why economic profits are zero in competitive markets, see Chapter three.

increases until some maximum stock size is reached. This is a particularly stable growth function, as the stock will quickly rebound from low population levels.

Figure 2.2. Different growth functions

(a) compensatory, (b) asymmetric compensatory, (c) depensatory, (d) critically depensatory



41. The growth function in panel (b) is similar to the logistic, but exhibits stronger growth rates at lower population levels. Like the logistic, this growth function is said to be *compensatory*; the relative growth rate is highest when the population is small, right down to the limit case of zero population size[4]. Depensatory growth functions show impaired growth of the stock at small population sizes. This can be the case when the stock becomes more vulnerable (e.g. easier prey at low densities) or experiences reproductive difficulties at lower populations. In panel (c), a growth function is shown where a stock grows relatively slowly at lower population sizes, but more strongly beyond a certain point. In panel (d), the stock is *critically depensatory*; below a certain stock size, the stock experiences negative growth. That is, below a critical threshold, the stock collapses.

42. It is clear how the growth function of a fishery has implications for its management. Fisheries exhibiting compensatory growth functions can rebound more easily from natural fluctuations or over harvesting, while those with depensatory growth functions must be managed much more carefully to avoid collapse (See Box 2.1). Moreover, when harvesting a stock exhibiting depensatory growth, it is possible to have many years of good yields with heavy effort, but at some critical point the stock will collapse

4. Technically speaking, a compensatory growth function is one that is concave over its entire range. The logistic is a symmetrical growth function defined as $G(X) = rX\left(\frac{1-X}{K}\right)$, where X is the stock size and r and K are parameters representing the intrinsic growth rate and carrying capacity of the resource.

dramatically. Thus, using yield and effort as indicators of stock health can be dangerously misleading in this case.

Box 2.1. Different growth functions--some real world examples

Many fisheries have suffered collapses in recent years, but only some of them have gone on to recover and become viable commercial fisheries again. Whether a fishery can recover from overfishing or other natural events depends on many things, but perhaps the most important is the ability of the stock to grow from small population levels.

In the early 1970s, the Peruvian anchovetta fishery had seen rapid investments in capacity and was relatively poorly managed. This left the stock vulnerable, and in 1972 an El Niño event precipitated the collapse of the fishery. Since then, the fishery has collapsed and recovered several times as the fishery underwent capital restructuring, changes in management system, and several El Niño events. By the 1990s, harvests were around the 7.6 MT mark identified by the Instituto del Mar del Peru (IMARPE) as the MSY capacity of the fishery.

Anchovetta, a pelagic prey fish, has a remarkably robust growth function that allowed it to recover from severe depletion not once, but several times. This allowed the fishery to be robust to the host of problems it faced as the fishery industrialised in the 1960s and 1970s.

In contrast, the 1992 collapse of the Cod fishery off the east coast of Canada has not been followed by a recovery, despite a near complete shutdown of the fishery. Numerous changes resulting from the collapse of the cod population have led to a persistent low-level stock equilibrium. Reasons given for this are the loss of their ecological niche to crustaceans, permanent alteration of migration patterns, vulnerability to predation, and loss of critical mass for spawning. Regardless of the cause, cod clearly exhibit a depensatory growth function that has proven unforgiving to management mistakes.

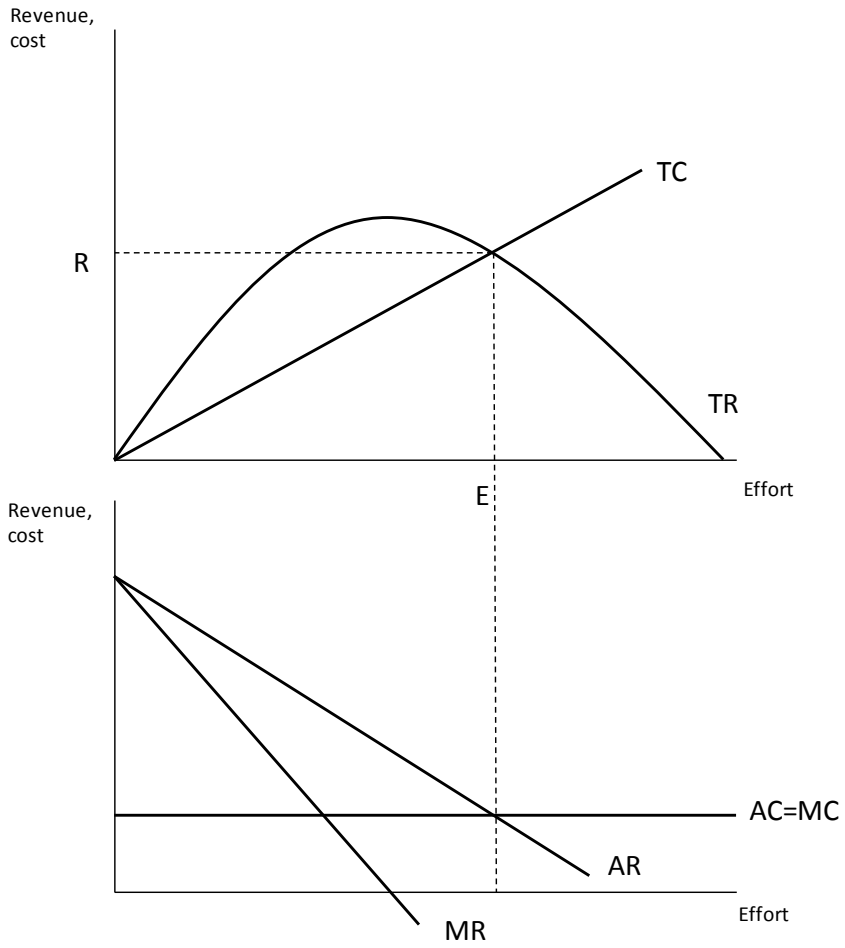
43. The second element of the G-S model is the incentives and behaviour of fishers, which is captured in two assumptions: A fixed price for harvested fish, and a cost of harvest that is proportional to the stock level. Assuming that the cost of harvesting fish is proportional to the population of the stock is particularly important - it implies that when the population is small, it is relatively expensive to harvest fish. This means that low stocks are a disincentive to harvesting, as profitability is lower. When this is true, fisheries tend to be more naturally stable, as lower stocks will lead directly to lower fishing effort.

44. This assumption of costs being related to stock size is most reasonable when the fish are fairly evenly distributed over an area, such as for ground fish. It is less the case for schooling pelagic fish that are easy to capture even when the population is low as the fish tend to group themselves together. The theory then immediately implies that it is more likely that densely schooling species will be overharvested. That these fish tend to have growth functions that allow them to recover from low population levels is very fortunate.

45. Putting the parts of the G-S model together yields the long-run equilibrium of an open-access fishery (Figure 2.3). The equilibrium occurs where total revenue of the fishery (TR) equals total cost (TC). At this point, profits are zero and a stable level of effort E leads to revenue level R.[5] At this point, marginal revenue is not equal to marginal cost, the key condition for optimality in the neoclassical model (this also defines an optimal solution for the fishery, it just isn't where the equilibrium is).

5. Economic profits equal to zero is a particular economic concept having to do with entry and exit from the sector. It represents the "normal" level of profit that is just enough to keep sector participants from going elsewhere. See Chapter 3 for more details on this.

Figure 2.3. The Gordon-Schaefer Model



Source: Cunningham, Dunn and Whitmarsh (1985)

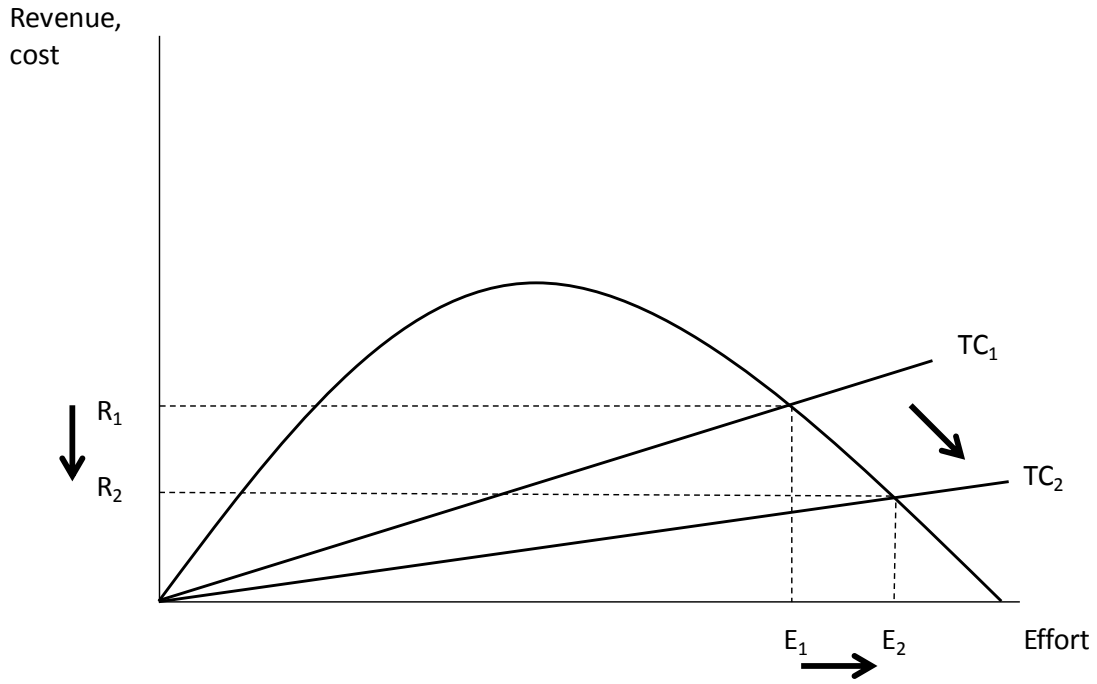
46. The G-S equilibrium where TR=TC reflects the long run situation where the growth of the stock and the level of harvest is in balance. To see that this is so, consider the shape of the TR curve, which after a certain point shows that increased effort lowers revenue. This is because high levels of effort eventually draw down the stock size such that harvests are reduced at that level of effort. For this reason, the TR curve is often called the "sustainable yield curve" as it describes the long term result of a particular level of effort. In any particular year, the relationship between effort and revenue is more linear - more effort will mean more harvest in the short run and more revenue, and the short run TR curve would always slope upward.

47. It is possible that the equilibrium of the G-S model is never reached. There is some path of adjustment of the stock over time, which can either tend towards this equilibrium, or end up in the collapse of the stock instead, if short run harvest levels are so high that the stock collapses before a long-run equilibrium is reached. This depends on the nature of the growth function, how harvesting costs relate to stock size, and initial conditions.[6]

6. The dynamics of stock adjustment over time are beyond the aims of this paper, but the interested reader can consult Conrad and Clark (1987) for a useful discussion.

48. It is also possible that if the equilibrium occurs a low stock level, natural variations due to external factors can act to collapse the stock. That is, the long run equilibrium is inherently stable only if the stock is not exposed to significant shocks. This problem can be exacerbated by technological advances that lower the cost of harvesting, in particular as stock sizes get small. In the G-S model, cost-reducing technological change reduces the equilibrium stock level and revenue at the equilibrium (Figure 2.4).

Figure 2.4. Cost-reducing technological change in the Gordon-Schaefer Model



Introducing management controls

49. Until now, the G-S model has been used to analyse the "open access" case where no active or binding management system is in place. While forming the basis of much of fisheries economics, this is not particularly relevant to the current situation where the fishery management system is key to the equilibrium in the fishery. The G-S model is useful to graphically investigate how some fisheries management systems can impact the equilibrium outcome.

50. The first step in including the management system in the G-S model is to identify the objectives of management in terms of stock, and the control method applied to reach the objective.[7] In terms of the stock, two different goals are often seen: Maximum Sustainable Yield (MSY) and Maximum Economic Yield (MEY). MSY has long been the traditional management objective, as it produces the most yield from the resource, but MEY has become more popular as managers come to understand that it produces better economic results.

Maximum Sustainable Yield (MSY): *Managing the stock so that the annual harvestable amount is as large as possible. It implies keeping the stock at the level where growth is most rapid.*
Maximum Economic Yield (MEY): *Managing the stock so that the resource rent generated by the stock is as large as possible. It implies choosing the stock level that maximises total profits for the sector.*

51. Once MSY or MEY (or some other stock level) is chosen as an objective, the way to achieve it must be identified. Input-based controls limit fishing effort by restricting the set of allowable techniques or actions. For example, restricting the number of days at sea, limiting the length or power of fishing vessels, or the total number of vessels in the fishery are all forms of input controls as they place limits on the inputs that determine fishing effort. Output-based controls limit overall catch, such as by setting a Total Allowable Catch (TAC). Management instruments are discussed in detail in Chapter 4.

52. The open-access problem has been identified as a key issue in fisheries management - avoiding the "tragedy of the commons" is a common but not universal objective of fisheries management. While in economic terms, open access poses several problems of efficiency, and has practical problems of sustainability, there are many cases where the idea of restricting individuals' access to fisheries is resisted. This stems from different perspectives on the role and nature of the fishery. When it is seen as a public resource to be shared by all, the idea of restricting the privilege of fishing to a select few or "privatising" the fishery is difficult for many to accept.

53. For this reason, input or output controls have been put in place that either address the open-access problem or do not (Table 2.1). It is possible to manage the stock level of a fishery without significantly limiting access to it by fishers, but the outcomes can be quite different when compared with those controls that do limit access.

Table 2.1. Examples of Management Instruments

	Limited-Entry	**Unlimited Entry**
Input Controls	• Restricted Vessel licenses • Individual effort quotas	• Season limits • Vessel power, size or gear restrictions • Days at sea limits
Output controls	• TAC with individual quota or restricted license • Community-based quotas	• TAC with unlimited licenses • Landing taxes • Vessel catch limits

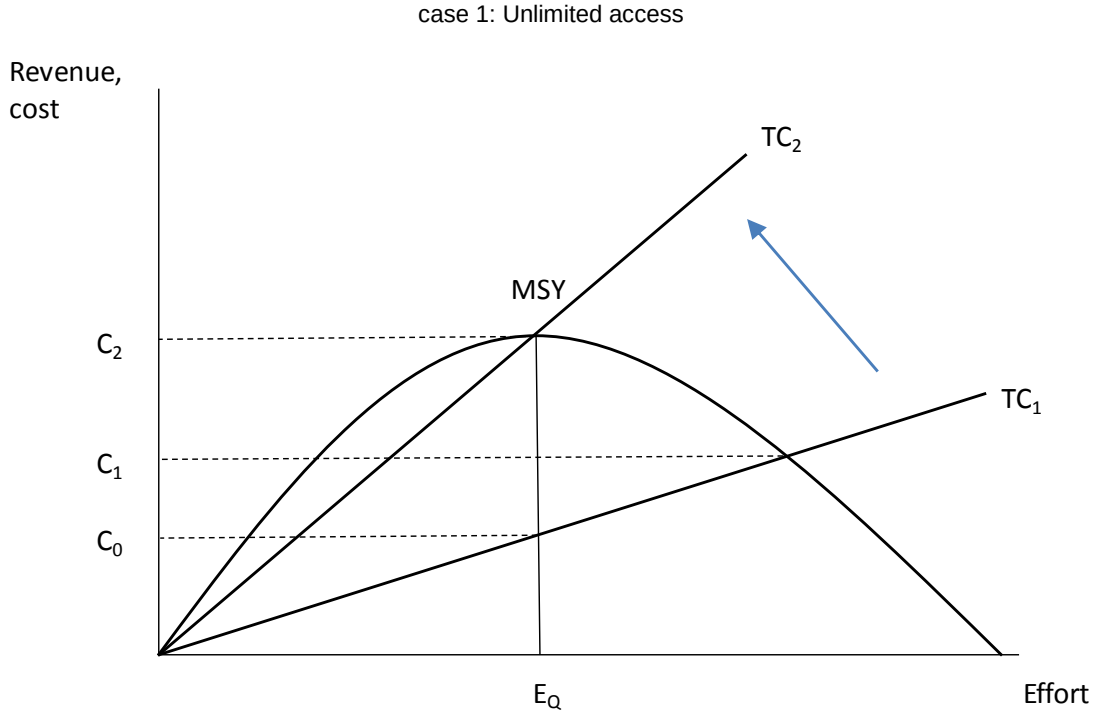
7. Because price is constant, revenue in Figures 2.3 and 2.4 also identifies harvest and stock levels. Quantity harvested has the same shape as the revenue function, being the revenue divided by price. The stock level is implied by the growth function, but in general terms would decline from left to right in the Figures. That is, higher effort means lower equilibrium stock levels.

What happens to profits?

54. The key difference in terms of economic outcomes is the preservation or dissipation of rents. It was demonstrated earlier that the open access equilibrium (as for the competitive equilibrium) occurs at the point of zero economic profit, where participants have no incentive to either leave or enter the fishery. When the quantity harvested (output control) or effort (input control) is effectively controlled by the management system, economic rents may still be dissipated, but the mechanism is a bit different. Fishers, understanding the limits that the management system place upon effort or harvest, will invest in methods that maximise their capacity to harvest and incur higher costs or accept higher risk as a result. They may also accept lower quantity harvested, resulting in a higher fixed cost per fisher as a share of total costs. This mechanism of adjustment is not clearly observable in the G-S framework, but acts like a shift in the cost per unit effort function (Figure 2.5).

*Economists use "**rents**" and "**economic profits**" interchangeably to mean those profits in excess of the amount required to stay in the industry.*

Figure 2.5. Adjustment after introduction of input or output control



55. This shift in the cost per unit effort has to occur, otherwise fishers would continuously enter the fishery to capture the potential profits. Any long-run equilibrium in a fishery with easy entry or exit must meet the condition TR=TC with zero economic profits. This leads to the phenomenon of "capital stuffing", where the amount of capital in the fishery in terms of vessels and gear is greatly in excess of the requirements to harvest the available amount. The implication of this is, without effective limits to entry, adjustment policies such as decommissioning schemes cannot be successful.

56. Figure 2.5 illustrates the situation of a shift from uncontrolled open access to controlled open access where overall effort or harvest is limited to that which yields the MSY level of output. The increased stock abundance at this level would normally reduce harvesting costs from C_1 to C_0, and enable rents equal to the difference between C_2 and C_0. However, the extra costs fishers incur from "racing to fish" or other strategies must increase costs until these rents are no longer available. The result is a shift of the cost curve from TC_1 to TC_2 and a new equilibrium with harvest at the MSY level and zero profits.

Capital Stuffing*—the tendency for excessive investment in productive inputs in response to regulations reducing fishing effort.*

57. The fact that rents of C_2-C_0 are possible at the MSY level, and the excess capacity represented by the curve TC_2 with higher costs C_2 at equilibrium have led fisheries policy makers in many cases to try to preserve these rents by limiting access to the fishery, thus preventing the behaviour that leads to the cost shift from TC_1 to TC_2. This could be done by granting licenses to existing participants in the fishery, for example.

Limited-entry and economic rents

58. When entry is limited, economic profits are not dissipated by new investment in the fishery, but what happens to these profits can be complicated to answer. It is a well-known phenomenon that such "excess rents" tend to become capitalised in the value of the input that is either most fixed or most directly connected to the restriction that gives rise to the rents.

59. For example, if a fisher is granted a licence to a fishery where his activities yield an excess profit of 1 000 dollars, that licence is therefore worth 1 000 dollars to the fisher. He would pay that much to purchase this licence, and others would pay that much to purchase it from him. If these licences were tradable, they would quickly acquire this value, such that the cost of obtaining them would cancel out the available rents in the fishery. If they are not tradable, this value passes to the vessel or other capital asset the ownership of which ensures the possession of the licence (See Box 2.2).

Box 2.2. The value of Licenses

Capitalisation is when the value of a future stream of benefits, such as profits, becomes embodied in the price or value of a fixed input. The input could be physical capital such as a vessel, or it could be a right to do something such as an assigned quota or license. The capitalised value of a quota that yields a certain amount of economic rents tends to follow the "net present value (NPV) formula" which is expressed as follows:

$$NPV = \sum_{t=0}^{N} \frac{R_t}{(1+i)^t}$$

Where R_t is the economic rent available in year t, i is a discounting factor reflecting the rate of time preference (often taken as the prevailing interest rate), and N is the number of years the rents are available. This is a forward-looking formula, as the value of R_t in the future is unknown; the fisher must form an expectation of this value based on the information currently available. It is possible for the NPV to increase or decrease over time as expectations of R_t are updated. The discount rate also takes into account future expectations - if the fishery or the quota system is not expected to persist, the discount rate will be higher to reflect this more short-term view of the value of the quota.

For example, the value of quota for the Sablefish fishery in western Canada was about CAD 20 per kilo when it was introduced in 1990, reflecting a NPV of the future profitability of the fishery as about 60 cents per kilo per year, assuming a 3% discount rate. By 2004, the value of quota had increased to CAD 100 per kilo, equivalent to about CAD 3 per kilo per year (OECD 2010). The increase in value came about from improved expectations regarding the stock under the new system. The annual value of the rent generated by the quota can also be observed when such quota is leasable on an annual basis. For example, in 1993, halibut quota allocations in western Canada were leasing for CAD 3.30 per kilo for a single year (Casey *et al.* 1995).

60. In only very limited cases could we expect the available profits in the fishery to be transformed completely into extra income for sector participants - the licence would have to be assigned to a fisher, non-tradable, and revert to the government upon the retirement or death of the fisher. This is not, however, necessarily a policy objective to be sought, as this is fundamentally a question of distribution - who should get these rents?

61. It has already been discussed that economic profits or rents are not desirable nor expected in normal economic situations, so preserving such rents for fishers is not obviously required. The first goal of the management system is to obtain the right harvest level with respect to the capacity of the stock, and this is why limits are often put in place. That such limits can generate rents is a consequence that can be dealt with in a number of ways.

62. When in the managed open-access situation (Figure 2.5) it was observed that costs to fishers increased from TC_1 to TC_2, exhausting economic rents. However, these increased costs are revenue for others such as input suppliers who are able to capture some of the benefits of the increased productivity of the resource. The rents do not disappear - they are dissipated elsewhere in the economy and thus benefit those who have some connection to the sector, e.g. vessel builders, net suppliers. Only in the case where the objective of the government is to enhance income for fishers would policies designed to keep these rents in place be used.

63. The rents that are generated by the management system can be distributed in unexpected ways. When tradable quotas are given away to sector participants, those initial recipients of the quota capture the benefits, as newcomers to the fishery are required to pay the present discounted value of the expected future rents in advance when they purchase quota. This makes sense to the purchaser as at a minimum "normal" profits are still available after the cost of the quota, they may have a cost advantage over the seller, and improvements in technology or fish stocks may increase rents over time. If the quotas are

initially auctioned off to fishers, then the government captures the initial economic rents, with later increases accruing to quota holders.

Summary

64. In the case of effort controls, and particularly when the fishery remains substantially open-access, it can be seen that the management system puts a set of constraints on the fisher to which they respond by changing their investment and fishing behaviour. This change in behaviour tends to increase their costs such that the economic benefits of improved stock management tend to be lost to the suppliers of inputs.

65. Output controls with limited entry do more to change the economic incentives facing fishers, and so are less likely to drive up costs. In fact, when quota or licences are tradable, costs may actually be reduced as lower-cost fishers are able to outbid others for quota.

The management system:

- *Changes incentives by changing market structure*
- *Constrains fishers by limiting actions through regulation*

66. This chapter has dealt with a number of economic aspects of fisheries and fisheries management. These concepts will be expanded upon in forthcoming chapters that are strongly implicated by them. Chapter 3 covers questions of capacity and investment in fisheries and so deals more explicitly with the incentives to invest in fisheries and overcapacity as an equilibrium outcome. Chapter 4 will address management mechanisms with a particular focus on market-based economic instruments, demonstrating how different systems can work with or against the incentives faced by fishers. Chapter 5 will discuss the economics of rebuilding fisheries.

67. Here are some of the main findings of this chapter:

- The open-access problem in fisheries is perhaps the most important exception to standard neo-classical assumptions, leading to an equilibrium outcome that is different from the optimal outcome.

- The fisheries management system corrects for the above by imposing controls on overall harvest. These controls can be based on inputs (effort) or output, and may or may not correct the open access problem.

- A consequence of management controls on harvest is capital stuffing, where investment in fishing capacity lead to higher costs, especially where fishers incur higher costs to avoid effort controls. This problem is worsened when fishery-specific capital is relatively long-lived and immobile between sectors.

- Management controls can also generate economic rents which can be captured as extra income by a number of different sector participants, depending on the specifics of the system.

- The resilience of a fishery depends strongly on the nature of the growth function and how the cost of harvest changes with stock size, especially at low population levels.

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CHAPTER 3: DEALING WITH CAPACITY ISSUES IN FISHERIES

68. There are few countries where policy makers are not concerned about the size and composition of the fishing fleet. Despite the ongoing policy effort aimed at adjusting fleet capacity, overcapacity remains high on the list of concerns of fisheries policy. Part of the problem of overcapacity has to do with the decline of fish stocks compared with the useful life of a fishing vessel. Part is due to earlier policy efforts to build up capacity. Part is due to the variable nature of fish stocks. Mainly however, overcapacity is the result of individuals making the decision to participate and invest in fisheries despite the fact of existing technical overcapacity relative to allowable harvest levels.

69. Why would people choose to invest in fisheries when the fleet is already more than sufficient to catch the harvestable biomass? The simple answer is that it is profitable to do so. Technical overcapacity is an equilibrium phenomenon. It is not a result of fishers' error and it is not self-correcting. In fact, many policy makers' conclusions that there is "overcapacity" in the fishery come from the observation that profits are too low. However, this is an assertion by lobbying organisations more than it is a certain fact. Business groups in every sector of the economy wish their profits were higher and express dissatisfaction to their government in the hope of obtaining supportive policies. This is a normal part of lobbying by interest groups, but it doesn't mean that current profits are inadequate in an economic sense. If they were, overcapacity is a problem that would solve itself.

Technical overcapacity exists when the potential harvesting capacity of the fishing fleet is larger than the harvestable biomass.
Economic overcapacity exists when the return to investment in fisheries is less than that of other sectors.

70. When working properly, economic forces move investments around in an economy to their most profitable use. But, new entrants to a sector tend to reduce overall profitability, so the result is an equilibrium situation where "economic" profits are zero (See Box 3.1). At this point, investments in fisheries would return the same amount as investments in any other sector; there are no excess or "economic" profits to be made by investing in fisheries. If investments in fisheries had lower returns than investments elsewhere, then economic overcapacity exists and individuals would reduce their investment in fisheries, either by running down (depreciating) their capital or by selling their invested capital and moving on.

Box 3.1. How do economists think about profits?

Economists are very excited about the idea of "zero economic profits". This is a key indicator of well-functioning markets and describes the optimal equilibrium condition of markets and the economy. But zero profits doesn't sound very attractive, and more profits are better than less profits, so what makes the idea of "zero economic profits so attractive?

First of all, economic profits have a fairly particular definition. Economists call what people normally think of as profits "accounting profits". The difference is that economic profits include what are termed "opportunity costs", which is the amount of money you could have made by investing in the next best thing. If you can make $100 by investing in Activity A and $90 investing in Activity B, the accounting profits in Activity A are $100, but the economic profits are only $10, as by choosing Activity A you give up the chance to earn $90 in Activity B.

This seems like a silly way to measure profits, but it actually has a very important use. It is comparing different investment opportunities by showing how much more (accounting) profits can be made by investing in the most profitable versus the next most profitable activity. So long as economic profits exist, someone can make more money by making better choices (by moving from Activity B to Activity A, say).

This movement has the effect of equalising the amount of profits to be made in any possible activity—balancing the returns on investment in different sectors of the economy. When investment returns are balanced, economic profits are zero, and no extra profit is to be made by readjusting investment. And that is the optimal economic equilibrium.

71. For example, if a gas station at a busy local intersection is doing a booming business and making lots of money, there is an incentive for others to try to get in on the action by opening their own gas station nearby. Even though everyone involved realises that this will lower the overall profit everybody earns as customers are divided among the gas stations, the investment will still make sense if the profits it can generate are higher than what could be made elsewhere. This is why it is common to see as many as four gas stations occupying each corner of an intersection. One might look at this and wonder if so many gas stations are required. Technically there is overcapacity, as there are more gas stations than are needed to meet the demands of local motorists, and each gas station makes less profit as a result of the presence of the others, but economically it is an optimal use of investment resources. In fact, any policy intended to alter this outcome would probably lead to worse problems elsewhere as the investment market becomes distorted by policy.

72. The point is that technical measures of capacity do not by themselves indicate the "right" level of capacity in the fishery. Whether someone invests in fishing capacity depends on the return to that investment compared with other possible investments. Normally, this leads to optimal outcomes in the economy as resources are allocated to the use that offers the best return.

73. If economic forces lead to the right amount of investment in the fishery, what is the problem? Well, unlike gas stations, fishers are using a common resource, so all the warnings and problems of the tragedy of the commons apply. That is, the amount of fishing capacity that would lead to zero economic profits in the sector does not lead to a optimal level of fish being harvested. Unlike the case for gas stations, the normal economic equilibrium does not lead to optimal resource use. The result: too many fishers chasing too few fish. Moreover, if it is generally the case that the optimal economic fleet capacity implies a technical overcapacity, that can lead to other problems for the policy maker.

74. Now is a good time to discuss why a policy maker would care about overcapacity. Two issues stand out as commonly cited reasons to try to control or limit capacity: Managing the stock at MSY or MEY, and maintaining the profitability of fishing. However, neither of these are truly capacity issues. A well-designed management system should be able to maintain the stock at the desired level irrespective of the number of fishers, and as far as profitability goes, fishers vote with their feet (or boats), entering or leaving the sector depending on the profits to be had. Efforts to increase profitability can only exacerbate

problems with technical overcapacity, as higher profits make the sector more attractive to new entrants. This is why trying to increase sector profits with decommissioning schemes is such a treadmill; if reducing the number of vessels increases average profits, the incentives to invest in the fishery just get that much higher.

75. While the management system should ideally be able to maintain the stock at the desired level regardless of the number of fishers, overcapacity does make this more difficult. There are several ways that overcapacity puts additional pressure on the management system.

- It increases the size of the sector lobbying organisations and provides them with ammunition (claims of lower profits) to support their demands for increased support.
- It increases pressure on fisheries managers to increase allowable effort or catches to provide greater fishing opportunities in order to match harvests to capacity.
- It increases the temptation towards IUU fishing as the capacity to fish illegally is readily available.
- It complicates and increases the cost of monitoring and enforcement when a large number of vessels are participating in a fishery.

76. The above reasons help explain why an objective of fisheries policy in many countries is to match the size of the sector to available biological resources. In short, it helps to reduce conflicts and maintain an orderly sector that is easier to manage effectively.

77. For the policy maker, dealing with capacity issues in fisheries starts with understanding that, without careful policy design, overcapacity as it is commonly understood is to be expected in most cases. To reduce technical overcapacity requires changing the conditions that led to it. This is one of the reasons that ITQ systems have seen success - tradable rights strongly promote concentration in the sector, leading to much capacity being shed. This will be discussed in greater detail in the section covering market mechanisms.

Overcapacity versus adjustment

78. As discussed above, the problem of technical overcapacity in a fishery is not an unusual outcome given the incentives to invest in a fishery and the differences between technical and economic overcapacity. Sometimes however, a situation occurs that calls for significant adjustment in the fishery. This could be from a collapse in the fish stock or other event that leads to a significant reduction in TAC or effort. It could result from a natural disaster, a change in support policy or an impediment to trade. A sudden change in the ideal size of the fleet in terms of economic capacity calls for *adjustment*, a change in capacity due to a (one-time) change in situation. These adjustment programs are aimed at the sudden presence of *economic overcapacity*.

79. Policy responses in this situation may be different from the way overcapacity is dealt with under normal circumstances. This is particularly the case when the shock to the system comes as a result of a policy change such as a change in the management system or support for the sector. Sector participants may demand compensation and adjustment assistance, and policy makers for their part may wish to prevent vessel owners or license holders from having large losses (Holland et. al. 1999).

One-time adjustment policies *are more easily justified than ongoing capacity schemes.*

80. The same policy tools are applicable for adjustment assistance as for capacity adjustment generally. These include decommissioning schemes such as licence or vessel buybacks or scrapping, along with pensions or other early retirement aids, retraining and extension of unemployment benefits. The main difference is that adjustment assistance should be explicitly tied to the change in situation faced by the fishery, and should be therefore time-bound in its application and targeted exclusively to those leaving the sector. A key differentiator between adjustment assistance and other forms of capacity adjustment is that the former is operating in a situation of economic dislocation, while the latter is trying to alter the investment and participation choices of individuals.

81. It may seem normal for a policy objective to be to prevent or compensate those who invest in the fisheries from economic losses, in particular when they stem from government-led factors such as a change in TAC. However, policies that do so systematically change the level of risk that individuals must bear when investing in a fishery. Less risky investments are generally preferred, and require a lower average rate of return than do more risky investments. So policies that systematically and significantly reduce the risks of investing in fisheries will have the impact of increasing the level of investment. When fishers know the government will compensate them when times are bad, they are more likely to stay in a fishery even if the income they earn is relatively poor.

Overcapacity and the management system

82. The fact that technical overcapacity is a common feature of fisheries, and the fact that technology tends to increase this fact over time means that the management system should ideally be robust to this fact. That is, the system should be able to tolerate a situation where fishing power exceeds available harvest without leading to overharvesting and a collapse of the resource.

83. In general, OECD research and recommendations have tended to support output- and market-based controls on fisheries over input controls. One of the reasons for this is their better tolerance of capacity issues. Controls on effort are easily thwarted by investments that increase fishing power within the limits of the regulations. For example, limiting vessel length leading to wider vessels, or limiting fishing days leading to faster, more capable vessels and the "race to fish". By their nature, input controls will always be chasing technology and fighting the capability of fishers to increase harvest via alternative means.

The management system has more impact on fishing capacity than most capacity adjustment schemes.

84. Output controls eliminate this by limiting the overall harvest of the stock to a defined TAC. Output controls are limited by the ability of the fisheries manager to enforce them effectively in the face of hidden landings or high-grading or other at-sea discarding activity, but when this is well-managed, capacity problems tend not to be severe. When output controls are combined with tradable access permits such as ITQs, they have been proven to reduce capacity such that technical overcapacity and economic overcapacity are much more closely balanced.

Policy approaches to overcapacity - Decommissioning schemes

85. In principle, the best option available to managers is to ensure that fisheries management systems are appropriately designed to prevent problems of overcapacity and overfishing from occurring in the first place. Management systems should provide appropriate incentives for fishers to automatically adjust fishing capacity and effort in response to changing prices, costs and environmental conditions.

Types of decommissioning schemes:

Vessel Buyback
Licence Retirement
Vessel Scrapping
Vessel Transfers

86. Decommissioning schemes take a variety of forms in OECD countries. These include vessel buyback programs, license retirement schemes, license buybacks, vessel scrapping programmes, and vessel transfer programmes, just to name a few. In the OECD countries, around USD 430 million were spent on such programs in 2005, accounting for 7% of total government financial transfers to the fishing sector.

87. These schemes are viewed as an active and visible policy intervention for dealing with the problems of excess capitalisation and capacity in fisheries. The political appeal of such schemes is strong and governments who introduce them generally expect to reap benefits from the high profile that is often attached to the introduction of the schemes. Industry is also often active in seeking the implementation of decommissioning schemes, both to improve the profitability of the fishers who remain in the industry and to provide a dignified exit from the fishery for marginal or unprofitable fishers. Lobbying for adjustment assistance is a regular feature of fishery organisations' representations to governments.

Expenditures on decommissioning schemes in OECD countries totalled around USD 430 million in 2005, accounting for 7% of total government financial transfers

Preliminary considerations prior to the development of decommissioning schemes

88. Decommissioning schemes can be effective when urgent action is required in order to bring fishing capacity in line with available fisheries resources. However, the effectiveness of these schemes is critically dependent on considerations of preliminary issues (such as an assessment of the current regime of management and the source for financing of the scheme). It is essential that the full range of management policies in place for the fishery, including the decommissioning scheme to be developed, are coherent and mutually supportive. If they fail to meet their objectives of permanently reducing capacity, decommissioning schemes result in a waste of public resources, increased pressure on fish stocks, and the creation of barriers to future adjustments in the sector.

89. In the case where the fishery is on open access, decommissioning payments will have no effect on fish stocks as new vessels will enter the fishery to replace the scrapped vessels. Indeed, the effects may be negative on stocks as decommissioned vessels would be replaced by new vessels which are typically more efficient than older ones. This was the case with the Washington State Commercial Salmon Fishery in the United States which was essentially open access during the 1990s and had a series of three buyback programs in the late 1990s at a cost of USD 14 million. The review of the three programs found that they were not effective at making inroads into fishing capacity due precisely to their open access nature. The expected outcome is the same with a regulated open access regime where only the catch is controlled.

90. Also, when effort is not controlled in a fishery, the implemented scheme may fail to deliver. This is caused by the effort expansion in limited entry or regulated open access fisheries following the implementation of a scheme. This happened in the Australia's Northern Prawn Fishery which has been controlled by input measures and has been subject to almost continuous restructuring and capacity

reduction over the past two decades. However, improved harvest technology and a rise in the use of unregulated fishing inputs largely negated the effects of the dramatic capacity reductions that took place.

91. In the case where there are effective use or property rights, vessel decommissioning schemes have no effect on landings, but they can speed up the adjustment process and reduce pressure on the management system stemming from poor profitability, enforcement difficulties and lack of compliance with regulations. It also can reduce pressure on the ecosystem. The remaining owners of the quota or effort rights receive the benefits from capacity leaving the fishery but have no incentive to expand effort or capacity and so decommissioning schemes merely represent a transfer from taxpayers both to those leaving the industry and to those remaining behind. For instance, Norway's buyback programs have resulted in improved profits due to the introduction of an individual quota regime under which vessels are tied to the quota.

92. Second issue to be addressed before the development of the scheme relates to financing. This should be clearly defined prior to any action taken in order not to weaken the political credibility of the reform. Instinctively, the first argument that comes to mind when questioning the financing of schemes is the "beneficiary pays" principle, which would require that industry participants who stand to benefit from a policy intervention should contribute to the costs of the policy intervention. This principle forms the basis of the cost recovery programs used in New Zealand, Australia and Iceland, to name a few. In most cases, however, decommissioning schemes have historically been funded by governments. This has partly reflected a concern that the need for decommissioning is required to correct for past policy failures. For instance the shrimp vessel decommissioning scheme undertaken in Mexico in 2005 was 100% government funded. Similarly, decommissioning schemes in Canada and Japan have been fully publicly funded.

93. Increasingly, mixtures of public and private funding are being used. In these cases, the industry contribution is often facilitated through a government loan that is then repaid through annual charge on landings or through license fees. A trend towards greater industry involvement is evident in the United States where the recent three large schemes have been predominantly funded by industry. Norway provides another model for facilitating public/private funding through a fee on value of first-hand landings of every Norwegian fishing vessel and a capital injection from government. From experience, it seems that a combination of industry and public funding improves the incentives for cooperative management of the fishery as the remaining fishers have an stronger stake in the future of the fishery, particularly if there is sound fisheries management in place.

Design and implementation of decommissioning schemes: issues and best practices

94. Based on a review of case studies by the OECD, the performance of decommissioning schemes can best be regarded as mixed. While some schemes have achieved lasting capacity reductions in, others have seen combinations of high program costs and only transitory impacts on capacity.

95. The design of decommissioning schemes should first identify the target of adjustment: vessels, licenses or both. This choice must take into account the objectives of the scheme, the rules that govern participation in the sector and budget constraints (purchasing licenses being often cheaper than purchasing vessels). The quantitative objectives of the scheme should be well-defined, clearly articulated and measurable in order to ensure that the reduction targets are achievable and will have a positive impact on resource sustainability and the economic structure of the sector.

96. The way in which prices are determined for vessels, licenses, fishing rights or gears buyback is an important design consideration. The mechanisms to determine the prices paid to decommission vessels, permits, licenses and other entitlements should maximise the impact of public funds in terms of changes in capacity.

97. Four broad types of mechanisms have been used to determine prices: auctions; fixed rate payments; one-on-one negotiations; and independent valuations (Holland *et al*., 1999). The advantages and disadvantages of each vary according to different situations (See Box 3.2). The process should elicit the valuations that individual fishers have of their willingness to sell their vessel or license. The following box gives some insights on the difference between auctions and fixed-rate payments.

Box 3.2. Auctions vs. fixed-rate payments

Auctions are the most effective means of ensuring that buyout prices for vessels or licenses reflect their value to their owners. There are many different auction formats, but they depend on the bidding process to lead owners to offer their vessel or license for the full value that they ascribe to it.

For auctions to work properly there needs to be sufficient bidding competition (Curtis and Squires, 2007. A small group of potential bidders will have the opportunity to collude with each other on bids, or use other forms of strategic behaviour. There are also risks when auctions take place over a sequence of years. For example, multiple round auctions were used in the British Columbia license retirement scheme. Such a system provides scope for fishermen to use the results of preceding bidding rounds to update their bids. In other cases, there may be a process of ongoing buybacks. As these become routine, bidders can determine the maximum likely acceptable bid rather than bidding according to their true opportunity costs.

Fixed-rate payments can be easier to administer than auctions and can improve transparency. In this process, the government offers a price to buyback vessels or licenses and the fisher is faced with a take-it-or-leave-it decision. This reduces uncertainty and transaction costs for both fishermen and the regulatory agency. However, fixed rate payments run a significantly greater risk of being inefficient due to problems arising if the price is set too high or too low. Unlike auctions, they require the government to have good information on the true value of licenses or vessels.

Fixed rate payments generally take the form of a payment of a flat rate per vessel or license or a payment that is weighted according to specific criteria (such as vessel tonnage or power or target species). Both types of fixed rate payments are often combined with government evaluation of the applications against specified criteria to help determine whether the bids achieve value for money or meet particular goals.

The use of flat rate payments is relatively rare. This process was used in the Mexico shrimp fishery where over 200 vessels were decommissioned in a trial scheme in 2005. The use of weighted fixed rate systems tends to be more common in Europe. Individual EU countries add a further weighting to the criteria under the Common Fishery Policy in order to adapt the buyback applications to meet their particular objectives in terms of fleet or fishery or target species. In France, for example, payments under the 2006 scheme were weighted according to the fish species targeted by the vessels. Decommissioning schemes in Denmark have used weighted fixed rates per vessel, but a process of comparative bidding was also used to select which vessels were to be awarded decommissioning grants.

98. The social acceptability of the scheme is a key design factor. Stakeholder involvement in the design and implementation of decommissioning schemes can improve participation and compliance with the schemes' objectives and operations. The use of pilot programs may help. Stakeholder involvement will also improve the likelihood of cooperation in the post-adjustment management of fisheries.

99. A fishery may have a large amount of idle capacity, such that a decommissioning scheme can mop up this latent capacity without impacting the amount of fishing effort. There may be advantages to purchasing latent effort first in order to ensure that it is not reactivated when a buyout of active capacity improves the economic conditions improve in the fishery. In any cases, governments should target both latent and active capacity to ensure that capacity is effectively reduced and that capacity does not become reactivated in the fishery following the decommissioning scheme.

100. *Ex-post* evaluations of the effectiveness and impact of decommissioning schemes are important to understand whether the programme has achieved its objectives. Four broad types of *ex-post* evaluations

can be identified: national governments undertaking in-depth evaluations of decommissioning schemes; national auditors focusing on specific schemes and through in-depth reviews of the effectiveness of the scheme; supranational bodies (such as the European Commission) or inter-governmental organisations (such as the OECD) carrying out evaluations; or academic community undertakes research on the economic costs and benefits of decommissioning schemes. Long-term evaluation is required to gauge whether a capacity adjustment process was durable.

Political economy

101. Fishers act according to expectations about future policies and programmes, making the outcome of a decommissioning scheme hard to anticipate. Three factors need to be taken into account in the development of a decommissioning scheme. These are the motivating factors behind the introduction of decommissioning schemes, their role as providing compensation to fishers and the credibility of the objective and the government's efforts to achieve it.

102. One of the advantages of decommissioning schemes is that they demonstrate action and policy commitment. Allowing fleet capacity to self-adjust can be perceived as a lack of interest on the part of the government, and results are more difficult to measure. Moreover, such programmes deliver funds to the sector, which has political benefits. This is balanced against the expense of such programs.

103. Decommissioning schemes can overcome resistance to management reforms by providing compensation to those who stand to lose from reform. Compensating transfers in the form of "buyouts" can be critical in obtaining the consent of affected individuals and groups to management change and allowing the change to take place. They can also be used to drive a wedge between subgroups within a fishery that may be blocking the management reform. This serves to break down the homogeneity of the group's interests and can increase its coordination costs. In this case, the decommissioning scheme serves as an enabler of needed reform rather than solely a means to adjust capacity.

Capacity adjustment programmes *can be an important part of a larger reform process by compensating fishers and aligning interests.*

104. Decommissioning can be driven by distributional concerns and can be used to offset the negative effects of change. Decommissioning schemes provide a means for individuals to exit the industry with dignity and with some return on their investment in the fishery over the years. Hence, the government can step in to buy the assets of fishers, allowing them to either relocate or retrain. However, providing decommissioning grants in the absence of other policy measures to assist economic diversification may not necessarily lead to sustainable social outcomes, particularly in fishery dependant coastal regions.

105. The credibility of government policy over time is central to ensuring that fishers receive the appropriate signals for ensuring sustainable and responsible fishing. As noted earlier, capacity adjustment programmes can indicate to fishers that the government will cover losses that may arise from excessive investment in capital (i.e. vessels). This would in general promote overinvestment in the fishing industry. This can be limited if a decommissioning scheme for a particular fishery or fleet is announced as being a "one-off" opportunity for adjustment or exit, rather than a repeated scheme for the same fishery.

106. Also, policy incoherence can significantly undermine policy credibility when it comes to fleet adjustment. A classic example is the coexistence of decommissioning schemes and payments for vessel construction and modernisation. This was the case until 2004 in the European Union where fishing vessels were given grants to leave the fleet on the one hand while the European Union was providing grants for construction of new vessels and modernisation of existing ones on the other hand. These contradicting signals called into question the commitment to structural adjustment and supported excessive investment.

Key Insights

- Technical overcapacity is not the same as economic overcapacity. The decision to enter a fishery depends on the return to investment, not the overall catching power of the fleet. Therefore, chronic technical overcapacity by itself does not justify a policy response.

- If technical overcapacity is a normal feature of fisheries, the management system should be robust to this. Output-based control systems tend to be superior to input-based control systems in this respect.

- Capacity adjustment schemes have a more sound policy rationale when they are in response to relatively sudden and unique changes in the economic situation of the fishery. In this case, they should be carefully targeted and time-limited.

- Market-based systems such as ITQs can bring technical capacity more into balance with economic incentives.

- Capacity adjustment programs can serve an important role in the policy reform process. They deliver funds to the sector to compensate for changes, signal action on the part of the government and can help align interests for reforms.

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CHAPTER 7: POLICY COHERENCE

Introduction

107. Chapter 1 described the different policy objectives of governments and presented ways in which objectives may be developed and pursued effectively. In most OECD countries, there are many objectives of fisheries policy, covering the state of the resource and surrounding environment, number, distribution and characteristics of fishers and so on. Chapter 1 reinforces the need for these objectives to be considered together when developing policies, and for those policies to be clearly matched to objectives.

108. But the fisheries sector has broader policy coherence problems than ensuring that fisheries objectives are compatible and effectively met. What happens in the fishery sector will be important in meeting broader government objectives concerning rural development, environment, social equity and fairness, trade and food security, among others. For this reason policy coherence has been identified as a key element of the OECD Green Growth Strategy and should be an integral part of the planning process for policy development in fisheries and elsewhere.

109. The need for policy coherence is even more important in developing countries, where the need for growth to reduce poverty is more acutely felt and where fisheries makes up a relatively larger share of the economy, and where fishers are predominantly poor and rural. For millions of people in developing countries, fisheries and aquaculture represent a means of livelihood, a source of food and nutrition, and a potential source of economic growth. In many parts of the world, fish is the main source of protein and this is especially the case for the poor with few other alternatives other than to go fishing.

110. Fisheries are also under pressure. FAO finds that three quarters of global marine fisheries are overexploited or fully exploited, and the pressure on fish stocks is increasing. Demand for fish is increasing as consumers throughout the world augment their living standards and seek healthier foods. It should also be noted that more than half of the fish eaten in OECD countries have their origins in the developing countries. As such fish is one of the most internationally traded food stuffs and trade policies play a key role for producers and consumers.

111. For OECD and non-OECD countries alike, the global fisheries situation poses some important challenges of coherence between development and fisheries objectives in a number of areas. This chapter looks at policy coherence for development and proposes a framework for the analysis of coherence issues.

112. The UN Millennium Summit, the Monterey Consensus, the Doha Development Agenda, the Johannesburg World Summit for Sustainable Development and the headline development meetings of 2005 have kept whole-of-government approaches to development high on the international agenda. Indeed the latest OECD Development Strategy, adopted by the Ministerial Council Meeting (MCM) in 2012, contains three overarching objectives:

- To improve the effectiveness and efficiency of the OECD's contribution to worldwide sustainable economic development;

- To enhance the OECD's and its Members' contributions to international efforts to achieve the agreed development goals, including the Millennium Development Goals (MDGs) and also looking beyond 2015;

- To help ensure that policies pursued by OECD members are coherent with the goal of promoting worldwide development.

113. Ministers at the MCM in 2012 also identified four priority themes for the OECD Development Strategy: innovative and sustainable sources of growth; mobilising resources; governance; and measuring progress.

114. Coherent or 'linking together' policies across government entities that support development objectives are an important contribution to achieving sustainable development goals worldwide, including the Millennium Development Goals and to the vision of the OECD Development Strategy. The aim of policy coherence is to better align national development objectives across the policies areas that potentially affect developing countries. In fisheries this would include areas such as trade, fisheries access agreements, provisions for capacity building in fisheries and aquaculture, joint management of fish resources (e.g. straddling and high seas stocks and RFMOs) and more generally development assistance directed to the aquaculture and fisheries sectors.

115. The focus of this chapter is on policy coherence for development. A number of questions are addressed: first, what does policy coherence (and policy incoherence) mean to fisheries managers? Second, how does this concept practically apply to fisheries policy and management? Third, what should a manager keep in mind about policy coherence when undertaking a reform or even in its day-to-day management? The chapter however starts by giving an overview of the concept of policy coherence.

The concept of policy coherence for development

116. Policy coherence has been defined by the OECD as:

"Different policy communities working together in ways that result in more powerful tools and products for all concerned. It means looking for synergies and complementarities and filling gaps among different policy areas so as to meet common and shared objectives. " (Source: Development Co-operation Report 2001, The DAC Journal, OECD).

117. In more simple words, coherence of policies is "ensuring that they are coordinated and complementary and not contradictory", as explained by Weston and Pierre-Antoine (2003). Policy coherence may be considered as a guide to policymaking suggesting that policy makers take a more holistic view, i.e. "whole of government view" in decision making (Box 7.1). Considering that expenditures on fisheries development policies amount to more than USD 500 million annually, these expenditures should be effective in delivering their stated objective and not be negated by lack of coherence with other policy domains.

Box 7.1. Policy Coherence for Development

The policy coherence for development framework includes four dimensions:

- **Internal**: the consistency among the ends, the means, and the resources that a country allocates to the implementation of development objectives
- **Whole of Government**: the congruence, complementarity and coordination of various policies within a country;
- **Harmonisation**: the consistency of policies across donor countries; and
- **Alignment**: the consistency between the policies and practices of one or more donor countries and its developing country partner(s).

118. In practice when translating the different dimension of policy coherence into policy making, three different levels of ambition can be identified: 1) various policies should be supportive of each other; 2) policies should not conflict; and 3) decisions regarding conflicting policies should be made in an open and transparent manner to mitigate possible negative effects.

Why policy coherence for development in fisheries

119. The international fisheries market is one of the most globalised and traded commodities. Fisheries employ some millions of workers directly worldwide and more than a billion people rely on fisheries for their protein intake. OECD countries are major consumers of fish and fish products and import more than half of their consumption from the developing world.

120. Many developing countries have rich fisheries under their management. This is especially true for tuna. The change in international fisheries legislation and in particular the institution of the 200 mile EEZs have made these fisheries a target of developed countries' fleets seeking to use available capacity. This has opened a market for trade in fishing rights and access agreements.

121. With growing incomes across the world and the emergence new purchasing power from countries such as China, India and Indonesia, fish consumption is forecast to continue to increase. Notwithstanding the capacity for aquaculture to respond to this demand, the implication is that pressure on wild resources will continue to increase.

122. Concurrently, and in particular in developing and emerging economies the fisheries sector plays an important social role in absorbing surplus labour. This, combined with poor fisheries governance and poor surveillance and enforcement, puts pressure on the wild fisheries –both the marine and inland.

123. It is against this background that the importance of policy coherence for development needs to be addressed. The economic, social and environmental sustainability factors of fisheries are important for developing and developed countries alike. And hence the need to ensure that the policies of both developed and developing countries with respect to policies applied to the fisheries sector are coherent and work towards congruent outcomes (Box 7.2).

Box 7.2. Policy coherence within and between countries

There are four categories that countries can use to consider the policy coherence of their policies

- Internal coherence: consistency between goals and objectives in a specific policy or programme.
- Intra-country coherence: consistency between aid and non-aid policies.
- Inter-donor consistency: consistency between aid and non-aid policies across countries in terms of contribution to development.
- Donor-recipient coherence: the consistency of policies adopted by rich and poor countries to achieve shared development objectives.

Source : Hersoug (in OECD 2006)

124. Three policy areas have attracted particular attention for the policy coherence agenda. These are governance , trade policies in fish and fish products and fisheries access agreements. Each of these policy areas and their relevance to the fisheries case will be briefly discussed in below.

Governance

125. Central to sustainable and responsible fisheries is the existence of a governance structure that can deliver on stated objectives with respect to fisheries management. Fisheries governance as defined by the FAO "is a systemic concept relating to the exercise of economic, political and administrative authority. It is characterised by:

- guiding principles and goals, both conceptual and operational;
- the ways and means of organisation and co-ordination;
- the infrastructure of socio-political, economic and legal institutions and instruments;
- the nature and modus operandi of the processes;
- the actors and their roles;
- the policies, plans and measures that are produced; as well as
- the outcomes of the exercise"

126. A central issue in fisheries is that governance has national, regional and international dimensions and is pursued through various institutional mechanisms (e.g. international treaties, regional management arrangements, national laws and institutions). And these institutional mechanisms evolve over time to encompass new challenges that arise. For example, the ecosystem management approach is a relatively recent addition to the manager's toolkit while the development of appropriate policy responses and tools to address IUU fisheries is still on-going.

127. In many emerging economies the lack of resources to provide a robust approach to governance is a serious problem. In many countries the political economy of fisheries reform combined with pressures from various stakeholder groups is a challenge for policy makers that has led to many examples of failed reform and poor fisheries management outcomes.

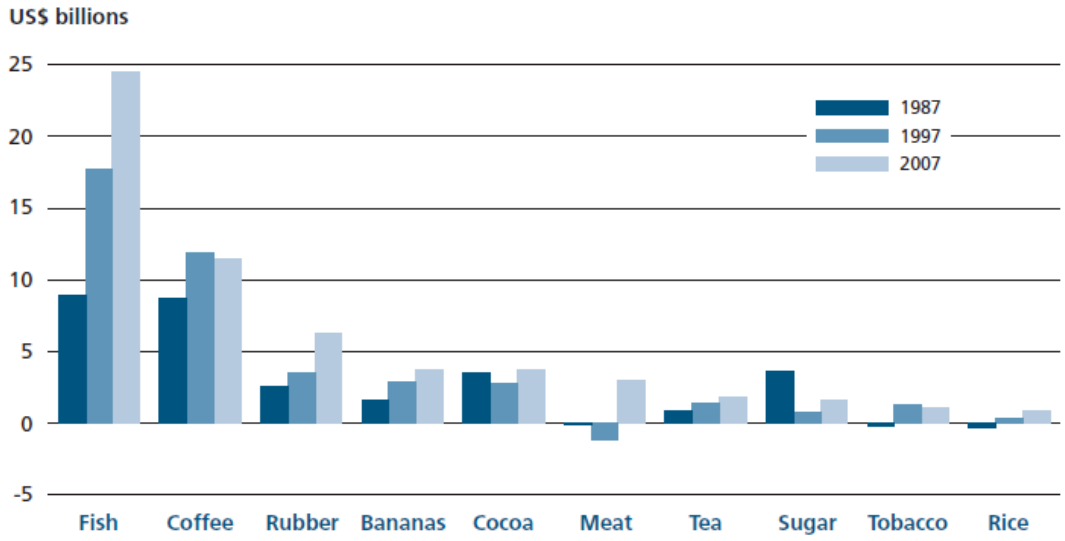
128. Addressing management challenges and building strong governance structures is a shared objective for all countries. Development assistance can usefully be applied towards this. In fact, the Johannesburg Plan of Implementation (adopted by the WSSD meeting in September 2002) states that:

129. *"To achieve sustainable fisheries, the following actions are required at all levels: … strengthen donor coordination and partnerships between international financial institutions, bilateral agencies and other relevant stakeholders to enable developing countries, in particular the least developed countries and small island developing states and countries with economies in transition, to develop their national regional and sub-regional capacities for infrastructure and integrated management and the sustainable use of fisheries".*

Trade policies in fish and fish products

130. For developing countries the exports of fish and fish products is of particular importance, with the value of exports exceeding that of many other agricultural commodities (Figure 7.1). For comparison, the European Union in 2008 imported a total of USD 23.9 billion of fish and fish products from non-EU suppliers, Japan imported for USD 14.9 billion and the United States USD 14.1 billion.

Figure 7.1. Net exports of selected commodities from developing countries



Source: FAO State of the World's Fisheries, 2010

131. Emerging economies play an increasingly important role for global trade in fish and fish products. This has taken place as production in both capture fisheries and aquaculture has increased more rapidly in the emerging economies than in OECD countries. Three of the most important exporters of fish and fish products are China, Thailand and Vietnam.

132. Trade policies as applied to fish and fish products are therefore an important consideration in policy coherences for development. Tariffs, while low compared to other food products are still in place for fish and fish products in major import markets. While preferential access agreements provides some relief, tariff escalation can make it difficult for emerging economies to add value to their domestic production before export. Such tariff structures conflict with the development assistance goals of the countries that impose them and as a result protect domestic processing at the expense of trade-driven development.

133. There are also a number of non-tariff barriers in place that may make it difficult for emerging economies to benefit from their resource endowment. These include requirements with respect to labeling, packaging, inspection, sanitary standards and recently eco-labeling initiatives. Costly requirements placed upon emerging economy exporters also bias trade towards bulk products (fillets, loins with little value added rather than, e.g. ready meals) and prevents the development of value added products.

134. Eliminating trade barriers can help developing countries advance and is relative simple (aside from its political feasibility), but finding solutions to non-tariff barriers can be more challenging. Sanitary and packaging requirements and other technical standards are an important part of health and safety objectives of importing countries. So long as they are not discriminatory against imported products, these requirements are unlikely to be changed. Importing countries can help by providing investments in infrastructure and expertise to help developing country exporters to bring their products up to international standards. For their part, developing countries should not hinder the development of modern infrastructure in favour of artisanal fisheries and should be receptive to foreign direct investment.

Fisheries access agreements

135. Fisheries access agreements have their origin in the introduction of 200 mile Exclusive Economic Zones (EEZs). These expanded EEZs, which became commonplace as from 1977, prevented many long-distance fleets from accessing fisheries where they traditionally operated. Thirty five years later, fisheries access agreements are still in place but now they seem to be driven by excess fleet capacity in the countries that use them. This has its roots in the failure of these countries to undertake effective structural adjustment of their fleets to correspond to available domestic resources. While some of the countries granting access to their fisheries would not have developed a domestic fishery, in many cases these access agreements prevent domestic fisheries from reaching their potential.

136. The development benefits of fisheries access agreements are modest in relation to their costs (OECD, 2006). While financial compensation may be substantial, and therefore difficult for emerging fishing countries to resist calls for access agreements, these arrangement are often not well controlled by the host country and may lead to IUU fishing. These agreements can form a large part of the budget in some countries, making them difficult to reform. They can also lead to corruption when the funds are diverted.

137. Fisheries access agreements can have a role to play under specific circumstances. Using market based instruments to ensure that the market forces play a role in valuing access would be an improvement over negotiations that may not be entirely fair or transparent. One way to do this is to auction fishing licenses or rights in an open and transparent way to fleets, thereby establishing the value of the fishery and ensuring a fair return for the host. This may also be a way to alleviate the problems of implicit subsidies involved when the cost of state-to-state access agreements is not fully recovered from the fleets benefitting from the arrangement. This type of subsidy to domestic fishers is likely to be in conflict with development goals, as well as domestic goals of developing competitive and market-oriented fisheries.

In summary

138. Policy coherence for development cuts across several policy domains, and requires coordination not only between government bodies within a country, but also effective communication and coordination between countries. For this reason, achieving real coherence is challenging, and examples of failures to coordinate outweigh successes. In particular, support to domestic interests can conflict with development goals with harmful consequences. While increasing awareness of policy conflicts is an important first step, policy coherence will come about as a part of larger policy reforms rather than as an addition to existing policies. By making domestic support more targeted and transparent, for example, the conflicts generated by indirect supports such as tariffs and other barriers and by access agreements can be reduced.

139. It is possible to invest in policy coherence for development, by increasing the capacity and effectiveness of governance systems domestically and abroad. But without taking into account the coherence of policies at an early stage, such investments will be less effective. On the other hand, clear objectives and carefully targeted measures will reduce policy spill-overs and can reduce the likelihood and impact of poor policy coherence. Good policy design can simplify policy coherence.

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Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **14-Mar-2012**

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TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

TAD/FI(2012)9
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DRAFT 2013-14 PROGRAMME OF WORK AND BUDGET OF THE FISHERIES COMMITTEE

23-25 April 2012

For discussion and approval at the 109th Session of the COFI Meeting.

The COFI is requested to:
- Agree to the proposed work for 2013-14;
- Confirm the work priorities; and
- Agree to the template set out in the Annex.

For further information, please contact:
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JT03317777

Complete document available on OLIS in its original format

English - Or. English

DRAFT 2013-14 PROGRAMME OF WORK AND BUDGET OF THE FISHERIES COMMITTEE

Introduction

1. The following sets out a Draft Programme of Work and Budget for the Fisheries Committee for the biennium 2013/14. The Committee, at its 109th Session, 23-25 April 2012, is expected to approve the programme, prioritise the agreed work and also agree to the text and figures in the attached template which subsequently will be submitted as input into the Organisation's budget discussions. Once agreed, it will be forwarded to the Secretary-General and, in due course, to the Council for decision.

2. The proposal for the draft Programme of Work and Budget (PWB) 2013-14 has been developed in light of the Committee's discussions on the orientation of the future PWB in October 2011, a subsequent initial orientation note (TAD/FI(2011)12 distributed on 16 December 2011 drafted by the Secretariat in late 2011, and written comments provided by Delegations in response to this note in February 2012. Delegates to the 109th Session will have an opportunity to discuss and refine the proposals in the following.

3. The template consists of one output area (3.2.3. Fisheries and Agriculture Sustainability), two Output Results "Monitoring, Evaluation and Statistics of Fisheries Policies" and "Fisheries, Green Growth and Development" and four Intermediate Output Results, i.e. (i) Monitoring, Evaluation of Fisheries Policies; (ii) Statistics for Monitoring Fisheries Developments; (iii) Fisheries and Green Growth; and (iv) Fisheries and Development. The following text has been organised following that outline.

4. The 2013-14 PWB for Part I is being prepared on the basis of Zero Real Growth, in accordance with the 2008 OECD MCM decision on financing reform.

Context and Policy environment

5. Fisheries and aquaculture policies have implications for the sustainability of natural resources use, a growing international concern. However, governments are often uncertain of the most effective policy mix to address growth while minimising externalities. Government financial transfers to fisheries may stimulate an industry already characterised by excess capacity, thus potentially further endangering the natural resource base. Maintaining the productive capacity in both aquaculture and fisheries is a shared objective of developed and developing countries and contribute to food security. Coherence across policy domains and for development are important for delivering sustainable growth.

6. The work of the Committee is one component of the OECD Council's strategic objective to *Contribute to Shaping Globalisation For the Benefit of All Through the Expansion of Trade and Investment.* The Committee can contribute to this objective by examining relevant policy issues for member and selected non-member countries. In particular, fisheries sustainability, green growth, and development have thus far been identified as priority areas for study.

7. The 2011 OECD MCM discussed and agreed a Green Growth Strategy. Within this overall context, there is a need to identify sector-specific policy recommendations that respond to emerging challenges and opportunities. Ministers also endorsed a new approach to development, in which the area of innovative and sustainable sources of growth may be of interest to the Committee, in particular with

respect to global food security. Other horizontal activities that are also underway in the Organisation include climate change, biodiversity and sustainable water use. All this work has important links to the fisheries and aquaculture sector.

8. In the Ambassador's Convergence paper on the 2013/14 Programme of Work for the OECD (dated 16 February 2012 and posted on the Delegates Corner) the Ambassadors noted that "Against a backdrop of increasing demands and tighter member country budgets, Ambassadors agreed that the OECD must deploy its resources effectively in support of the OECD's 50th Anniversary Vision Statement. They stressed the need for the Organisations' deliverables to be increasingly more targeted towards the specific challenges faced by member countries, and for together integration in the work carried out by Part I and Part II programmes."

9. The Programme Implementation Report (PIR) covering the year 2009-10 for the COFI, produced the weakest results for the Committees served by the Trade and Agriculture Directorate, and below average results for the OECD as a whole. It is important that the Committee addresses these weaknesses when considering its future programme of work. Central to this is to ensure that the COFI has a shared vision about the deliverables expected in the upcoming PWB, and in particular that the outputs are well defined and have high policy relevance. In this regard the Secretary-General's guidance document on the Programme of Work (posted on Delegates Corner on ……..) notes that (paragraph 7) *"it is essential that for the coming biennium Committees redouble their efforts to identify outputs that are those most likely to influence policy discussions and decisions, based on a careful definition and consideration of the Expected Outcomes for each area. Increased relevance and impact should remain an overarching goal, not only to continue identifying best practices and supporting our member and partner countries with key policy advice, but to help them with the implementation and advancement of reforms. The "what to do" should continue to be accompanied by the "how to do it", with the OECD acting as a key partner to advance policy reforms."*

10. Delegates are reminded that during the first quarter of 2014, the Committee will, once more, be the subject of an In-Depth Evaluation (the first such IDE took place in 2008). The focus of the IDE has evolved to include a qualitative description of how and how well a particular committee: (1) establishes its policy direction through the development of its mandate and work programmes; and; (2) implements its work programme [C(2011)123/REV1].

11. The COFI mandate expires on 31 December 2013 and some time and effort will therefore be required by the Committee to prepare a timely revision for consideration by the OECD Council. The Committee may wish to consider setting up a Mandate Renewal Working Group to expedite this task. At the same time, it remains to be seen if a temporary mandate extension is appropriate until such time as the IDE can be completed and thereby inform the mandate renewal decision.

Description of outputs

1. Monitoring, Evaluation and Statistics of Fisheries Policies

1A. Monitoring and Outlook

12. Comments submitted by Delegates show that the *Review of Fisheries* has the highest priority and is seen as a key exercise of the Committee. There is a commitment to continued improvement in the quality of submissions from participating countries; this concerns both the information on policy developments as well as the data submitted for the fisheries database.

13. This is an on-going activity. A *Policy Review of Fisheries* will be published in 2013 Q2 (work starting in 2012).

14. The addition of a fisheries module to the OECD-FAO Agriculture Outlook has been welcomed by delegates and there is a shared view that additional resources and time of COFI meetings be directed to support this work. In practice it is suggested that a dedicated time slot at COFI sessions will be reserved for a discussion of recent policy developments of importance in production and trade with potential influence on the outlook work. The Outlook process requires 10-year projections of capture and aquaculture production to be developed each year, and COFI members have an important role to play in developing these. Countries with recent experiences with fisheries policy reforms will be asked to share their views. This discussion could be supported by a short Secretariat note outlining some key developments over the past year that merits further discussion among delegates. This is an exercise that started in 2011 and will continue as an on-going exercise.

15. Delegates have responded positively to undertaking a review of the GFT methodology although the specific issues to be addressed need further elaboration. In the existing framework GFTs include direct payments from government budgets to fishers, cost-reducing transfers, general services (e.g. management, surveillance) and cost recovery. A key characteristic of these transfers is that they can be measured using available budget data. It should be noted that the OECD is the repository for several sets of data related to financial transfers/support; in addition to the fisheries GFT the other important data set is the agriculture PSE/CSE data. One of the objectives sought from the proposed exercise is to seek further alignment, when feasible, of the two methodologies housed in the Trade and Agriculture Directorate.

16. Market price support is included in the present GFT terminology but data have not been collected primarily due to methodological problems. In the meantime, transfers to the fisheries sector are also being provided through other channels notably through the tax system and specific fisheries unemployment and social schemes. These are at present not included in the GFT database. Furthermore, further insights and clarification of the importance of market price support is needed to ensure consistency with the PSE methodology.

17. As this is a rather technical exercise the Secretariat proposes to set up an ad hoc expert group that would report its findings to the COFI. The key objective of the ad hoc expert group will be to provide further transparency on the issues around GFTs in fisheries and aquaculture. The group would initially meet for one day as an extension of the 111th Session (April 2013) to review the classification and data-collection process and assess the feasibility and practicability of expanding the coverage of the GFT exercise. The overall aim would be to assess the feasibility for enhancing the GFT classification to facilitate policy analysis using this data and generally add value to the database. Based on the discussion and possible recommendations of the ad hoc expert group, the COFI will subsequently decide on any changes to the present GFT classification and on the addition of new data.

1B. Statistics for Monitoring Fisheries Developments

18. A *Statistics Review of Fisheries* has been published every year but since the transfer of data to a new platform will be available in electronic form only. The Secretariat reviews and organises the information submitted by participating countries (members and observers) and ensures that the database is kept up to date. This is an on-going activity.

2. Fisheries, Green Growth and Development

2A. Fisheries and Green growth

19. Green growth is at the centre of OECD policy thinking and most submissions recognise the need to investigate how these principles apply to fisheries policy. During 2012, the Committee will discuss

green growth as it relates to fuel use, waste, governance and aquaculture and specific work streams on these issues will be developed.

20. Members' comments have been supportive of green growth work as it relates to fuel, aquaculture and governance. The comments from delegates also suggest that the green growth area is the second priority of countries. The following provides an overview of work on these three areas. Work on waste (TAD/FI(2012)3) will be finalised in 2012. The specific outlines in development will suggest a phased process extending into 2013/14 pending other work elements to be considered.

21. **Green Growth and Aquaculture:** The purpose of the proposed work is to identify green growth policies for aquaculture and to understand the critical success factors for aquaculture development across the participating countries. Such an analysis can help develop policy recommendations that may be used as a roadmap for national aquaculture planning. The work will also discuss the effects of incorporating green growth principles into policy on the competitiveness of aquaculture. Participating countries will be asked to submit relevant economic data for the sector. This will include data on production, industry turnover, costs (if it exists) and employment as well as information on how externalities are addressed (policy checklist). This information will be complemented with country case studies on policy initiatives taken to enhance the sustainability of aquaculture. Such case studies would analyse the economic impacts of these policies and also discuss the drivers of policy change. Information on factors for aquaculture growth may include research and development, framework conditions, cooperation between the industry, the authorities and research institutions, infrastructure, use of space and interaction with other user groups. Based on the analysis of the submitted information the work will identify common success factors.

22. This proposed work is scheduled to be finalised at the 113th Session of COFI (Q2 – 2014) with a report describing common success factors for green growth in aquaculture. Additional detailed information is contained in document TAD/FI(2011)8/PART4/REV.

23. **A Green Growth Perspective on Energy Use in Fisheries and Aquaculture:** Two possible studies are proposed under this heading. The committee would select one of these to be undertaken in the 2013/14 biennium.

24. The first possible study is a continuation of the work already underway as [TAD/FI(2012)2] that characterises energy use in the fisheries sector and is currently scheduled to conclude in Q1 2013. The aim of the proposed study would be to deepen and expand upon that work by drawing connections between different policy instruments, the fisheries management system and energy use in the sector. That is, the work would transition from taking stock of the current situation *vis-a-vis* energy use to policy-focused research and analysis. This study would provide sound policy advice regarding how to improve fuel efficiency in a way that is positive both for the sector and the environment. Connections to Green Growth principles will be highlighted where appropriate. In particular, policy coherence between the objectives of fisheries policy and climate change will be examined. The principal outcome is a report relating fisheries policies and energy use in fisheries, including case studies and economic analysis supporting policy recommendations and best practices.

25. The second possible study under this heading relates to the evaluation contained in *"An Evaluation of Alternative Methods for Analysis of Fuel tax Concessions in Fisheries"* [TAD/FI(2012)1]. This study would be more narrowly focused on the impact of fuel tax concessions as measured by one of the three possible approaches put forward in the evaluation. These are: an analytical study, a simple numerical fisheries model, or a more complex numerical general equilibrium model. Either of the two numerical modelling options are relatively resource intensive and would require additional staff resources to be diverted from the work currently proposed under the Monitoring and Outlook heading. The committee would have to evaluate which items under that heading would be reduced or deferred.

Additional funds would also have to be allocated to cover the necessary consultancies. The principle outcome is a publication evaluating the impact of fuel tax concessions on selected economic indicators in the fisheries sector and elsewhere.

26. Delegates need to decide which of the two projects proposed it wishes to undertake recognising under the heading of energy use in fisheries recognising that the second proposal have resource implications for other proposed studies.

27. **A Green Growth Perspective on Fisheries Governance:** Getting fisheries on a Green Growth path requires a new approach to fisheries governance as a widening of the policy objective is likely to challenge current governance systems. Concurrently, the governance structure can help fisheries to contribute to Green Growth for example by decoupling economic growth in fisheries from resource pressures. The objective of this study is to analyse how different governance structures and fisheries management policies affect green growth in the sector. The study will be based on information provided by participating countries using a common template/questionnaire. The template is designed to enable a comparison of the most important green wand growth policies in each country. In particular information related to where and how decisions are taken, stakeholder involvement and how the policies affect the greening and/or growing fisheries will be sought. The subsequent analysis will bring to light policy coherence or incoherence with regards to green growth in fisheries. The project is non-normative and is dealing with national fisheries only (thus excluding RFMO). The Study will yield interesting lessons on policy coherence across the national institutional settings that influence fisheries sector outcomes.

28. The key outcome is a report on the findings how different governance structures and policies affect green growth in fisheries and will include lessons learned and identify possible future work on the issue. The project is expected to be finished by 2014 Q4. Additional detailed information is contained in document TAD/FI(2012)4.

2B. Fisheries and Development

29. Considering the highly globalised nature of the fishing industry, both from a production and a trade perspective, submissions from delegates acknowledge the importance of the OECD Development Strategy for COFI. Also, most delegates are in favour of a closer working relationship with the DAC/COFI/WB/FAO and can agree to a joint session.

30. What is less evident is the subject for the joint DAC/COFI/WB/FAO meeting. The Secretariat initially proposed (i) sharing experiences with rights based fisheries management (RBM) with a focus on how RBM can benefit small scale fisheries; (ii) the future of aquaculture – the place of the developing world; (iii) green growth in fisheries and aquaculture (fuel and waste); and (iv) governance reform – sharing experiences. Submissions from delegates suggest that this agenda is too broad and not an appropriate basis for the discussion of key issues.

31. One delegation has raised the subject of "policy coherence for development" and that the discussion should be case-study based. This would be similar to the exercise that took place in April 2006 which gathered around 125 experts and was very successful (See Workshop Proceedings: "*Fishing for Coherence*", OECD 2006). Another important issue which is high on the organisations agenda is "food security" and work on this is presently undergoing in the TAD; the COFI might wish to consider using a joint session to also contribute to these parallel exercises and thus raise the profile and importance of the fisheries sector's contribution to food security.

32. In this context, it is worth noting that within the fisheries development agenda, many aspects converge on developing countries' ability to implement international fisheries management instruments as

well as pursuing national policies that serve to bolster fisheries as a major source of food supply and source of income from international trade. If "policy coherence for development" is the preferred subject, the joint meeting could be seen as an exercise to review the evidence on policy coherence in national and international fisheries policy development.

33. **At the 109th Session the Committee should decide on the subject, i.e. policy coherence for development and timing for a joint meeting between COFI and DAC/WB/FAO (the Secretariat has initially proposed April 2014 in conjunction with the 113th Session)**. It is important at this stage to reserve a date so the institutions can be alerted and for appropriate invitations to relevant participants to go out. The detailed agenda and the content of the meeting can be developed at a later stage.

34. The proposal to develop a classification of development assistance programmes does not at this stage receive broad support. There is also a need to further explore with the WB and the FAO (and other donor institutions) whether they have undertaken similar exercises to catalogue the various forms of development assistance in fisheries and aquaculture. At this stage perhaps a more cautions way forward will be to first host the joint DAC/COFI/WB/FAO meeting and then based on the outcome of the discussions to return to the issue of the need for a catalogue/classification of development assistance. A tangible outcome of the joint meeting will be a report from the discussion (2014 Q3).

Prioritisation

35. Based on the discussion at the 108th Session and the feedback from delegates in response to the note circulated in December 2012, it would seem that the Output Result, "Monitoring, Evaluation and Statistics of Fisheries Policies", is a 1st Priority while the OR "Fisheries, Green Growth and Development" is a 2nd Priority. Delegates to the 109th Session are asked to confirm this.

Follow-up

36. After final discussion and decision by the Committee at its 109th Session in April 2012, the resulting draft PWB will be forwarded to the Secretary-General in preparation for the meetings of the Budget Committee in July 2012. In addition to discussing the 2013-14 budget envelope (to be approved by the Council), the Budget Committee sessions will include a presentation by Directors of their committees' PWB submissions. During September and October PWB submissions will be finalised and consolidated and a decision by Council on OECD's overall PWB 2013-14 is expected by the end of the year.

Actions required by the COFI

37. The COFI is requested to:

1. Agree to the proposed work for 2013-14;
2. Confirm the work priorities; and
3. Agree to the template set out in the Annex.

STRATEGIC OBJECTIVE:	**3**	**Contribute to Shaping Globalisation for the Benefit of All through the Expansion of Trade and Investment**			
OUTPUT GROUP:	**3.2**	**Agriculture**			
OUTPUT AREA:	**3.2.3**	**Agriculture and Fisheries Sustainability**			
			2012	**K EUR 2013**	**2014**
		Base Part I Budgeted Resources	**-**	**737**	**755**
		% change per year	-	-	*+0.8%*
		CPF	**-**	**-**	**-**
		Sub-total Direct (Base + CPF) Part I Budgeted Resources	**-**	**737**	**755**
		% change per year	-	-	*+0.8%*
		Attributed Indirect Part I Budgeted Resources (Operating Overheads)	**-**	**-**	**-**
		% change per year	-	-	-
		Total (Direct + Indirect) Part I Budgeted Resources	**-**	**737**	**755**
		% change per year	-	-	*+0.8%*
		% of total substantive Part I Output Areas			

Total Estimate of Voluntary Contributions Planned	**-**	**-**	**-**

Total Estimated Cost (Direct Part I Budgeted Resources + Estimated Voluntary Contributions)	**-**	**737**	**755**

Pre-Accession Budget	**-**	**-**	**-**

RESPONSIBLE MANAGER: Mr. Rintaro TAMAKI

RESPONSIBLE DIRECTOR: Mr. Ken ASH

COMMITTEE INFORMATION:	MANDATE or SUNSET:
Committee for Agriculture (COAG) *Observers:* Argentina, Brazil, Romania, South Africa, Council of Europe (COE), UN Food and Agricultural Organization (UNFAO), World Trade Organization (WTO)	31/12/2013
Fisheries Committee (COFI) *Observers:* Argentina, Chinese Taipei, Russian Federation, Thailand, UN Food and Agricultural Organization (UNFAO), World Bank, World Trade Organization (WTO)	31/12/2013
Joint Working Party on Agriculture and the Environment (JWPAGR/ENV)	31/01/2014

Committee Approval/Endorsement of this Draft PWB	

Policy Environment:

Fisheries Committee

Fisheries and aquaculture policies have implications for the sustainability of natural resources use, a growing international concern. However, governments are often uncertain of the most effective policy mix to address growth while minimising externalities. Government financial transfers to fisheries may stimulate an industry already characterised by excess capacity, thus potentially further endangering the natural resource base. Maintaining the productive capacity in both aquaculture and fisheries is a shared objective of developed and developing countries and contribute to food security. Coherence across policy domains and for development are important for delivering sustainable growth.

Expected Outcomes:

Awareness/Understanding:

Fisheries Committee

- Increased understanding among members, IOs and international fisheries management bodies on how different fisheries management policies work,
- Lessons and evidence for improvements of fisheries policies at both at the national and international level
- Increased appreciation and knowledge of best practices across a range of fisheries policy instruments
- Recognition of the need for fisheries reform and how this can affect the fisheries and aquacultures sectors.

Usage :
Fisheries Committee • Support to national administrations, other IOs and fisheries management bodies on fisheries policy reform • Support to national administrations, other IOs and fisheries management bodies, in developing policy instruments. • The work on government financial transfers assists negotiations in other fora, most notably in the WTO.
Effects :
Fisheries Committee • Improved fisheries economic outcomes with a reduction of environmental externalities • Increase coherence across policy domains that impacts the fisheries and aquaculture sector.

			2013 (K EUR)					2014 (K EUR)				
2013-14 Expected Output Results in Priority Order	**Accountable Committee/ Subsidiary Body/ Global Forum**	**Ongoing/ Time Bound (end-date)**	**Total Estimated Cost (TEC)(1)**	**Part I Budget**	**CPF(2)**	**VCs in Hand**	**New VCs**	**Total Estimated Cost (TEC)(1)**	**Part I Budget**	**CPF(2)**	**VCs in Hand**	**New VCs**
1. Monitoring, Evalutation and Statistics of Fisheries Policies (one publication and one database)	**COFI**	**Ongoing**	**324**	**324**	**-**	**-**	**-**	**299**	**299**	**-**	**-**	**-**
1.1. Monitoring, and Evaluation of Fisheries Policies (one publication)	COFI	Ongoing	279	279	-	-	-	253	253	-	-	-
1.2. Statistics for Monitoring Fisheries Developments (one database)	COFI	Ongoing	45	45	-	-	-	46	46	-	-	-
2. Fisheries, Green Growth and Development (one publication, one joint meeting - CoFI, DAC, WB, FAO and proceedings)	**COFI**	**Time Bound Q4 2014**	**413**	**413**	**-**	**-**	**-**	**456**	**456**	**-**	**-**	**-**
2.1. Fisheries and Green Growth (one publication)	COFI	Time Bound Q4 2014	267	267	-	-	-	305	305	-	-	-
2.2. Fisheries and Development (one joint meeting CoFI, DAC, WB, FAO and proceedings)	COFI	Time Bound Q4 2014	146	146	-	-	-	151	151	-	-	-
TOTAL			**737**	**737**	**-**	**-**	**-**	**755**	**755**	**-**	**-**	**-**

Pre-Accession(3)	2013	2014
Accession: Principles, Policies and Instruments	**-**	**-**

[1] TEC is equal to the sum of the Part I funds (Part I Budget, CPF and 'Other funding' proposals), Voluntary Contributions in Hand and New Voluntary Contributions.
[2] Secretary-General's proposed estimates of CPF allocations
[3] Output Area accession budgets are not financed by Part I but by pre-accession budgets contributed by the accession candidate countries.

End-users:

European Commission, Non-Governmental Organisations (NGOs), Policy makers, Policy makers in non-member countries

Stakeholders:

Academia, BIAC, Civil society, Environmental NGOs, Inter-governmental organisations, International and national farm organisations, Non governmental organisations in member and non-member economies, Research organisations

Expected Contributions from other OECD Output Areas:

2.3.5 Horizontal Project on Sustainable Development, 5.1.1 Effective States, Empowered Societies and Policy Coherence

Co-ordination with Other International Organisations:	
Name :	**Planned Co-ordination:**
UN Food and Agricultural Organization (UNFAO)	General co-operation between the Secretariats of the two Organisations with regard to work on agriculture and fisheries through participation in each other's meetings including expert meetings. More specifically, together with other organisations (UNFCCC, World Bank, IFPRI), collaboration has been established in analytical activities in particular concerning work on Climate change and Agriculture. As regards fisheries, the next edition of the Outlook will include a section dealing with agriculture.

Gender Mainstreaming:

Not applicable

Global Relations Summary:

In October 2010, the COFI adopted its Enhanced Engagement Strategy that takes a more pro-active approach to the participation of selected non-members in its work. Recognising the importance of the EE countries to world fisheries and aquaculture, in 2011, the COFI decided to invite these countries to participate in its meetings. A number of observers i.e. Argentina, Chinese Taipei, Thailand and the Russian Federation are actively engaged in the work of the COFI and are important players in the fisheries world.
The EE countries are important for the international fisheries agenda both as potential and present fisheries producers and as markets for fish and fish products. They will increasingly be important competitors for raw material, including fish, and it is therefore a shared interest to further engage providing transparency and understanding and thus diffuse potential conflicts. Maintaining the productive capacity of both aquaculture and fisheries is a shared objective of developed and emerging economies; the Committee's proposed work will help advance the sustainability of fisheries and aquaculture resources which are important in many developing countries. Coherence across policy domains and for development is an important pre-condition for delivering green growth.

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Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **02-Apr-2012**

English - Or. English

TRADE AND AGRICULTURE DIRECTORATE
FISHERIES COMMITTEE

TAD/FI(2012)9/ANN
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DRAFT 2013-14 PROGRAMME OF WORK AND BUDGET OF THE FISHERIES COMMITTEE

ANNEX

23-25 April 2012

This annex contains the Guidance from the Secretary-General to Directors and Heads of Programmes concerning the preparations for the PWB 2013-14 as well as the Informal Convergence Paper derived from the meeting of Heads of Delegation (HODs) on 9 February, as top down contributions to the PWB development. The Committee for Fisheries is invited to give them due consideration when discussing its 2013-14 PWB.

These notes were also posted earlier on the Committee's portal.

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JT03319028

English - Or. English

GUIDANCE FROM THE SECRETARY-GENERAL TO DIRECTORS AND HEADS OF PROGRAMMES CONCERNING PREPARATIONS FOR THE PWB 2013-14

I. The Policy Environment

1. In my input to the HODs discussion, I described the Policy Environment for 2013-14 in the following terms:

"The recovery from the worst financial and economic crisis of our lifetimes is still unsure for many of our Members, and the prospects for the coming biennium unclear. Policymakers face complex and formidable policy challenges, including overcoming weak economic activity, resolving the sovereign and banking crises in the euro area, stabilising the financial sector, tackling high (and persistent) unemployment, restoring the health of public finances without choking growth, making growth stronger, greener, more inclusive and improve economic wellbeing over the longer term.

Governments are also faced with a loss of confidence in their ability to deal effectively with the crisis and in the capacity of the market economy itself to meet citizens' needs and expectations. At the same time, the international community will need to make progress in addressing global challenges, such as moving forward with the climate change agenda and implementing existing commitments, as well as strengthening the multilateral trading system, after the demise of the Doha Round.

The forthcoming deadline for the Millennium Development Goals, and the need to launch a new partnership for development, will also be central to international efforts. The challenges that individual governments and the international community face call for brave and timely policy decisions, making sound evidence-based policy advice more important than ever."

2. The OECD should continue to be at the forefront of efforts. to overcome these challenges. To this end I have made a call to "Go structural", advancing the policy reforms that will make our economies more competitive; to "Go social" to address the increased inequality and lack of jobs, and to "Go green" to promote a growth path that takes due account of the environmental constraints we are facing. We also need to "Go institutional" to address the current confidence gap in institutions and markets.

II. Work Programme Priorities for 2013-14

3. The priorities for the OECD's PWB for 2013-14 reflect members' broad agreement with the Secretariat's views on where and how the OECD can contribute most effectively to members' policy concerns in a difficult and uncertain policy environment. In one respect, this is not surprising, as this reflects an on-going process, building on:

- the conclusions of the 50th Anniversary MCM in May 2011, including the long-term 'Vision Statement' endorsed by Ministers at that time;
- my Strategic Orientations for 2011 and beyond [C/MIN(2011)1];
- the current Work Programme priorities that were agreed just over a year ago;

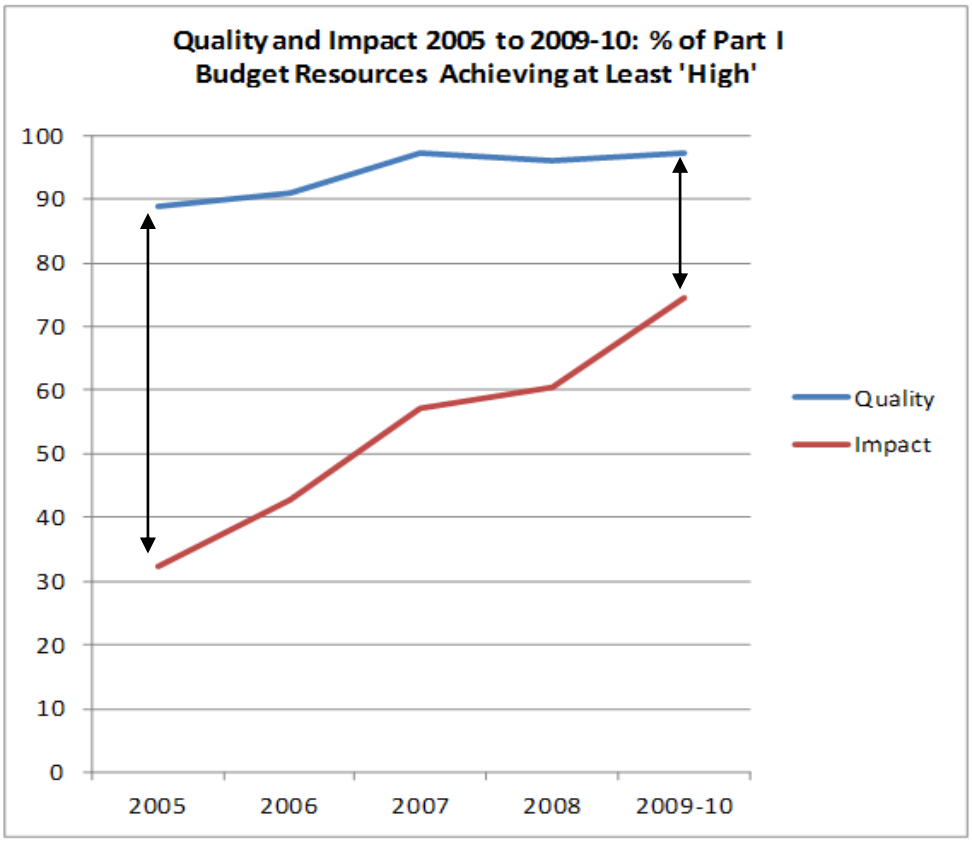
- My own input to the HODs meeting, based on constant interaction with ministers, senior officials and many other stakeholders inside and outside of government, and which will evolve over the coming months into my Strategic Orientations paper for the 2012 Ministerial meeting. This document benefited from your comments and suggestions; and

- the Ambassadors' Informal Convergence Paper on PWB 2013-14. [Council 16 February 2012, Room Document No. 3 (attached)].

4. It is also worth noting that the results of the Medium-term Orientations (MTO) Survey for 2013-14, conducted in the second half of last year, confirms the high level of satisfaction of member countries with the work of the OECD.

5. In preparing for each new biennium since taking up my initial mandate as Secretary-General, I have identified increased relevance and impact as the overarching 'mission' of the OECD. We have achieved real progress in this regard, as evidenced by the most recent Programme Implementation Report (PIR) Survey results for 2009-10, which show impact ratings increasing over time and approaching the very high quality ratings of OECD outputs.

Chart 1. Improvements in the Quality and Impact of OECD Outputs from 2005 to 2009-10



6. While this offers grounds for satisfaction, it is essential that for the coming biennium Committees redouble their efforts to identify outputs that are those most likely to influence policy discussions and decisions, based on a careful definition and consideration of the Expected Outcomes for each area. Increased relevance and impact should remain an overarching goal, not only to continue identifying best practices and supporting our member and partner countries with key policy advice, but to help them with

the implementation and advancement of reforms. The "what to do" should continue to be accompanied by the "how to do it", with the OECD acting as a key partner to advance policy reforms.

7. The satisfaction of members with OECD current and recent outputs is matched by their high expectations about the Organisation's capacity to make meaningful contributions to their needs in a broad range of policy areas. The relative priorities for the Organisation in 2013-14, based on the different inputs identified above, are as follows:

- Renewing efforts to foster growth (*"Go Structural" and New Sources of Growth)* including innovation, green growth, trade, investment, skills, taxation, competition, knowledge based assets, regulatory effectiveness; entrepreneurship and SME's). The "New Approaches to Economic Challenges" initiative will require a major effort from all of us by adjusting our economic framework, our tools and models to a post-crisis world and by developing more horizontal analysis and policy recommendations across various interdependent policy fields. The "knowledge economy" will call for integrating work on innovation, skills, education, competition, internet, intellectual property and trade. We should also address the challenges linked to competitive neutrality, new industrial policy, and fighting protectionism, as well as reinforce our anti-corruption efforts.

- Ensuring that growth is socially responsible and for the benefit of all (*"Go Social"*):

  - ❖ Addressing the unemployment challenge, particularly for the young and to foster job creation;
  - ❖ Reducing inequalities through a fair and efficient tax system and by investing in people and improving education, training outcomes and skills with long term perspectives;
  - ❖ Addressing gender equality through women's economic empowerment in Education, Employment and Entrepreneurship;
  - ❖ Addressing the long term challenges of ageing societies, family structures, intergenerational fairness and migration;
  - ❖ "Go social" also includes building on the "Better life Initiative."

- We should continue our efforts to ensure that the growth process takes into account the environmental constraints we face (*"Go Green"*), and provide answers to the climate change and water challenges, among others. Our Green Growth strategy should now move to country chapters, advancing the key indicators and strengthening assessment and monitoring.

- As restoring confidence is one of the key policy priorities in Member and Partner Countries, we will need to address institutional questions for governments and markets *("Go Institutional")* (open government, government effectiveness and efficiency, political process, regulatory framework for markets, decentralisation and regional policies.)

- We should also redouble our efforts to deliver on the *"Development Strategy"* at the next Ministerial, but also in the years ahead. More than a horizontal program, this Strategy is a new way of working with developing countries, to support their policy challenges, and an initiative that will involve us all.

- We need to work towards a new *trade narrative* beyond Doha. While fighting protectionism and opening markets remains a priority, we have to continue to lead with our path-finding work on trade and employment, trade and jobs, trade in services, trade in value-added and the impact of global production networks. This new narrative includes also our ongoing work on food security, trade and agriculture and export credits.

- In terms of increased impact, the OECD should continue its efforts to work with emerging economies, and to perform an important role in the international governance architecture, as it has been doing in several areas, including on the competitiveness front in Europe; in the G20 and the G8; and with countries high on the international agenda such as the MENA region.

- Finally, given the current economic developments, we need to be ready to support countries when they need it, to be proactive, and to determine when our thematic flagships, horizontal programs or specific policy work could be further enhanced by targeted country assessments, reviews or chapters.

8. I wish to emphasise some points concerning the translation of these priorities into your preliminary PWB submissions. You are asked to bring these considerations to the attention of your Committees and that Committee priority-setting and budget discussions take them into account:

- the importance of making adequate provision in the choice and scope of outputs in each area to be responsive to overall priorities;

- the continued, growing emphasis on working across policy areas, capitalising on the Organisation's unique ability to address interlinked and complex policy challenges;

- the need to ensure that the costing of outputs allow for effective follow-up on our overall priorities but also for communication efforts, and for urgent and/or *ad hoc* requests (briefings, papers, speeches) that make fundamental contributions to the pursuit of impact, and are part of the cost of producing outputs; and

- the need to provide for tailor-made policy advice and specific policy products. This is an indispensable part of our work that needs to be strengthened. We need to respond to the immediate needs of our member and partner countries, as well as to requests derived from the international governance architecture.

- As noted above, major deliverable in the upcoming biennium is the Development Strategy, and I envisage that several Committees will need to factor work with developing countries into their submissions. To ensure consistency in this area, and provide for a fully horizontal approach, the following key criteria should be addressed in determining responses through new or adjusted outputs, and any proposals for additional funding:

    - Is this proposed output demand-driven?
    - Is there clear value-added in the OECD's undertaking this work?
    - Does it promote knowledge-sharing with the country/ies involved?
    - Is this an initiative being undertaken jointly with the 'development cluster' or more widely through external partnerships?
    - Is the proposed output duplicating work undertaken by other international organisations?

- Priority will be given to horizontal proposals that incorporate more than one directorate, and that blend together the expertise of the development directorates with the thematic ones. It will be important to show that the request is also demand driven, and that specific developing countries have shown interest.

III. Resources Assumptions

9. The PWB 2013-14 for Part I will be prepared on the basis of Zero Real Growth (ZRG), in accordance with the 2008 MCM decision on financing reform. Members' continued support for the financing agreement is an important confirmation of their satisfaction with the outputs of the Organisation, notwithstanding the current difficult economic circumstances and budgetary constraints facing many of them.

10. For Part II programmes, the situation varies. A significant number continue to be affected by discussions on financing; and it is unclear whether agreement will be reached in any or all programmes over the coming months. For others, the general starting assumption should be Zero Real Growth as for Part I, unless the relevant Governing Board concerned decides otherwise.

11. In terms of individual resource allocations, the starting assumption for each Output Group in Part I is the same budget base as 2012. This assumption reflects the following considerations

- the Central Priorities Fund (CPF) was increased significantly as from 2011 and again marginally as from 2012, with the result that there is financing available, within limits, to meet priorities in 2013-14; and

- the expectation that each area will need to adapt its outputs, and their financing, in addressing the priorities set out above. This has been achieved in recent bienniums, and there is no reason to assume that this should not be the case for the coming one. As noted above, Committees will need to give adequate space in their PWB submissions to these overarching priorities.

12. It should be stressed that these are the *starting* assumptions. There may be a need to review some allocations in light of overall budget pressures that emerge as we proceed through the PWB preparations.

13. I have considered carefully the funding of the three Output Areas identified by HODs in their Informal Convergence paper as being of relatively low priority.

- In the case of Tourism, the direct budget allocation in 2012 is KEUR 51, a minimal level of funding for an area that a significant number of members wish to see retained in Part I. (Voluntary contributions in 2012 are estimated at KEUR 860).

- In the case of 'Horizontal Work on Sustainable Development', there is agreement to move away from the AMSDE mechanism that a number of members called into question, and have closer linkages with green growth. A proposal will be presented to members to this effect.

- In the case of 'Environment and Globalisation', budget allocations had already been reduced in 2011-12 (to around KEUR 500 each year compared with KEUR 1 600 in 2010), and the remaining outputs provide important contributions to cross-cutting issues areas including 'development and environment' and 'trade and the environment'. I therefore propose in this case to suppress this Output Area for 2013-14, while retaining substantive analytical capacity by reallocating within the Output Group the work on development and environment, which is directly related to climate change and would find a natural home in the climate change and natural resources area, and moving the work on trade and the environment to the area concerned with environment, innovation, indicators and sector policies.

14. I would note that we intend to continue with management improvements in the coming biennium. These improvements will need to be met within available resources. This will place considerable strain on

the corporate service areas, which will also be implementing the decision taken by Council in December 2011 to place asset investment and renewal on a sound basis, through the operation of the Capital Investment Budget and Reserve Fund (CIBRF). This will require identification of up to MEUR 2.6 each year from 2013 from within operating resources to be directed to investment to safeguard the assets of the Organisation.

15. Finally I would note, as did the HODs, the importance of voluntary contributions in the PWB. VCs will again represent a significant part of funding of outputs, including priorities, in the next PWB. Voluntary contributions are crucial to our capacity to deliver outputs to all members. I would ask Directors and Committees to be as realistic as possible in making assumptions about anticipated VCs for the next biennium. There will be clearer distinctions in this coming PWB between those outputs for which reasonable expectations regarding VCs are made, and those which clearly will only be carried out if and when VCs arrive. This is set out in the more detailed accompanying guidance to be provided by EXD/PBF. There will also be additional guidance forthcoming shortly concerning the great importance we will need to continue to place on achieving excellent value for money on behalf of our members.

IV. The Next Steps

a) Submissions to Committees and Governing Bodies

16. Several Directors and Heads of Part II Programmes have already presented broad outlines of PWB proposals to their Committees/governing bodies. Others will do so in the coming months. Those that have already done so will need to ensure that any necessary adjustments are made in light of the foregoing advice

17. Directors may include in their initial PWB submissions to Committees, proposals they intend to make for additional budget resources. These will be managed as set out below. There should be no assumption made at this stage that the additional resources will be forthcoming. Moreover, for the most part, new initiatives and contributions to horizontal projects which are overall priorities for the Organisation, are expected to be met from within available resources and thus be included as part of the regular Work Programme.

b) Management of the Central Priorities Fund and Longer-Term Reallocations

18. As noted above, the additional Budget allocations for Part I priorities will be of two kinds:

- Financing from the Central Priorities Fund (CPF), a revolving fund allocated each biennium to new and emerging priorities that are in general to be delivered within the biennium, and

- Financing through Long-term Reallocations (LTR), to meet structural, on-going budget pressures, the financing needs for which are expected to exceed two biennium's. Within a ZRG budget envelope (ZNG) for some Part II programmes), long-term financing needs are met through reallocations from elsewhere in the budget.

19. All requests for CPF allocations will, for the first time, include a commitment to finance at least 30% of the proposed budget component (Part I plus CPF) from existing budget allocations. This new requirement for an 'upfront commitment' adds considerable potential flexibility to the CPF and will help to ensure reallocation within the areas bidding for additional funding. In general, requests should not be made for CPF financing that exceeds two bienniums.

20. I will assess the proposals for additional budget allocations (short-term and long-term) in the light of their contribution to the priorities listed above and their relevance and expected impact. Preference may be given to proposals that reflect multidisciplinary horizontal approaches. Unfortunately, it will certainly not be possible to satisfy all or even most of the anticipated requests. A strict prioritisation will need to be applied. That said, there are always legitimate funding needs and pressures, not to mention important initiatives, in areas outside the listed priorities. It is not my intention to limit original ideas and a small part of the CPF may be allocated to such initiatives.

21. The CPF/LTR templates will be provided separately by EXD/PBF. Submissions should be submitted to the Head of PFB copying the OECD Chief of Staff. **The deadline for these submissions is 30 March**.

22. On current planning, Directors may expect to be informed about **the proposed allocation of the CPF and LTR by 30 April.** This should provide time for the proposals to be refined and shared with Committees and to meet the deadline for finalization of the preliminary submissions (see below). For those Committees that meet prior to the notification of allocation of funding, Directors may share the CPF/LTR proposals with the Committee, on the basis that there are no guarantees at that stage that the proposals will be included in the formal submission to be presented in October.

c) MCM, 23-24 May

23. As noted above, I will be developing my Strategic Orientations paper for the MCM in May. This paper and consideration of it by Ministers, may result in some additional, adjustments to the planning of the preliminary PWB submissions reflecting the respective policy priorities in Member countries.

d) Deadline for Preliminary PWB Submissions: 4 June

24. The deadline for submission of preliminary PWB submissions to EXD/PBF is determined by the requirement that Directors will present them to the Budget Committee in June/July. Separate guidance will be provided in due course regarding those presentations.

25. Some Committees will not meet until just before, or even after, this deadline. That will need to be managed for this biennium (*e.g.* by use of written procedure). It is important however to note that these deadlines for the PWB preparations will remain and, indeed, have been more or less stable for some years. As noted in the recommendations of the Council Working Party on Priorities, the timing of Committee meetings in future may need to be adjusted to take account of these factors.

26. Part II programmes are not required to present their preliminary submissions to the Budget Committee, but those that are subject to OECD Council approval will present their formal submissions progressively during the last quarter of this year, having sought governing body approval before the end of October.

e) The Budget Guidelines Paper

27. I will prepare and present to Council in late June a paper outlining the main budget parameters, pressures and proposals for 2013-14 as we know them at that time. It will be discussed in the Budget Committee in July, along with the preliminary PWB submissions and priority allocations. Ideally, Council will then endorse in July the ZRG budget for 2013-14, as well members' views on the overall shape and content of the draft PWB for the coming biennium.

f) Formal PWB Submissions

28. In line with the Financial Regulations, the formal PWB submission will have to be presented to members before the end of October. Further guidance will be provided closer to the time about the finalisation of submissions and any necessary adjustments thereto.

V. Conclusion

29. We have, with the members, made an encouraging start to the PWB preparations. There is broad agreement on the policy environment and the substantive priorities and a great sense of urgency to continue to increase the value and contributions of this Organization in the particularly difficult circumstances. I look forward to a continued constructive discussion in this important exercise, as I do to your cooperation and support to ensure a successful conclusion.

AMBASSADORS' CONVERGENCE PAPER[1]
PWB 2013-2014

The Convergence Paper serves as an informal input to the Secretary-General´s guidance for the development of the OECD´s **Programme of Work and Budget (PWB) for 2013-14**.[2] The Paper is shared, along with the relevant PWB guidance, with Directorates and committees alike, and informs the preparation of the Secretary-General´s *Strategic Orientations*.

Against a backdrop of increasing demands and tighter member country budgets, Ambassadors agreed that the OECD must deploy its resources effectively in support of the OECD´s 50th Anniversary Vision Statement. They stressed the need for the Organisations´ deliverables to be increasingly more targeted towards the specific challenges faced by member countries, and for tighter integration in the work carried out by Part I and Part II programmes.

While expressing satisfaction with the work of the OECD, Ambassadors called for the Organisation to continue improving management practices that enhance prioritization, efficiency, and transparency. Overall, there was a broad convergence of views around substantive priorities linked to the core activities of the Organisation.

I. Substantive Issues

In the short-run, the OECD has to remain in a "crisis-fighting" mode and provide comprehensive and innovative answers to challenges faced by member countries—key amongst them growth and jobs.

a. Growth and Jobs

Ambassadors highlighted the need to use OECD expertise and multidisciplinary analysis to urgently address these interlinked priorities, underlining the multiple dimensions of growth and the conditions that must exist to encourage investment in people and job creation. Further work was encouraged on structural reforms, fiscal consolidation, and taxes. Likewise, there was interest on issues related to job resilience and environmentally sustainable growth, with strong support for deepening and mainstreaming the work around Green Growth.

Concerns were raised on the growing inequalities in OECD economies, with calls for path-finding work on how to close the "gap". A horizontal approach was favoured, covering work on gender equality, aging, training, education, and taxes, while taking into account institutional settings across federal, regional and local policies.

Another common theme was the transition towards a "Knowledge Economy", with calls for integrating on-going OECD work on innovation, skills, education, competition, intellectual property, and trade.

1. On 9 February, the Permanent Representatives and the Secretary-General met in a Heads of Delegations (HODs) session to discuss the strategic priorities of the OECD, as a first step in the process to prepare the Organisation´s PWB for 2013-14. The Ambassadors shared written statements and provided comments which are reflected in this Informal Convergence Paper, prepared by the Dean of the Council, Ambassador Agustin Garcia-Lopez, and the chairs of the three standing committees, Ambassador Stefan Flueckiger (Budget Committee), Ambassador Motohide Yoshikawa (Executive Committee) and Ambassador Pascale Andréani (External Relations Committee), in consultation with the Secretary-General. The Informal Convergence Paper is provided without prejudice to positions adopted in subsequent stages of the budget discussion process.

2. As called for in C(2009)111/REV1, ANNEX II, and C(2011)96, paragraph 4.

On the issue of "jobs", Ambassadors highlighted youth and long-term unemployment, as well as skills, life-long learning, and education—all part of an "enabling environment". More broadly they called for a better understanding of the link between labour policies and informal economic activities, as well as between growth, employment, and social cohesion.

Recalling that sectoral work is one of the comparative advantages of the OECD, Ambassadors called for the analysis of policies targeted at restoring fiscal and financial health, avoiding and monitoring protectionism, preserving "competitive neutrality", promoting investment, reinforcing anticorruption efforts, and pursing an "open government". There were also calls for boosting productivity by undertaking further work on developing rules-based systems (e.g. competition, intellectual property) and implementing confidence-building measures (e.g. business environment and entrepreneurship).

Beyond GDP

Ambassadors expressed support for the OECD's "Better Life Initiative", with some calling for the mainstreaming of the initiative. There were also calls for "going social" by expanding work on building human capital and analyzing family structures, including on issues of intergenerational fairness.

New Approaches to Economic Challenges[3]

Ambassadors expressed considerable interest in the Secretary-General's proposal for a "New Approach to Economic Challenges", which explores ways to re-shape the prevailing economic models by deriving hard lessons from the crisis. They also reacted positively to his proposal to intensify the work on trade in services and on measuring trade in value-added terms, to better understand how global production networks impact employment. Ambassadors requested further information on the substance, timeline, process and deliverables of both proposals.

Ambassadors asked for the OECD to continue supporting international discussion mechanism, like the G20. Interest was also expressed—with different degrees—for work on trade and innovation, migration, trade and agriculture, water, export credit arrangements, fossil fuels subsidies, and internet policies, among other issues.

b. Development

There was a general recognition that development, as a core policy priority, should be incorporated across all of the Organisation´s activities; in addition to efforts linked to the launching of the OECD Development Strategy. The latter is expected to result in improved coherence across all existing development work, particularly on the linkages between development and growth/jobs, and serve as a vehicle to foster outreach. OECD development cooperation work was highlighted as one of the comparative advantages of the Organisation.

c. Global outreach and cooperation with Key Partners

Ambassadors viewed outreach efforts with Key Partners *(EE5 countries)* as central for incorporating a global policy perspective in OECD work, through the sharing of knowledge, promotion of reforms, and adherence to the Organisation´s best practices and standards. They called for greater involvement of Key Partners through innovative means. Having local contact points on Key Partner countries was deemed useful. There was interest in also engaging middle-income emerging economies.

3. This initiative is referred to as "New Economic Thinking" in the *Secretary-General´s Preliminary Views On The Policy Environment And Priorities For The PWB 2013-14*

d. Lower Priorities

Some Ambassadors indicated their preference for a decrease in resources or an exit from the following output areas: "Horizontal Work on Sustainable Development", "Environment and Globalisation", and "Tourism".

II. Budgetary Process

Ambassadors confirmed that the PWB 2013-14 should be prepared on the basis of ZRG, in accordance with the 2008 financing reform agreement.

Prioritization

Ambassadors noted the results of the Medium Term Orientation Survey (MTO), exchanged views on the difficulties for reprioritization given the broad range of members´ interest in OECD outputs, and asked to review the MTO survey to facilitate future prioritization exercises. Some proposed adopting a "haircut", applied across the board, and using the resulting resources to finance emerging priorities, in the event that other approaches did not work; the adoption of an efficiency target was also proposed by some. The Secretary-General indicated that the Central Priorities Fund (CPF) permitted members to reallocate resources each biennium, equivalent to 5.0% of the Organisation's substantive Part I outputs.[4] Ambassadors emphasized that resource allocations need to be approved by members as part of the PWB process.

Horizontal Initiatives

There was strong support for ongoing horizontal initiatives (e.g. Development Strategy, Green Growth) and calls for emerging priorities to be addressed in this manner. Ambassadors also called for clearer identification of resources allocated to horizontal initiatives, greater ownership by substantive committees, and regular reporting to Council.

Voluntary Contributions

Noting the role that voluntary contributions (VCs) play in supporting the PWB, Ambassadors called for prudent assumptions regarding anticipated VCs.

4. The Secretary-General noted that additional flexibility could be achieved through the adoption of a "down payment" threshold (30% of Part I funding) for all CPF proposals.

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OECD Conference Centre, CC6, Paris
23-25 April 2012

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