國際海洋資訊
International Ocean Information

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海巡外交：護漁與外交之雙贏推手！

Coast Guard Diplomacy: A Win for both Fishery Protection and Diplomacy!

海洋委員會 Ocean Affairs Council 發行

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國際合作不缺席，讓世界看見臺灣！

關鍵字／海洋、APEC、海域安全

主任委員：李仲威

海洋具有豐富多樣的生態與環境，更是人類賴以生存的資源。因此，與海為伍的國家都不會放棄對海洋的重視，海域（岸）的安全更需要各國共同來維護。

本期專題報導從蔡英文總統於2019年3月的「海洋民主之旅」啓航，航程亮點是我國最近與3個邦交國之間簽訂的海巡合作協定，跨出了打擊跨國犯罪、維護海上秩序的重要進展；而臺灣位居亞洲重要樞紐位置，參與亞太經濟合作（APEC）來共同維護亞太區內的經濟與環境更是責無旁貸，因此，列為APEC今年主題的優先領域之一的「永續成長」所關注之海洋議題和海洋及漁業工作小組（OFWG）是我們都該關注的焦點。除此之外，本期亦深入分析「海廢變黃金」的循環經濟發展、海域執法的最新科技發展，以及2019年聯合國最新的「海洋與海洋法」報告等重要課題。

海洋不僅具備豐富資源與生態，與海洋相關的課題更是多元而值得深入瞭解。期許你我都能夠以開闊的視野來一齊關心海洋議題，只要我們在國際間持續發聲，就能夠讓世界看見臺灣！

圖片來源／總統府

海巡外交：護漁與外交之雙贏推手！

撰文／黃釋緯（台灣經濟研究院副研究員）
關鍵字／海巡外交、海域安全、國際合作

蔡英文總統於2019年3月21～26日之「海洋民主之旅」出訪帛琉、諾魯及馬紹爾群島等3個邦交國，與帛琉、諾魯簽署海巡合作協定，共同發展海巡合作、打擊跨國海上犯罪，讓亞太地區的海域安全更進一步得到保障。

圖說／蔡英文總統參觀帛琉艾萊州男人會館及品嚐當地風味餐
圖片來源／總統府

蔡英文總統於2019年3月21～26日之「海洋民主之旅」出訪帛琉、諾魯及馬紹爾群島等3個邦交國，其中馬紹爾群島共和國先於2018年7月27日海妮（Hilda C. Heine）總統訪臺期間，見證臺馬簽署「中華民國（臺灣）政府與馬紹爾群島共和國政府海巡合作協定」，本年3月22日與帛琉簽署「中華民國（臺灣）政府與帛琉共和國政府海巡合作協定」，另於3月25日與諾魯共和國簽署「中華民國（臺灣）政府與諾魯共和國政府海巡合作協定」，此3份海巡合作協定，主要係為發展海巡合作及打擊跨國海上犯罪，其合作領域主要為二國人員互訪、訓練交流、海難救助、漁業執法與跨國合作打擊犯罪等項目。在此國際合作架構下，海上聯合巡航、漁業執法、演訓等是合作的重點項目。以下說明海洋委員會海巡署（下稱海巡署）在海巡外交的重要建樹。

海域安全的守護神—海巡署

海洋委員會海巡署，前身為行政院海岸巡防署，係納編原國防部海岸巡防司令部、內政部警政署水上警察局及財政部關稅總局緝私艦艇等任務執行機關，成為我國海域執法的機關，確立岸海合一之執法機制。一方面致力於維護國家的海洋權益、保障人民的生命財產；二方面注重執法的妥當性，在執法的過程中，兼顧公平、適當、澈底等原則，其目標在於維護臺灣地區海域及海岸秩序，與資源之保護利用，確保國家安全，保護人民權益，海巡署依法掌理下列事項：

一、海洋權益維護之規劃、督導及執行。
二、海事安全維護之規劃、督導及執行。
三、入出港船舶或其他水上運輸工具及通商口岸人員之安全檢查。
四、海域至海岸、河口、非通商口岸之查緝走私、防止非法入出國及其他犯罪調查。
五、公海上對中華民國船舶或依國際協定得登檢之外國船舶之登臨、檢查及犯罪調查。
六、海域與海岸巡防涉外事務之協調、調查及處理。
七、海域及海岸之安全調查。
八、海岸管制區之安全維護。
九、海巡人員教育訓練之督導、協調及推動。
十、其他海岸巡防事項。

圖說／「海洋民主之旅」總統視察海巡搜救演練
圖片來源／總統府

公海巡護 強化中西太平洋漁船作業安全

為善盡國際漁業管理責任，確保我國漁民及漁船在公海作業之安全，海巡署每年配合漁業署規劃，依據「海岸巡防機關執行中西太平洋漁業員會公海登臨檢查作業要點」規定，派遣巡護船進行公海巡護任務，於公約水域規劃2至3航次中西太平洋漁業巡護任務，執行中西太平洋高度洄游魚類種群養護與管理公約範圍內之公海海域進行漁船之檢查程序。自2018年與太平洋友邦簽署海巡協定後，海巡署更加強與太平洋友邦國家海巡執法的交流，為太平洋區域的海域安全及海洋資源做出貢獻，保障漁船作業安全，並增進邦誼。

臺馬簽署合作協定 強化民間交流

2018年7月馬紹爾群島共和國海妮（Hilda C. Heine）總統來臺訪問，本次訪問除了簽署「海巡合作協定」外，另簽署「兩國國民互免簽證協定」，蔡總統感謝馬紹爾長期支持臺灣參與國際事務，期盼透過簽署上開協定，以強化雙方民間交流，共同守護二國海域安全與海洋資源。

由於二國同屬南島文化體系之一，臺灣與太平洋地區的島嶼國家可以有更緊密的交流與合作，一起追求聯合國永續發展目標，迎接氣候變遷和地緣政治的挑戰，在二國的合作下，一定能為國際社會做出貢獻。蔡總統也感謝馬紹爾群島共和國長期支持臺灣參與國際事務，臺灣也將全力支持馬國發展海洋事務，共同把二國的共享的信念和價值傳遞給全世界。

圖說／蔡英文總統在總統府會晤馬紹爾群島共和國海妮總統
圖片來源／總統府

臺帛合作 深化海巡搜救演練

2019年3月下旬「海洋民主之旅」出訪期間，我國海巡署與帛琉海洋執法局共同辦理搜救演練。蔡總統與帛琉雷蒙傑索（Tommy Remengesau）總統均出席會場，本次演練主要由我國1,000噸級「巡護七號」船進行演練，假想「巡護七號」船接獲帛琉籍的「倫敦號」漁船通報，其船上有2名漁工失聯，疑似在整理漁具時不慎落海失蹤，請求我國「巡護七號」船前往該海域協助搜救，「巡護七號」船在抵達通報海域後，施放小艇進行現場搜救，救生演練因漁工落海受傷程度不同，我國海巡人員以不同方式施救。在二國人員互訪、訓練交流、海難救助、漁業執法及打擊海上犯罪等領域，海巡署持續推動深化與太平洋友邦間的海巡交流與合作。

圖說／我國「巡護七號」在海洋民主之旅期間於帛琉海域執行搜救演練
圖片來源／總統府

另外，7月份帛琉副總統歐宜樓（Raynold Oilouch）來臺訪問交流，則是延續二國海巡合作的基礎，進一步強化與我國在海洋安全等領域之交流與合作，透過二國之合作，促進二國在太平洋地區中，成為確保和平與維護海洋生態永續發展重要關鍵國家。

定期演練 強化南海救援能量

為維持我國海洋安全，2019年5月21日海巡署會同交通部、國防部、外交部、衛生福利部及國家搜救指揮中心等相關機關，在南沙太平島海域實施人道救援演練（南援四號演練），藉此彰顯我國南海搜救、醫療與國際人道救援任務的能量，以貫徹蔡總統「使太平島成為人道救援中心與運補基地」的南海政策。

演練內容主要係模擬載有25名乘客及機組員的小型觀光客機迫降太平島海域，並與附近漁船發生擦撞，造成機上2人落海，1人死亡、2人重傷，另漁船12人中，3人輕傷，整個救援操演過程緊湊逼真，充分展現我國各機關協調合作的默契，海巡署未來將持續規劃辦理南海人道救援演練，深化與周邊國家救援合作機制，實踐太平島成為南海人道救援中心與運補基地的角色與地位。

圖說／南援四號演練，海巡署官兵搜尋落海失蹤人員搶救過程
圖片來源／軍事新聞通訊社

2019 APEC「永續成長」優先領域

撰文／陳璋玲（國立成功大學海洋科技與事務研究所教授）
關鍵字／APEC、永續成長、海洋垃圾、非法捕魚

2019年APEC主辦國是智利。今年主題是連結人群、營造未來（Connecting People, Building the Future），在此主題下設定四大優先領域：「數位社會」（Digital Society）、「整合4.0」（Integration 4.0）、「婦女、中小企業及包容性成長」（Women, SMEs, and Inclusive Growth）、「永續成長」（Sustainable Growth）；其中「永續成長」優先領域和海洋議題有關。

圖說／減少海洋垃圾是APEC致力保護海洋的手段之一
圖片提供／陳璋玲

APEC長期透過區域經濟整合，加強貿易與投資，以促進亞太地區的經濟成長。然而如何確保永續成長，落實其致力於改善人民生活的承諾是APEC在21世紀之際面臨的挑戰。此挑戰必須以平衡與永續的方式來改變現有的經濟活動。其中棘手的問題包括：垃圾及污染減量、發展乾淨及更有效率的能源、改善都市基礎設施，以建立更有活力及健康的智慧城市。

基於這些問題，「永續成長」優先領域設定三大議題為：(1)保護海洋及海洋生態系（Protecting our oceans and marine ecosystems）、(2)永續能源（Sustainable energy）、(3)建立智慧城市共通的標準（Developing common standards for smart cities）。

本文主要介紹第一項的保護海洋及海洋生態系議題，後二項議題則簡略介紹，以利瞭解永續成長涵蓋的面向與內涵。此外，APEC的海洋漁業工作小組（Ocean and Fisheries Working Group, OFWG）亦每年探討海洋及漁業議題，此部分的內容另於本期〈APEC海洋及漁業工作小組〉一文中予以介紹。

保護海洋及海洋生態系

APEC保護海洋及海洋生態系的策略主要有二：打擊海洋垃圾（Combating marine debris）和避免非法捕魚（Preventing illegal fishing）。事實上，APEC長期以來關注海洋議題，例如2014年廈門宣言（Xiamen Declaration）確認4個關鍵優先領域，分別為：海岸與海洋生態系保育和災害韌性（coastal and marine ecosystem conservation and disaster resilience）；海洋在食品安全和食品貿易扮演的角色（the role of the ocean on food security and food-related trade）；海洋科學、科技與創新（Marine science, technology and innovation）；藍色經濟（Blue Economy）。APEC更以「藍色經濟」用詞來描述太平洋地區可觀的養殖生產量，其總量占全球養殖產量的80%。

此外，2015年APEC在智利瓦爾帕萊索（Valparaiso）召開之「及時保護我們海洋」（Protect our Oceans in Time）會議，智利會中宣布將於復活島附近劃設海洋保護區，以保護海洋免於過漁、污染和海洋垃圾等威脅。該保護區經過官方、地方居民和漁民、業者及NGO等多方努力，終於在2018年2月成立，名為拉帕努伊保護區（Rapa Nui Marine Protected Area），面積達72萬平方公里，約智利在南美大陸的大小，保護142種海洋生物，其中包括瀕臨滅絕的27種生物。

一、打擊海洋垃圾

全球有五大海洋垃圾集中區域，稱之為垃圾帶（garbage patches），其中兩個分別位於北太平洋和南太平洋，其面積分別為第1大和第3大。據估計每年約有8百萬噸塑膠流入海洋，而太平洋的垃圾，約有40%來自亞洲國家。海洋塑膠垃圾主要來自陸地，而且約90%是經由河川流入海洋。海洋垃圾不僅影響海岸生物，對於航運和人體健康亦有負面影響。然而目前塑膠對海洋生物和人類健康的影響尚未全然瞭解。海洋垃圾種類多，其中以塑膠垃圾特別引起重視，主要係因塑膠耐久性高，不易分解，可在環境存在超過400年之久，又大部分塑膠是不可回收的，最終就容易流入海洋。

減少和消除來自陸地的海洋垃圾，以及清除已存在於海洋的垃圾需要各國合作努力。海洋垃圾監測和垃圾管理措施是重要的手段，前者有助海洋保護及採取有效的海洋垃圾減緩策略；後者則包括實施垃圾收受系統、提升垃圾回收利用、將不可回收的塑膠轉換成能源、清除河道累積的塑膠垃圾，以及禁止特定塑膠種類的使用。

此外，水銀是全球關注的污染物，其對生態和人體健康有負面效果。近來環境中水銀濃度顯著增加，而海洋是水銀主要的貯存環境之一。為減少人體曝露於水銀，以及改善魚和動物健康，必需逐步淘汰含有非必要水銀的產品（non-essential mercury-containing products），因此有必要研發新的操作、使用和處置含有水銀的產品。

基於上述，智利於今年會議中推動跨區域的海洋垃圾監測試驗性計畫，主要朝建立海洋垃圾監測標準而努力。此外，智利亦推動不含水銀產品的商業化，相關作法包括：成立工作坊和訂定技術指導來促進沒有水銀添加物產品的商業化。

二、避免非法捕魚

全球海洋洋區中，太平洋的面積最大。APEC經濟體對於太平洋魚產品的依賴很深，其消耗70%的全球漁業相關產品，90%的全球養殖漁業產品，65%的全球魚捕量。另全球前10大魚產國中，有9個是APEC經濟體。

非法、未報告和非規範（illegal, unreported and unregulated, IUU）捕魚已是全球關注的焦點。IUU對於魚類系群和海洋生態有負面影響，且亦扭曲全球漁獲市場貿易及危害食品安全供應。海洋資源和漁業諮詢專家於2016年估計IUU的成本代價介於100億至230億美元，另亞太地區約有306,440噸鮪魚由IUU捕獲或運送。

鑑於IUU在太平洋地區的活動規模，智利提議每個APEC經濟體檢視並評估其現行實施的IUU策略，相關作法包括：成立打擊IUU資訊分享工作坊、確認策略集中的領域和最佳實踐方法、研擬APEC地區打擊IUU的行動方案。

圖說／避免非法捕魚是APEC致力於保護海洋的手段之一
圖片提供／陳璋玲

永續能源

永續能源主要在促進電動能（electromobility）成為乾淨和可負擔的能源。基於APEC地區的能源需求占全球的60%，以及2011年APEC發表宣言，宣示2035年前減少2005年能源使用量的45%。在此目標下，能源合作及推動再生能源是非常重要的。

因此，智利今年主持能源工作小組（Energy Working Group）會議，討論偏遠地區的能源解決問題和電動能系統供應的技術挑戰和機會等議題，以促進乾淨和可負擔的能源及電動能的發展。

建立智慧城市共通的標準

2050年前，全球人口的80%將居住於城市地區。城市將持續是經濟成長的重心，而智慧技術可更正確地監測和評估人類和自然環境與人造環境的互動。為促進APEC地區的全面性成長、繁榮與進步，提升創新和永續的都市基礎設施，以及建立智慧和綠城市是非常重要的。今年會議討論城市整合服務、自主管理系統、有效網路系統、交通擁擠管理、交通事故避免、減少環境衝擊，以及公共空間等議題。希望透過這些議題討論，APEC經濟體分享智慧城市的最佳實踐方案，以建立智慧城市共通的標準。

圖片來源／Tumisu from Pixabay

漁業廢棄物之加值應用技術與循環經濟商機

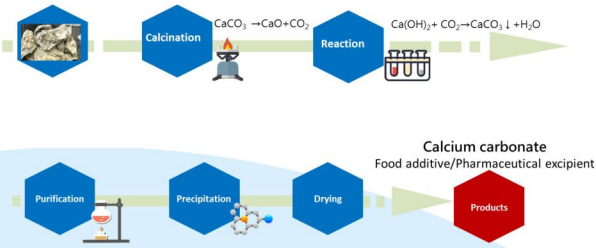
撰文／鄭慧玲（工業技術研究院生醫與醫材研究所資深研究員）
圖片提供／工研院生醫與醫材研究所
關鍵字／循環經濟、牡蠣殼、生技材料

配合政府重要施政方針之循環經濟概念，研發專業製程與生物技術，使得漁業廢棄物可循環再生形成新的高值化資源，進而廣泛應用於食品與生醫領域。

技術切入

臺灣西南部無垠海岸線上孕育了海洋養殖奇蹟的同時，也造就沿岸大量漁業廢棄物堆置的特殊風景。臺灣每年產生逾12萬噸廢棄物牡蠣殼，對環境及當地居民影響甚大，以往牡蠣殼多採以磨碎方式使其形成牡蠣殼粉，可作為飼料與肥料使用。

牡蠣殼中具有大量的碳酸鈣成分為其研發優勢，如何去蕪存菁、去除大量不純物、保留住碳酸鈣，則為加值化技術切入的思考點。技術重點聚焦於如何去除不純物與提升純度為主要製程開發著力點，成品以符合食品級添加物與醫藥級賦形劑之規範。牡蠣殼加值技術簡圖如下：



圖說／牡蠣殼加值技術說明

市場概況

經工研院產科國際所整理研究指出，在2018年全球碳酸鈣市場規模約230億美元，預估至2022年市場規模約290億美元，年複合成長率為5.3%；主要生產地區則分布在中國、北美與歐洲，在其應用上，則以造紙、塑膠、塗料等工業用途為最大宗，其中食藥品應用占整體規模7.0%。根據臺灣海關進出口資料顯示，2007至2017年臺灣進口碳酸鈣重量約1萬公噸左右，進口量無太大變化，主要進口來源以中國、日本、越南、美國為主；出口國家以印尼、越南、泰國為主。

食品添加物與賦形劑碳酸鈣產品在臺灣市場中大多仰賴進口，幾乎無臺灣產業自製品。因此如可藉由生技技術加值，協助產業建立技術及高附加價值產品，更可達到環境友善效益，為臺灣帶來更多的創新與循環經濟應用收益。

產業發展

臺灣為四面環海之海島國家，同時有廣大的海洋資源優勢，近年政府推動循環經濟政策下，產業重新檢視廢棄物資源化之可行性評估，研發專業製程技術與高附加價值之產品。除了可使資源持續循環使用外，如何讓其發揮更大經濟效益則為產業投入點。

其實碳酸鈣產品環繞在大家的生活中，其於食品方面作為酸鹼度調整劑、抗結塊劑、著色劑、硬化劑與安定劑等功能，被廣泛應用於各種食品製作與產品中。例如在醫藥部分常作為賦形劑、制酸劑、鈣片，更可加值衍生作為藥物載體及人工骨材等應用，可見碳酸鈣廣泛發展。在加值技術建立的同時擴散來源應用，基於考量漁業生物資源的廢棄物多具有碳酸鈣成分之特性，同時對於多種漁業生物資源廢棄物來源建立製程技術，期以對於臺灣產業及循環經濟帶來廣大的創新循環綜效。

碳酸鈣技術生物資源來源

圖說／碳酸鈣技術多種漁業生物資源廢棄物來源

結語

臺灣四面環海具有充足的海洋資源高度優勢，但資源並非取之不盡用之不竭。產業有其責任於開發資源的同時，藉以高附加價值生技技術可讓廢棄物進行資源再生，達到綠色循環與環境友善效益，更期能帶領臺灣產業於國際占有領先契機，同時為臺灣達到更大的創新循環經濟綜效。

海洋廢棄物的循環經濟利用—遠東新寶特瓶回收

撰文／方佳南（國立中央大學地球科學院行政專員）
黃志誠（國立中央大學水海所副教授）
江佩儒（桃園市政府海岸工程管理處生態保育科科長）
關鍵字／海洋廢棄物、海岸垃圾、寶特瓶、循環經濟

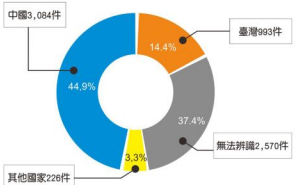
海洋廢棄寶特瓶透過收集與處理，可再製成環保製品，使海洋廢棄物形成循環經濟，為海洋環境與人類帶來良性循環。

海漂垃圾

海漂垃圾是當今地球環境最棘手的問題之一，動物誤食海漂垃圾死亡時有所聞，據英國艾倫・麥克阿瑟基金會（Ellen MacArthur Foundation）發表報告，每年約有800萬噸廢棄塑膠流入海洋，推估至2050年海中廢棄物將可能比魚還多，這問題不僅讓大海窒息，也造成沿海生態環境的變異與凋零，更重返進入人類食物鏈，威脅人類健康。對此問題，人們群起積極淨灘、淨海，也有越來越多的國家響應推動各項減塑政策。

海漂垃圾，你哪來？

依據桃園市政府海岸管理工程處委託國立中央大學執行「108年桃園市海岸水文地理資訊暨海漂垃圾調查評估計畫」發現，桃園海岸的海漂垃圾主要為廢棄寶特瓶、一般生活用品、廢棄漁具等，該計畫並以廢棄寶特瓶做來源調查分析。如右圖所示，統計結果指出，44.9%廢棄寶特瓶來自中國大陸，14.4%來自臺灣境內，37.4%無法辨識來源，來自其他國家則合計約3.3%。



圖說／桃園市海岸垃圾中廢棄寶特瓶來源統計結果
（調查範圍：桃園海岸，調查期間：2019年3～5月間）
資料來源／108年桃園市海岸水文地理資訊暨海漂垃圾調查評估計畫

海漂垃圾，你哪去？何處是你的終途？

淨灘、淨海是對海漂垃圾問題最常見、最直觀的行動，然而行動之後呢？海漂垃圾回收後的再循環利用須積極推動，這是減少塑膠垃圾留滯海岸、進入海洋的最後一哩路。源頭減塑是衆所皆知的減少塑膠廢棄物進入海洋，抑制污染發生的根本之道，但尋求便捷、利益是人的天性，要人們對便利、廉價的塑膠「斷、捨、離」，成效仍緩不濟急。因此，降減海廢威脅的另一方法是讓廢料成為生產物料，再一轉身成為再製品，不讓廢塑料只有留待萬年消解一途可走。

環境能否改善？有請織女

臺灣紡織業曾一度走向夕陽工業，如今已轉變為全球紡織業研發重鎮，其中全球機能性布料市占率高達7成。機能布料與海漂垃圾又有什麼樣的鏈結呢？臺灣沒有參加2018年世界盃足球賽，但有16支國家代表隊穿著臺灣紡織業製作的球衣，在球場上競技求勝，球衣的原料就是海漂垃圾頭號戰犯「廢棄寶特瓶」的華麗轉身。

臺灣的紡織和回收技術進步，PET寶特瓶經由清洗、破碎製成環保粒，再透過抽紗、加工，就能變成一件件舒適、環保的機能運動衣。德國Adidas運動品牌於2016年全球發售的限量海洋環保鞋，所有材料都是漂浮在馬爾地夫周圍海洋的垃圾，而協助再生製鞋的就是來自桃園市觀音區的亞東創新發展公司，是再生製造的佼佼者。桃園市政府在2019年6月起與亞東創新合作，將桃園市淨灘、淨海清理出的廢棄寶特瓶、交給亞東創新進行回收後，再製成環保衣，並回饋桃園市政府海岸巡護隊志工穿著，讓廢棄寶特瓶獲得第二生命，守護著淨海的最後一哩路。

依據桃園市政府海岸管理工程處統計，市府海岸淨灘、淨海的維護成果，自今年6月至7月底已收集有980公斤的垃圾廢棄寶特瓶集運至亞東創新，進入回收循環，依據顏色與清潔程度進行初分類，再壓製成瓶磚，瓶磚會經過解包、洗滌、脫標籤、分色分類、粉碎、清洗、去除雜質、脫水，處理成乾淨的PET碎片。接著送至遠東新世紀公司新埔廠將PET碎片再加以分解、重新聚合及高溫熔融，成為PET酯粒，又稱再生聚酯粒（Recycled PET），也就是環保粒，接著再抽絲紡紗，製作環保織品，每公斤的寶特瓶約可製作5件環保慢跑衣。海廢寶特瓶回收再製流程如下圖。

圖說／海廢寶特瓶回收再製流程圖　資料來源／亞東創新公司

結論

從源頭禁塑的海洋減塑政策是為減少塑膠累積為廢棄物的機會。已經存在的海漂垃圾則可積極進行各種淨灘、淨海活動，從自發性的志工活動到政府實施的海岸清潔計畫等，都可降低海洋中垃圾存在的程度。從海岸撿拾而回的垃圾，透過循環經濟將無用的垃圾變成有用之物，就能帶來良性循環。當民眾察覺環保行動能帶來明確而可見的優點時，也將更樂意參與行動。期待未來廢棄塑膠不再是海上常客！

APEC 海洋及漁業工作小組

撰文／劉光明（國立臺灣海洋大學海洋事務與資源管理研究所教授）
關鍵字／APEC、OFWG、海洋及漁業工作小組

APEC（Asia-Pacific Economic Cooperation）是亞太經濟合作的論壇平台，透過非約束性的承諾與成員的自願來運作。本篇介紹APEC十大工作小組（Working Groups）之一的海洋及漁業工作小組（Ocean and Fisheries Working Group, OFWG）。

圖片來源／Asia-Pacific Economic Cooperation

亞太經濟合作（APEC）是促進亞太區內各地區之間經濟成長、合作、貿易、投資的重要論壇之一，目的在藉由經濟合作的相關作為，促進亞太地區的互利共榮。亞太經濟合作設立於1989年11月5日至7日，由美、加、紐、澳、日、韓、及東協六國在澳大利亞首都坎培拉舉行APEC首屆部長級會議並正式成立，目前有21個經濟體成員。

APEC是經濟合作的論壇平台，其運作是通過非約束性的承諾與成員的自願，強調開放對話及平等尊重各成員意見，不同於其他經由條約確立的政府間組織（Elek, 1991）。我國於1991年以中華台灣（Chinese Taipei）名稱加入APEC。APEC的發展脈動為我國推動各項經濟發展措施的重要參考依據，也是擴展亞太市場或建立國際合作的適當管道。

海洋資源保育工作小組（MRC）

海洋資源保育工作小組（Marine Resources Conservation Working Group, MRC）每年舉辦1～2次的工作小組會議，討論該工作分組的年度重點工作。1998年6月4日於智利維那狄瑪市（Vena del Mar）舉辦的「第11屆亞太經濟合作海洋資源保育工作小組會議」，我國由當時的行政院環境保護署水保處阮國棟處長率團與會，會議期間積極參與各項議題討論並提出多項建議，與其他會員體有良好互動，因此在會議中，獲與會各會員體一致支持，並取得擔任海洋資源保育工作小組主事國（Lead Shepherd）一職，為期2年。

我國在接任APEC海洋資源保育工作小組主事國一職後，致力推動會員體部長會議所決議之永續海洋環境行動計畫、主導與審核會員體之執行計畫、提報年度工作成果、負責與其他工作分組進行協調工作等事宜。我國並於2000年起每年均獲准自費辦理APEC企業／私人部門參與海洋環境永續性圓桌會議，迄今共計辦了19屆圓桌會議。

圖說／第19屆亞太經濟合作組織企業／私人部門參與海洋環境永續性圓桌會議
圖片來源／臺灣海洋大學海洋事務與資源管理研究所

小組再升級：MRCWG+FWG=OFWG（海洋及漁業工作小組）

2011年「海洋資源保育工作小組」與「漁業工作小組（Fisheries Working Group, FWG）」合併而成APEC海洋及漁業工作小組（OFWG），為APEC十大工作小組之一，相關會議的位階係在「領袖會議（Leader's Meeting）」、「部長會議（Ministerial Meeting）」和「資深官員會議（Senior Official Meeting, SOM）」之下，工作小組工作重點分別為海洋資源保護及漁業永續。

APEC海洋及漁業工作小組底下設有3個APEC中心，分別為APEC海洋環境培訓和教育中心（APEC Marine Environmental Training & Education Center, AMTEC）、APEC海洋永續發展中心（APEC Marine Sustainable Development Center, AMSDC）和APEC海洋和漁業資訊中心（APEC Ocean and Fisheries Information Center, AOFIC）。

APEC海洋及漁業工作小組的主要目標致力於：
一、促進貿易和投資機會，以促進漁業、水產養殖和海洋生態系統資源的永續利用。
二、確保永續利用海洋資源，以及保護支持漁業和水產養殖所需的海洋生態系統。
三、推動共同的辦法，預防非法漁撈及相關的貿易。

在2014年於中國廈門會議期間，APEC海洋和漁業部長會議通過了APEC海洋和漁業議程的4個優先領域：

一、沿岸與海洋生態系的維護及災害復原。
二、海洋在糧食安全與糧食相關貿易上扮演的角色。
三、海洋科學、科技與創新。
四、跨論壇合作以擴大藍色經濟—關注海岸和海洋作為經濟增長的永續推動力。

「廈門宣言」承諾到2020年，將通過管理的海洋保護區至少包括10%的沿海和海洋區域。同年11月，亞太經濟合作部長會議還通過了關於亞太地區海洋合作的具體附件。

2019年海洋和漁業工作小組將展開的活動和措施目的都在響應APEC領導人的宣言、部長及高級官員聲明、資深官員（SOM）的決定、SOM經濟暨技術合作指導委員會優先事項、及APEC企業諮詢委員會（如適用）建議。OFWG將持續實施「首爾海洋宣言」（Seoul Ocean Declaration, 2002）、「峇里行動計畫」（Bali Action Plan, 2005）、「巴拉卡斯宣言」（Paracas Declaration, 2010）、「廈門宣言」（Xiamen Declaration, 2014）、「糧食安全高階政策對話」（High Level Policy Dialogue on Food Security, 2015）、「藍色經濟行動計畫」（Blue Economy's Action Plan, 2015）、關於糧食安全的「皮烏拉宣言」（Piura Declaration on Food Security, 2016）、及應對氣候變化的「糧食安全和永續農業高階政策對話」（the High Level Policy Dialogue on Food Security and Sustainable Agriculture in Response to Climate Change, 2017）。


圖片來源／Pride Advertising Agency Ltd.

2019～2021 OFWG策略方針將採取的措施如下：

一、自由開放的貿易和投資。
二、永續發展海洋和保護環境。
三、糧食安全。
四、氣候變遷。
五、自然災害／應急準備／災害恢復力。
六、藍色經濟。
七、OFWG營運。

2019年OFWG預定舉辦兩場會議，第一場會議OFWG 12已於2019年2月23～24日在智利首都聖地牙哥召開，OFWG的工作及其項目如下：

一、回應智利的主事國優先事項，特別關注永續增長優先事項，因為它涉及漁業、水產養殖和海洋環境。
二、繼續採取行動，提高解決非法、未報告和不受規範（illegal, unreported and unregulated fishing, IUU）捕撈對APEC經濟體永續漁業和糧食安全的負面經濟影響的能力。
三、開發工具以評估和解決海洋垃圾、和廢棄漁具對APEC經濟體漁業和海洋環境的影響。
四、開發工具以評估和解決氣候變遷對APEC經濟體漁業、水產養殖及海洋環境的物理和經濟影響。
五、根據OFWG 3的協議，促進APEC內的持續活動，以符合藍色經濟的共同觀點。
六、促進對APEC海洋永續發展報告的持續與改進／更新。
七、加強部門公私伙伴關係，包括參與和交流OFWG工作。
八、發展及加強跨文化合作：將與海洋有關的問題納入亞太經濟合作的主流，承認婦女在漁業和水產養殖中發揮的重要作用，並認識到農業部門面臨的共同挑戰，特別是與糧食安全相關的挑戰。
九、通過進一步的OFWG項目促進加強能力建構，包括自籌資金項目。
十、採取行動加強與糧食安全政策夥伴關係（PPFS）的合作，包括積極參與PPFS的相關項目，並為制定2019年巴拉斯港糧食安全宣言（SOM3 2019）的優先事項做出貢獻。
十一、加強OFWG與其3個APEC中心，APEC海洋環境培訓和教育中心、APEC海洋永續發展中心及APEC海洋和漁業資訊中心之間的協調，並探索與其他APEC中心合作的潛在可能。

海洋科研發展與執法能量

撰文／施義哲（國家海洋研究院綜合規劃及人力培訓中心主任）
關鍵字／海洋科研、科研計畫、海域執法

海洋權益的維護，有賴強而有力的執法與裝備，推陳出新的現代科技則是海域執法任務最好的輔助。本篇簡單介紹海洋科學研究的發展與執法能量。

圖說／無人機　圖片提供／海巡署北部分署

海洋是各先進國家科技發展的重要領域，對於海洋資源開發、拓展海洋空間及權益，與日俱增。海洋科技是永續發展的根基，我國應更加重視海洋科技，活絡人才培育和運用，發展高端的海洋科技，建立更穩固的科技根基來支撐且合理利用與保育海域資源、永續發展的現代海洋國家。而從戰略的角度觀之，以往的觀點，是誰掌握了海洋、誰就擁有全世界，而新世代的觀點，是以全方位的軍事競爭、經濟競爭和科技競爭，海洋科技水準和創新能力，已經在海洋的激烈競爭中占主要的地位。意即誰掌握了完整的海洋科研資訊，誰就擁有全世界，顯見海洋科研的重要。

海洋科技發展概述

海洋科學是研究地球上海洋的自然現象、性質及其變化規律，以及和開發與利用海洋有關的知識體系。其研究對象即為占地球表面近71%的海洋，其中包括海洋中的水體以及溶解或懸浮於海水中的物質，生存於海洋中的生物，也有海洋底邊界之海洋沉積和海底岩石，以及海洋側邊界之河口、海岸地區，還有海洋的上邊界之海面上的大氣邊界層等，它的研究內容包括海水的運動規律、海洋中的物理、化學、生物、地質、生態、大氣科學、水文科學等均有密切的關係。

隨著科技的發達，人類對海洋資源開發的能力有很大精進，越來越多的國家對其沿海海洋資源與開發也逐漸重視，此外，海洋科學與技術的快速變遷使得海洋產業之工作環境及所需知識也隨之改變，產業界對於海洋專業人才的需求內涵也與傳統海洋產業不同。例如，隨著海洋運輸科技的發展，需要熟知海洋運輸系統與e化環境物流管理人才；海洋管理專業人才，需要熟悉海洋事務相關領域；海洋漁業之船員幹部，需要具備使用科技資訊、熟知海洋法律、海洋事務管理及語文溝通等能力；養殖產業則除需要養殖專業能力外，更需要生物科技、環境管理、監測及管理行銷之人才等，相關領域所需人才之層級、數量、內涵及培育模式乃為當前及未來海洋界發展重點。

國際海洋科技發展概況

海洋蘊藏豐富水資源、海洋能源、礦物資源、生物資源及觀光資源，海洋成為各國爭相重視的寶藏。例如，海洋中石油資源占全球總量27%至45%，天然氣資源占全球總量50%至55%；海洋資源的開發成為促進經濟發展的重要策略，當前國民所得超過2萬美元之國家，有80%為濱海及面海的國家。

在國際海洋科技發展國家中，美國幾乎是群龍之首，成為國際海洋科技領域的領導者，如斯克里普斯海洋研究所（Scripps Institution of Oceanography）、伍茲霍爾海洋研究所（Woods Hole Oceanographic Institution）及各著名大學的海洋研究所等，其他國家則因為資源與產業的發展方向，而各有千秋。而美國、日本及其他歐洲國家的海洋科技之所以發達，究其根本在於擁有完整有效的國家海洋科技技術與創新系統，為其海洋科技活動提供基礎與後盾。而分析這些先進海洋科研國家之特點與優勢可歸結幾個重點：1.重視海洋科學技術創新規劃；2.注重海洋科研人才的培養；3.海洋科技創新投入；4.國家科技法規的擬定；5.海洋產業的輔助；6.海洋科技的國際合作等。

海洋環境有其獨特性，資源的分布有其複雜性，海洋的科技研究需要世界各國的合作，充分的發揮各國優勢，在海域進行長時間的監測、調查和研究。美國在國際海洋科技合作也倡議和主導大型的國際海洋科研合作的研究計畫，例如：國際地球生物圈計畫（International Geosphere-Biosphere Programme, IGBP）、世界大洋環流實驗（World Ocean Circulation Experiment, WOCE）、熱帶海洋和全球大氣方案（Tropical Ocean and Global Atmosphere Programme, TOGA）、全球海洋通量聯合研究（Joint Global Ocean Flux Study, JGOFS）、大洋鑽探計畫（Ocean Drilling Program, ODP）、全球海洋觀測計畫（Global Ocean Observing System, GOOS）、世界氣候研究計畫（World Climate Research Programme, WCRP）等。如全球海洋觀測系統（GOOS）由政府間海洋學委員會（Intergovernmental Oceanographic Commission, IOC）、世界氣象組織（WMO）、國際科學聯合理事會（ICSU）和聯合國環境規劃署（UNEP）發起，總部設在巴黎。主要功用在提供海洋環境現況、海洋資訊評估和預報、氣候變遷預測等，提供有效、安全和永續利用的海洋環境。GOOS 2030策略願景是成為一個真正的全球海洋觀測系統，提供永續發展、安全福祉和繁榮所需的基本資訊。而其任務是領導海洋觀測並建立夥伴關係，建立一個綜合，反應迅速和持續的觀測系統。

海洋科技領域重大海洋研究計畫的推行，不僅促進了各國海洋科技的交流，也加速了海洋科研的整合，推動海洋科技的持續發展。

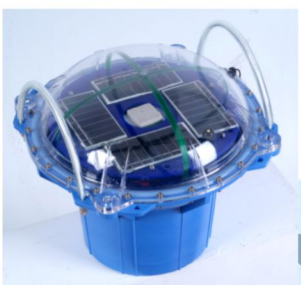
海域執法能量

海洋科學領域逐漸成長茁壯，不論是在海洋科研的硬體或軟體方面皆有初步基礎，而其成果提供海域執法之能量建構如下：

1.海洋科研裝備：都卜勒流速剖面儀（Acoustic Doppler Current Profiler, ADCP）、拖曳式海洋資料蒐集系統、多功能水質監測紀錄系統等。海洋委員會海巡署艦隊分署（前身為「海巡署海洋巡防總局」）為了能有效的執行海上搜索救助任務，自民國98年起陸續添購了表面海流浮標（Datum Marker Buoy, DMB），107年開始與台灣海洋科技研究中心（TORI）合作輕型浮標；配合任務需求，巡防艦艇在海上執勤時，可施放DMB、ADCP、海水監測等儀器，並追蹤其浮標漂流軌跡、以掌握精確的海流等海象資訊及瞭解海洋環境狀況，這些現場實測數據對海上搜救任務的順利執行極具重要性。

2.建置海洋資料庫：建置周邊水域的海洋資料庫，提供海域執勤任務的參考，海洋資料庫包括海難資料庫、轄區水文資料庫、海洋環境資料庫、海洋油污指紋資料庫、海洋資源資料庫等。建立轄區水文資料庫，藉由友軍單位的研究船所探測成果，針對實驗目的，由研究船實際於研究海域選定特定測站位置進行海水探測，以瞭解區域內海水之溫度、鹽度及密度等重要水文資料，判斷其物理特性並研究其海水主要來源。

3.無人飛行載具（Unmanned Aerial Vehicle, UAV）裝備：為確保海域（岸）安全之目的，目前已運用機動、迅速之無人飛行載具，結合巡防區指揮體系，於海域、岸際實施偵巡任務，發揮預警功能，期能迅速應處狀況。同時也頒布了相關的執行作業規範，驗證實際任務，以完善勤務標準程序。UAV在各領域已被很多國家使用，在執法應用上非常廣泛，如查緝走私、協助消防勘查與人員救護任務；亦有使用UAV進行海洋環境保護與海岸環境勘查，如潛在危險地貌的侵蝕速率調查。透過UAV的偵查資料，可快速準確地分析大型空間資訊，再結合地理資訊系統，即能掌握海域環境狀況與勤務作業條件。目前國家海洋研究院也協助海巡署UAV機隊進行國土監測的科技專業訓練，以協助建立系統性海岸地區影像圖資大數據庫，將可做為國土變遷監測之政策參據。



圖說／表面海流浮標
圖片提供／海巡署

圖說／描繪全球海洋觀測系統（IOC-GOOS）

圖片來源／Glynn Gorick produced for UNESCO IOC-GOOS

結語

世界各國在科技領域不斷地向海洋拓展其探索能力，因此積極發展海洋科學、海洋環境監測與其基礎設施，而取得的相關海洋資訊與海洋科研成果則是提供海洋治理、海洋管理、海洋規劃與海洋永續之基礎。

聯合國秘書長2019年海洋與海洋法報告簡析

撰文／曾煥昇（國立臺灣海洋大學助理教授）
關鍵字／聯合國海洋法公約、海洋與海洋法報告

透過聯合國秘書長每年所提出之「海洋與海洋法」報告內容，可瞭解國際社會近期所關切之海洋議題，並可提供我國海洋相關機關參考。

圖說／聯合國日內瓦辦事處
圖片提供／鄧旭博

前言

聯合國於1982年12月10日通過「聯合國海洋法公約」（United Nations Convention on the Law of the Sea, UNCLOS），1994年11月16日生效，迄今已有157個國家簽署，有學者稱之為「海洋憲法」（Constitution for the Oceans）。長期以來，世界各國對海洋議題極為關注，自1984年起聯合國秘書長每年向聯合國大會提出海洋法相關發展之總體回顧年度報告。由秘書長每年所提出之「海洋與海洋法」（Oceans and the Law of the Sea）報告內容，即可瞭解國際社會近期所關切之海洋議題。

2019年海洋與海洋法報告焦點議題

2019年海洋與海洋法報告係以「海洋科學與聯合國海洋科學促進永續發展十年」為主題，強調海洋科學研究的重要性，相關焦點議題如下：

一、海洋科學的範圍及功能

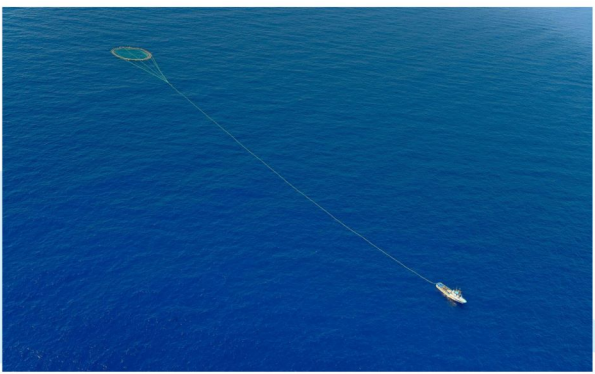
海洋科學係與海洋研究有關的一系列學科，包含：物理、生物、化學、地質、水文、衛生、社會科學、人文科學、工程學及多學科研究，以瞭解海洋地質、地球物理、動植物分布、海洋與大氣之關聯、氣候變遷與海洋酸化對海洋的影響。藉由海洋科學的研究，將可有效管理人類在海洋所進行的活動，確保適度開發，消除貧窮，加強糧食保障，促進海洋永續發展，降低人類生命財產損失，改善人類生活。

二、海洋科學努力的方向

為了充分瞭解海洋在地球生態系統中的作用，許多領域仍需進一步調查，例如：生態系統養護、對生物多樣性與海洋生產力對社會經濟的影響、海洋與氣候之間的關係、海洋物種的數量與分布、水下噪音對海洋環境與海洋物種的影響、海洋污染、海洋廢棄物、高度洄游魚類種群與跨界魚類種群分布、沿海區綜合管理等，都需要投入更多研究，以獲得更多海洋相關資訊。

三、鼓勵女性參與海洋科學

2017年女性科學家僅占海洋科學研究人員的38%，在海洋科學的不同領域中，顯示女性對海洋科學的參與仍然不足，應鼓勵女性多參與海洋科學研究。



圖片來源／Pride Advertising Agency Ltd.

四、將原住民與地方社區傳統知識納入海洋科學

因原住民與地方社區的知識體系已發展出獨特的海洋傳統知識與經驗，將原住民與地方社區傳統知識納入海洋科學，可以擴大知識基礎，有助於決策者進行更加妥善的決策。

五、加強科學與政策之間的銜接

科學研究的目的係消除貧窮、改善人類生活、減少災害對人類的損害，科學研究與政策並非各自獨立，將科學資料納入政策，有助於海洋及資源的永續發展。因此，科學研究的成果納入政策決定，使科學與政策銜接，將有助於以永續的方式，管理人類活動。

六、加強海洋科學研究的能力

海洋科學有賴熟練的人力資源、技術與體制基礎設施、經費支持及國際合作等要素。各國應提升海洋科技研發能力，透過海洋人力培育，可以改善提升海洋科學研究能力，蒐集、儲存、整理及分析海洋相關資料，強化災害警報系統的應急能力，使人類從中獲益。

七、促進國際協調與合作

透過雙邊與多邊合作，以國際合作方式推動科學進步，建立戰略伙伴關係，擴大跨學科與跨部門的合作努力，促進協調及合作功能，有助於單邊資源不足的限制，提升海洋科學的發展，增進對海洋的瞭解。

結論

2019年適逢聯合國海洋法公約生效25週年，全球的海洋正面臨前所未有的巨大壓力，海洋朝向健全發展，與每一個人息息相關。我國於2018年成立海洋專責機關「海洋委員會」，並下設「海巡署」、「海洋保育署」及「國家海洋研究院」，應以全面性、整體性之思維，透過培育海洋人才、鼓勵女性參與海洋事務及科學研究，加強與其他機關、其他國家或國際組織之協調合作，提升海洋科學研究之能量，並將科學研究的成果納入海洋政策，確保海洋之永續發展。

Take Part in International Cooperation to Raise Worldwide Visibility for Taiwan!

Keywords: ocean, APEC, territorial water security

Minister of the Ocean Affairs Council: Chung-Wei Lee

The sea has a rich and diverse ecological environment as well as resources humanity depends on. For this reason, no coastal country will cease to value the sea; and the protection of territorial (coastal) waters demands international cooperation.

This issue's editorial report begins with the "Oceans of Democracy" state visits conducted by President Tsai Ing-wen in March 2019. The highlight was the signing of agreements on coast guard cooperation that represented an important step towards fighting international crime and law enforcement at sea; The central position of Taiwan in Asia makes it incumbent upon Taiwan to support regional economies and the environment by participating in Asia-Pacific Economic Cooperation (APEC). The maritime issues in "Sustainable Growth", one of the priorities at APEC this year, as well as the Ocean and Fisheries Working Group (OFWG) are all topics that we should focus our attention upon. In addition, this issue also features in-depth analyses of important issues such as the development of circular economy through "turning marine waste into gold"; the latest technological development of sea area law enforcement; and the 2019 United Nations Oceans and the Law of the Sea Report.

The sea not only has rich resources and ecology, but its diverse issues also merit in-depth understanding. We hope everyone including you and me can approach marine issues with an open mind. As long as we continue to speak out on the world stage, we can raise the international profile of Taiwan!

Image by Office of the President, Taiwan

Coast Guard Diplomacy: A Win for both Fishery Protection and Diplomacy!

Shi-Wei Huang (Associate Researcher, Taiwan Institute of Economic Research)
Keywords: Coast guard diplomacy, maritime security, international cooperation

President Tsai Ing-wen visited three countries that have diplomatic relations with Taiwan, namely Palau, Nauru and the Marshall Islands, for her "Oceans of Democracy" tour from March 21 to March 26, 2019. Agreements on coast guard cooperation were signed with Palau and Nauru on the joint development of coast guard cooperation and combating transnational crime at sea. Maritime security in the Asia-Pacific region will be further assured as a result.

President Tsai Ing-wen tours the Arai Bai (Men's Meetinghouse of Airai) and samples the local cuisine in Palau
Image by Office of the President, Taiwan

President Tsai Ing-wen visited the three Taiwanese allies of Palau, Nauru and Marshall Islands for her "Oceans of Democracy" state visits from March 21 to March 26, 2019. President Hilda C. Heine from the Republic of Marshall Islands had previously witnessed the signing of the Agreement between the Government of the Republic of China (Taiwan) and the Government of the Republic of the Marshall Islands on Coast Guard Cooperation on July 27, 2018, during her visit to Taiwan. The Agreement between the Government of the Republic of China (Taiwan) and the Government of the Republic of Palau on Coast Guard Cooperation was signed with Palau on March 22 of this year, while the Agreement between the Government of the Republic of China (Taiwan) and the Government of the Republic of Palau on Coast Guard Cooperation was subsequently signed March 25. The three agreements will focus on the development of coast guard cooperation and combating transnational crime at sea. The areas of cooperation between the two countries include mutual visits, training exchanges, maritime search and rescue, fisheries law enforcement and combating transnational crime. Joint sea patrols, fisheries law enforcement and training exercises will form the key components of this framework for international cooperation. The key contributions made by the Coast Guard Administration of the Ocean Affairs Council (hereafter referred to as the "CGA") to coast guard diplomacy are outlined below.

Coast Guard Administration - Guardian of Maritime Security

The predecessor of the Coast Guard Administration of Ocean Affairs Council was the Coast Guard Administration of the Executive Yuan. A number of separate mission-specific enforcement agencies such as the Coast Guard Command (Ministry of National Defense), Marine Police Bureau (National Police Administration of the Ministry of Interior) and anti-smuggling cutters from the Directorate-General of Customs (Ministry of Finance) were amalgamated into a single unified agency for coastal and maritime law enforcement. The CGA first priority is the protection of national maritime rights and interests as well as the life and property of citizens; the second priority is the appropriateness of law enforcements by adhering to the principles of fairness, suitability and thoroughness. The mission of the CGA is to maintain order in Taiwanese waters and coastline, as well as the protection and use of resources to ensure national security and protect citizens. By law, the CGA is responsible for the following matters:

I. To plan, supervise and execute the protection of maritime rights and interests.
II. To plan, supervise and execute the protection of marine safety.
III. Security inspection of vessels, other forms of water-borne transport and personnel entering/exiting ports.
IV. Anti-smuggling, prevention of illegal entry/exit, and other criminal investigations at sea, along the coast, in estuaries and closed ports.
V. Boarding, inspection and criminal investigations of R.O.C-flagged ships or other foreign ships where boarding inspections is allowed by international agreements in international waters.
VI. Coordination, investigation and handling of matters involving for eigners in territorial waters or within coast guard patrol zones.
VII. Safety investigations in territorial waters and along the coast.
VIII. Maintaining the security of coast control zones.
IX. The supervision, coordination and promotion of education and training for CGA personnel.
X. Other matters relating to coastal patrols.

CGA Hsun Hu No. 7 conducting search and rescue drills in Palauan waters during the Oceans of Democracy tour
Image by Office of the President, Taiwan

High Seas Patrol: Enhancing Safety for Fishing Ships Operating the in the Central and West Pacific

To fulfill our international responsibility on fisheries management as well as ensure the safety of Taiwanese fishermen and fishing vessels operating on the high seas, the CGA coordinates with the Fisheries Agency to dispatch patrol ships on high seas patrols every year in accordance with the Regulations for Coast Guard Administration to Conduct WCPFC High Seas Boarding and Inspection Procedures. Between two to three fisheries patrol missions are organized to board and inspect fishing boats in the convention area for the Conservation and Management of the Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Since the signing of the coast guard agreements with Pacific allies in 2018, the CGA has stepped up its exchanges with Pacific allies on coast guard law enforcement. These have made a contribution to maritime security and marine resources, helped ensure the safety of fishing operations, and strengthened links with our allies.

Taiwan and the Marshall Islands Signs Cooperation Agreement to Strengthen Private Sector Exchange

Before the Oceans of Democracy tour, President Heilda C. Heine of the Republic of the Marshall Islands visited Taiwan in July 2018. During this visit, the countries signed the Coastal Guard Cooperation Agreement as well as the Bilateral Agreement of Citizen Visa Exemption. President Tsai expressed gratitude for the Marshall Islands' long-term support for Taiwan's participation in international affairs, and hoped that by signing the aforementioned agreements, the two countries can enhance private sector exchanges and protect the safety of the two countries' waters and marine resources together.

Since the two countries belong to the same Austronesian cultural system, the agreements may facilitate closer exchanges and cooperations between Taiwan and Pacific island countries in common pursuit of the United Nations Sustainable Development Goals in confronting challenges of climate change and geopolitics. The cooperation between the two countries will definitely make contributions to the international community. President Tsai also thanked the Republic of the Marshall Islands for their longstanding support for Taiwan's participation in international affairs. Taiwan will in turn do all it can to support the development of maritime affairs by the Marshall Islands so that the ideals and values shared by the two countries can be conveyed throughout the world.

Taiwan-Palau Cooperation Strengthens Coastal Guard Rescue Drills

During the "Ocean of Democracy tour" conducted in late March, 2019, a joint search and rescue exercise was conducted by the CGA and Palau's Division of Marine Law Enforcement. Both President Tsai and President Tommy Remengesau of Palau attended the exercise. It was performed by the 1,000-ton class patrol vessel Hsun Hu No. 7. The scenario was that Hsun Hu No. 7 had received a message from the Palauan fishing boat "London" that two of its crew members are missing and may have fallen overboard while sorting out fishing equipment. London requested Hsun Hu No. 7's assistance with the rescue in the area. Upon arrival, Hsun Hu No. 7 dispatched small crafts to conduct search and rescue. During the exercise, CGA personnel demonstrated how different rescue techniques were used depending on the severity of the injuries suffered by fishermen after falling overboard. CGA is continuing to promote exchanges and cooperation with the coast guards of Pacific allies in areas such as mutual visits of personnel, training and exchange, maritime rescue, fishery law enforcement, and combating maritime crimes.

President Tsai meets President Hilda C. Heine of the Republic of the Marshall Islands in the Office of the President, Taiwan
Image by Office of the President, Taiwan

Vice President Raynold Oilouch of Palau's visit to Taiwan in July also served as a basis for further coast guard cooperation and exchange on maritime security and other fields between the two countries. The cooperation is conducive to the two countries' goal of becoming key players in keeping the peace and ensuring the sustainable development of the marine ecology in the Pacific region.

Regular Drills: Strengthening Humanitarian Assistance Capabilities in the South China Sea

To maintain the maritime security of Taiwan, The CGA along with the Ministry of Transportation and Communications, Ministry of Defense, Ministry of Foreign Affairs, Ministry of Health and Welfare, and National Rescue Command Center, conducted a humanitarian rescue drill ("Nanyuan No. 4 Drill") in the waters around Taiping Island on May 21, 2019. The purpose of the drill was to showcase Taiwan's ability to conduct search and rescue, medical care, and international humanitarian rescue missions in the South China Sea, and thereby realize President Tsai's South China Sea policy of "making Taiping Island the center of humanitarian rescue and base of supply."

The drill was mainly based on the simulation scenario of a small tourist aircraft carrying 25 passengers and crew members performing an emergency landing in the waters near Taiping Island. The aircraft collided with nearby fishing boats, causing 2 people to fall overboard, 1 death, and 2 serious injuries, while 3 among the 12 people on the fishing boat suffered minor injuries. The entire process of rescue operations was intense and realistic, fully demonstrating the team work among various government agencies in Taiwan. The CGA will continue to plan and implement South China Sea humanitarian rescue drills in the future, and thereby intensify the cooperation mechanism with surrounding countries, and realize the project of making Taiping Island the humanitarian rescue center and the supply base for the South China Sea.

2019 APEC Priorities for Sustainable Growth

Chung-Ling Chen (Professor, Institute of Ocean Technology and Marine Affairs, National Cheng Kung University)
Keywords: APEC, sustainable growth, marine litter, illegal fishing

The 2019 APEC is hosted by Chile. This year features the theme Connecting People, Building the Future. Under said theme are four priorities, namely Digital Society; Integration 4.0; Women, SMEs, and Inclusive Growth; and Sustainable Growth. Sustainable growth, in particular, is concerned with marine issues.

Reducing marine litter is one of the means of the APEC in its devotion to protecting the ocean
Image by Chung-Ling Chen

APEC has been known for its promotion of economic growth in the Asia-Pacific Region through regional economic integration and reinforced trade and investments over the long term. Ensuring sustainable growth and fulfilling its commitment to improving the life of people, however, is the challenge facing the APEC in the 21st century. The challenge is about changing current economic activities in a balanced and sustainable way. The intractable problems are: reducing trash and pollution, developing clean and efficient energy, and improving urban infrastructure in an effort to build more vigorous and healthy smart cities.

To address these issues, in terms of sustainable growth, the three priorities are: (1) protecting our oceans and marine ecosystems, (2) sustainable energy, and (3) developing common standards for smart cities.

This article mainly addresses the first priority, that is, protecting our oceans and marine ecosystems. The other two priorities, on the other hand, are briefly introduced in order to understand the dimensions and content covered in sustainable growth. In addition, APEC's Ocean and Fisheries Working Group (OFWG) also explores marine and fishery issues on a yearly basis. Contents in this regard are covered in another article of the current issue entitled "APEC's Ocean and Fisheries Working Group."

Protecting Our Oceans and Marine Ecosystems

There are mainly two strategies for protecting our oceans and marine ecosystems. They are combating marine litter and preventing illegal fishing. In fact, APEC has been concerned with marine issues for a long time now. The 2014 Xiamen Declaration, for example, recognized four priority areas. They are: coastal and marine ecosystem conservation and disaster resilience, the role of the ocean on food security and food-related trade, marine science, technology and innovation, and Blue Economy. Blue Economy, in particular, is adopted by the APEC to describe the impressive aquaculture production size in the Pacific Ocean, as it accounts for 80% of the global aquaculture production size.

In addition, during the 2015 meeting that took place in Valparaiso, Chile, entitled "Protect our Oceans in Time," Chile declared that it would set the periphery of Easter Island as a marine protection zone in order to protect against overfishing, pollution, and marine litter. Under the efforts of all parties, including the government, the local residents, the fishermen, business practitioners, and NGOs, the protected area was established in February 2018 under the name of Rapa Nui Marine Protected Area, spanning 720 thousand square kilometers in area, which is about the size of Chile on the South America Continent. One hundred and forty-two types of marine creatures are protected, including 27 nearing extinction.

I. Combating marine litter

There are five major marine litter concentration areas around the world. They are referred to as garbage patches. Two of them are located in the North and South Pacific Oceans, the largest and the third largest in the world, respectively. It is estimated that around eight million tons of plastics flow into the ocean each year. Among the debris in the Pacific Ocean, around 40% comes from Asian countries. Marine plastics come mainly from the land, around 90% of it flowing into the ocean through rivers. Marine debris impacts negatively not only living things along the coastal line but also navigation and human health. The impacts of plastics on marine creatures and human health, however, lack a thorough understanding at present. Given the variety of marine litter, plastics, in particular, are drawing attention mainly because they are relatively durable and do not easily decompose. Plastic can remain in the environment for more than 400 years, and the majority of plastics are non-recyclable and hence tend to flow into the ocean.

Reducing and eradicating marine litter from the land and removing existing marine litter require collaboration among countries. Marine litter monitoring and management measures are important means. The former helps protect the ocean and adopts effective strategies to reduce marine litter. The latter, on the other hand, includes the implementation of a litter collection system, enhancement in recycling and reutilization, conversion of non-recyclable plastics into energy, clearance of plastics built up in river paths, and prohibited use of specific types of plastics.

Moreover, mercury is a pollutant of global concern due to its negative impact on the ecology and human health. The concentration of mercury in the environment has significantly increased recently, and the ocean is one of the major places for the storage of mercury. To reduce the exposure of humans to mercury and to improve the health of fish and animals, phasing out non-essential mercury-containing products is required. Therefore, new approaches to operate, use, and dispose of products containing mercury need to be researched and developed.

Based on the foregoing, Chile initiated during this year's meeting a pilot project to monitor marine litter throughout the region at the coastal edge, with the objective of building a regional standard. In addition, Chile promotes commercialization of products without mercury. Related approaches include: Forming workshops and establishing technical guidelines to promote commercialization of products without mercury-based additives.

II.Preventing illegal fishing

Of the world's oceans, the Pacific Ocean is the largest. APEC economies are highly dependent on fish products from the Pacific Ocean; they consume 70% of fish-related products globally, 90% of aquaculture fish products globally, and 65% of the global catch. In addition, among the top 10 fish producing countries around the world, nine are APEC economies.

Illegal, unreported and unregulated (IUU) fishing has become the focus of global attention. Not only does it negatively impact the fish population and the marine ecology, IUU also distorts fish trade and food security Marine Resources & Fisheries Consultants estimated in 2016 that the cost of IUU was between US$10 billion to US$23 billion. Meanwhile, IUU activity in the tuna fisheries is about 306,440 tons either harvested or transshipped within the Asia-Pacific region.

In light of the IUU scale in the Pacific Ocean, Chile proposed that each APEC economy review and evaluate its current IUU strategies, including forming a workshop where information is shared to combat IUU, confirming the fields of focus and best practice, and formulating action plans to fight against IUU in APEC regions.

Preventing illegal fishing is one of the means of APEC in its devotion to protecting the ocean
Image by Chung-Ling Chen

Sustainable Energy

Sustainable energy deals mainly with the promotion of electromobility as clean and affordable energy. In light of the fact that energy consumed in APEC regions accounts for 60% of global consumption and the APEC declaration in 2011, it is declared that a reduction of 45% will be accomplished by 2035 compared to energy consumption in 2005. Under that goal, cooperation in energy and promotion of renewable energy are crucial.

As such, Chile hosted the Energy Working Group meeting this year to discuss how to fulfill energy demand in remote areas and the technical challenges and opportunities in the supply of electromobility systems, among other issues, in order to promote the development of clean and affordable energy and electromobility.

Developing Common Standards for Smart Cities

By 2050, 80% of the global population will live in cities. Cities remain the center for economic growth. Smart technologies help more accurately monitor and evaluate interaction between mankind and nature as well as the artificial environment. In order to promote comprehensive growth, prosperity, and progress in APEC regions, enhancing innovative and sustainable urban infrastructure and building smart and green cities are crucial. Issues covered in this year's meeting included integration services in cities, autonomous governance, efficient network systems, congestion management, accident prevention, environmental impact reduction, and public spaces, among others. It is hoped that by discussing these issues, APEC economies can share the best practices on the implementation of Smart Cities in the APEC region and develop common standards for smart cities.

Image by Tumisu from Pixabay

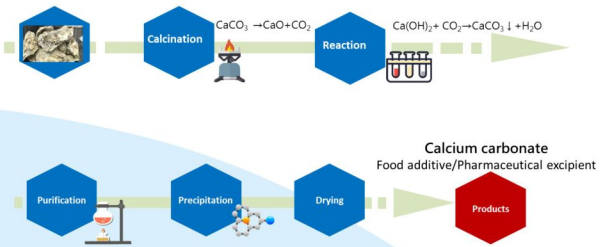
Value-added Technology for Fishery Waste and Its Business Opportunities of Circular Economy

Hui-Ling Cheng（Senior researcher, Biomedical Technology and Device Research Laboratories, Industrial Technology Research Institute）
Image by Biomedical Technology and Device Research Laboratories, Industrial Technology Research Institute
Keywords：Circular economy、Oyster shell、Biomaterials

In response to the government's industrial innovation plan-circular economy, technology and manufacturing process were investigated to bring greater economic benefits and achieve environmentally friendly effects, establish a circular economy industry, create high added value to replace imported materials, and calcium carbonate products will have an important role in Taiwan food and pharmaceutical market in the future.

Technology highlight

The southwestern coastline of Taiwan has a lots of fishery sources, and it has also created a special landscape of large amounts of fishery waste along the coast. According to the statistics of the Council of Agriculture of Executive Yuan, the wasted oyster shells reached 120,000 tons in 2015. Those induce environmental problems for residents. In the past, the oyster shells were commonly milled to form oyster shell powder that used as feed and fertilizer. The major component of oyster shell is calcium carbonate that is worth to develop high technology to keep calcium carbonate and remove organic impurities to form high purity products for food and pharmaceutical application. The highlight of technology is how to enhance purity and remove impurities that is important impact to develop value-added technology. The final products were met the specifications for food grade additives and pharmaceutical grade excipients. The technical scheme is as follows:



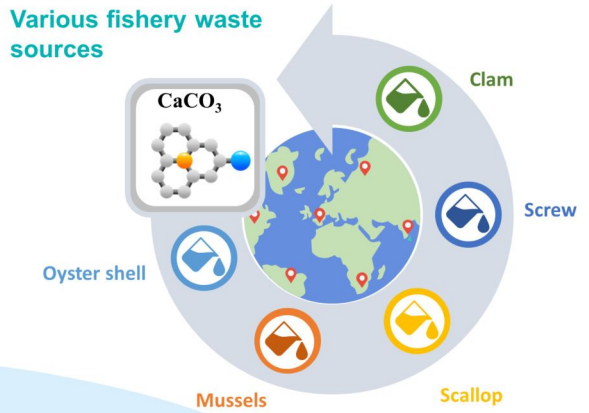
Technology scheme

Overview of market

According to report of Digital China Merchants conducted by ICST, the global market of calcium carbonate in 2018 is about 23 billion US dollars, and the market size is estimated to be 29 billion US dollars by 2022. The compound annual growth rate (CAGR) is 5.3%. The main areas of production are China, North America and Europe. The application fields are focused on papermaking, plastics, coatings and other industrial applications. The food and pharmaceutical market is the smallest and about 7.0% of the overall scale. Based on the import and export data of Taiwan Customs, the weight of imported calcium carbonate of 2007-2017 is about 10,000 tons without huge change. The major sources of imports are China, Japan, Vietnam, and the United States and the exports are Indonesia, Vietnam and Thailand. Calcium carbonate of food additives and pharmaceutical excipients are mostly relied on imports in Taiwan market and didn't have any Taiwan-own products. The value-added technology has established the oyster shell of Taiwan's oyster production industry to become a true circular economy that can be recycled and reused, creating high added value to replace imported materials, and further increasing the value-added and high-tech food and pharmaceutical grade products. Recycling waste oyster shells for recycling, that could reduce environmental pollution in coastal areas, create high-value products, establish a green energy environment and respond to circular economy development policies. That can make Taiwan's oyster production industry form new industrial cycle, and become real circular economy that can be recycled and reused.That technology could be utilized to support the industry transformation and achieve environmentally friendly benefits and bring more innovation and recycling economy benefits for Taiwan.

Industrial development

Taiwan is a sea-island country with various ocean resources. In recent years, the industry search and plan to evaluate for feasibility assessment of waste recycling and plan to develop professional techniques and high value-added products under circular economy of government's policy. In addition to continuously recycling resources, how to make it to become more economical is the point for ndustry. The calcium carbonate products are used in our life. They are wide utilized as pH adjusters, anti-caking agents, colorants, hardeners, and stabilizers in various food processes and products. In pharmaceutical products, they are commonly as excipient, antacid, and calcium nutrient and advanced modified as drug vector and artificial bone material. Except for technology, the application of different fishery waste is also important. Based on the consideration of characters of calcium carbonate in fishery waste biosources, technology should be established for variety fishery waste biosources to provide high quality products. Those will bring innovation and better cycles for Taiwanese industry and circular economy.



Various fishery waste biosources

Conclusions

Taiwan has lots of ocean resources but resources are not inexhaustible. When industry develop the resources and also has its responsibility for achieving blue recycling and environmentally friendly benefits, high value-added technology could allow fishery waste to reutilize as resources for other application. Technology of circular economy could lead the industry with advantages and opportunities in the international market.

The Circular Economy of Marine Waste — PET Bottle Recycling of the Far Eastern New Century Company

Chin-Nan Fang(Administrative Assistant, College of Earth Sciences, National Central University)
Zhi-Chang Huang (Associate Professor, Institute of Hydrological and Oceanic Sciences, National Central University) Pei-Ru Jiang (Head of the Ecology Conservation Division, Office of Coast Administration Construction, Taoyuan City Government)
Keywords: marine waste, coastal litter, PET bottle, circular economy

Through collection, processing and reproduction that transforms waste PET bottles in the sea into recycled products, marine waste can generate a circular economy that brings a positive feedback to the marine environment and the humanity.

Marine Litter

Marine litter is one of the toughest modern global issues. News about marine life dying is frequently reported due to their mistakes of ingesting marine litter. According to a report from the Ellen MacArthur Foundation, approximately 8 million tons of plastic waste were float into the sea every year. It is estimated that the volume of marine waste will probably surpass that of fish by 2050. The situation will not only suffocate the sea but also lead to changes in and the withering of the coastal ecosystem. The waste will even eventually return to human beings via the food chain. In response to this issue, people have started working actively together to clean up beaches and oceans, while more and more countries have started to support various plastic reduction policies.

Marine Litter, Where Do You Come from?

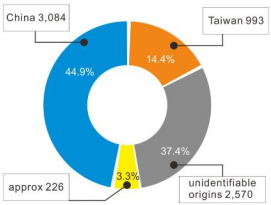
According to the findings of the 2019 Taoyuan City Coastal Hydrographical Information and Marine Litter Survey and Assessment Plan commissioned by the Office of Coast Administration Construction under the Taoyuan City Government and implemented by National Central University, marine litter around the coastal areas of Taoyuan consist chiefly of discarded PET bottles, everyday supplies, and discarded fishery equipment. PET bottles were chosen for the source survey and analysis. As the statistics in the figure below shows, 44.9% of the discarded PET bottles came from Mainland China, 14.4% from Taiwan, 37.4% from unidentifiable origins, and approx. 3.3% from other countries.

Marine Litter, Where Are You Going? Where Is Your Final Destination?

Beach and ocean cleanups are the most common, straightforward response to the problem of marine litter. But then what? It is essential to actively promote the recycling and reuse of marine litter in order to prevent plastic waste from remaining at the coasts and eventually entering the sea. As is commonly known, plastic reduction from the origin is the fundamental way to prevent plastic waste from entering the sea and causing pollution. However, as it is human nature to pursue convenience and interest, requiring people to completely refrain from using convenient and cheap plastic products will not be an effective approach. For this reason, an alternative approach to campaigning for marine waste threat reduction is to turn waste into productive materials and then into recycled products, thus offering an option other than simply waiting for thousands of years for plastic waste to degrade on its own.

Can the Environment Be Improved? The Textile Industry Is a Key

Taiwanese textile was once a dying industry. Now that it has become a R&D hub for the global textile industry, its functional fabrics have a 70% share in the global market. What connection will be formed between functional fabrics and marine litter? Taiwan did not participate in the 2018 FIFA World Cup, but 16 participating national teams wore uniforms made by the Taiwanese textual industry to compete on the field. Those uniforms were made from waste PET bottles, the bête noire of marine litter that were transformed into spectacular recycled products.



Results of Taoyuan City coastal waste PET bottle source statistics (survey scope: coastal areas of Taoyuan; survey period: March–May 2019)
Source: 2019 Taoyuan City Coastal Hydrographical Information and Marine Litter Survey and Assessment Plan

Taiwan has sophisticated textile and recycling technologies. Through washing and crushing into recycled pellets, followed by spinning and processing, PET bottles can be transformed into comfortable and eco-friendly functional sportswear. In 2016, sports products manufacturer Adidas offered globally a limited edition pair of recycled ocean plastic shoes. All of the materials were originally litter floating on the waters surrounding the Maldives. The company assisting with the manufacturing of these recycled shoes was the Oriental Resources Development, a top recycling manufacturer from Guanyin District, Taoyuan City, Taiwan. From June 2019 onwards, the Taoyuan City Government has cooperated with Oriental Resources Development by handing PET bottles collected during beach and coast cleanups to the company for recycling and manufacturing clothes from recycled materials. The clothes will be offered in turn to Taoyuan City Government's coast guard volunteers, thus giving a new life to waste PET bottles and finishing the last mile in protecting the clean ocean.

According to the statistics from the Office of Coast Administration Construction of the Taoyuan City Government, the outcome of the city government's beach and ocean cleanups include 980 kg of waste PET bottles collected from June to July this year; these bottles were transferred to the Oriental Resources Development for the recycling process. The bottles were primarily sorted by color and degree of cleanliness, and then crushed and pressed into bricks, which are to be unpacked, laundered, delabeled, sorted by color, crushed, washed, removed of impurities, dehydrated, and made into clean PET chips. The PET chips will then be sent to the Xinpu Plant of the Far Eastern New Century Company to be further decomposed, re-polymerized and melted at high temperature into PET pellets, also known as recycled PET pellets, i.e., eco-friendly pellets. The pellets will then be spun and woven into eco-friendly fabrics. It is estimated that 5 pieces of eco-friendly jogging suits can be made per kilogram of PET bottles.

Conclusions

Regarding ocean plastic reduction, the policy of prohibiting the use of plastic products will offer an opportunity to prevent plastic materials from accumulating into waste. As for existing marine litter, the beach and ocean cleanups that are actively implemented, volunteer activities, and government-implemented coast cleanup plans, have all attempted to reduce the amount of litter in the ocean. Litter collected from the coasts can now be transformed into useful products by employing thinking different and exercising a circular economy, thus bringing a virtuous circle to the environment. When the public perceive discernible advantages brought by environmental actions, they will become more willing to take action. We hope that plastic waste will no longer be common in the sea in the future!

APEC's Oceans and Fisheries Working Group

Kwang-Ming Liu (Professor, Institute of Marine Affairs and Resource Management, National Taiwan Ocean University)
Keywords: APEC, Ocean and Fisheries Working Group (OFWG)

APEC is an economic cooperation forum in the Asia-Pacific that operates on the basis of non-binding commitments and members' voluntary participation. There are 10 Working Groups of APEC in total; this article introduces one working group in particular —the Ocean and Fisheries Working Group.

APEC is an important platform and forum that facilitates the economic growth, cooperation, trade and investment of regions within the Asia-Pacific. Its objective is to facilitate the mutual benefit and common prosperity of members in the Asia-Pacific by means of appropriate cooperative economic actions. APEC was officially established during November 5–7, 1989, with the first ministerial meeting taking place in Canberra, capital of Australia, and attended by delegates from the US, Canada, New Zealand, Australia, Japan, South Korea, and the original six member states of ASEAN. Its membership currently consists of 21 economies.

APEC is a platform and forum for economic cooperation. It operates on the basis of non-binding commitments and members' voluntary participation. It emphasizes open dialogue and equal respect for the views of all participants, and is thus different from inter-governmental organizations established by pacts or treaties (Elek, 1991). Taiwan joined APEC under the name "Chinese Taipei" in 1991. The developmental trajectory of APEC serves as an important reference for Taiwan's promotion of various economic development measures. APEC is also an appropriate channel over which Taiwan can expand its Asia-Pacific market or establish international cooperation.

Marine Resource Conservation Working Group (MRCWG)

The Marine Resource Conservation Working Group (MRCWG) is one of the working groups under the APEC. It organizes 1–2 working group meetings, in which key annual tasks of the working group are discussed. The 11th APEC Marine Resource Conversation Working Group Meeting took place in Vena del Mar, Chile, on June 4, 1998. Taiwan's delegates were led by Ruan Guo-Dong, then head of the Department of Water Quality Protection under the Environmental Protection Administration, Executive Yuan. In the meeting, Taiwan actively participated in discussions of various issues, offered many suggestions, and had good interactions with other members. As a result, Taiwan gained unanimous support from the members in becoming Lead Shepherd of the MRCWG for a 2-year period.

After taking the position of Lead Shepherd for APEC's MRCWG, Taiwan has been committed to the following tasks: promoting the sustainable marine environment action plan resolved in ministerial meetings among the members; directing and reviewing the members' implementation plans; presenting annual work outcomes; and taking charge of coordinating with other working groups. In addition, since 2000, Taiwan has annually submitted a proposal for the self-funded implementation of the APEC Roundtable Meeting on the Involvement of the Business/Private Sector in the Sustainability of the Marine Environment to the Oceans and Fisheries Working Group (OFWG). To date, Taiwan has organized 19 Roundtable Meetings.

The 19th APEC Roundtable Meeting on the Involvement of the Business/Private Sector in the Sustainability of the Marine Environment
Image by Institute of Marine Affairs and Resource Management, National Taiwan Ocean University

Working Groups Upgraded: MRCWG+FWG=OFWG (Ocean and Fisheries Working Group)

In 2011, the MRCWG and the Fisheries Working Group (FWG) were merged into the Ocean and Fisheries Working Group (OFWG) as one of the 10 Working Groups under APEC. The level of its related meetings is subordinated to the Leader's Meeting, Ministerial Meeting, and Senior Official Meeting (SOM). Its key tasks are marine resource conservation and fishery.

Three centers were established under the OFWG, namely the APEC Marine Environmental Training & Education Center (AMTEC), APEC Marine Sustainable Development Center (AMSDC), and APEC Ocean and Fisheries Information Center (AOFIC).

The working group is committed to

I. Facilitating trade and investment opportunities that promote the sustainable use of fisheries, aquaculture, and marine ecosystem resources;
II. Ensuring the conservation and sustainable use of marine resources as well as protection of marine ecosystems needed to support fisheries and aquaculture; and
III. Promoting a common approach to preventing illegal fishing and related trade.

During a 2014 meeting in Xiamen, China, APEC Ocean and fisheries ministers adopted four priority areas for APEC's Ocean and Fisheries agenda:

I. Coastal and marine ecosystem conservation and disaster resilience
II. The role of the ocean on food security and food-related trade
III. Marine science, technology and innovation
IV. Cross fora collaboration to expand the Blue Economy—a focus on coasts and oceans as a sustainable driver of economic growth

The Xiamen Declaration committed the forum to conserve at least ten per cent of coastal and marine areas through managed marine protected areas by 2020. In November the same year, APEC ministers also adopted a specific annex on Ocean Cooperation in the Asia-Pacific Region.

The activities and measures on the agenda of the OFWG in 2019 aim to support the declarations of APEC leaders, statements from ministers and senior officials, decisions made by SOMs, priority matters of the SOM Steering Committee on Economic and Technical Cooperation (SCE), and advice from the APEC Business Advisory Council (if applicable). The OFWG will continue to implement the Seoul Ocean Declaration (2002); Bali Action Plan (2005); Paracas Declaration (2010); Xiamen Declaration (2014); High Level Policy Dialogue on Food Security (2015); Blue Economy's Action Plan (2015); the food security-related Piura Declaration on Food Security (2016); and the High Level Policy Dialogue on Food Security and Sustainable Agriculture in Response to Climate Change (2017).

Based on the OFWG's strategic direction, the measures to be taken during 2019-2021 include:

I. Free and open trade and investment
II. Sustainable development of the sea and environmental protection
III. Food security
IV. Climate change
V. Natural disaster/emergency preparedness/disaster resilience
VI. Blue economy
VII. OFWG operation

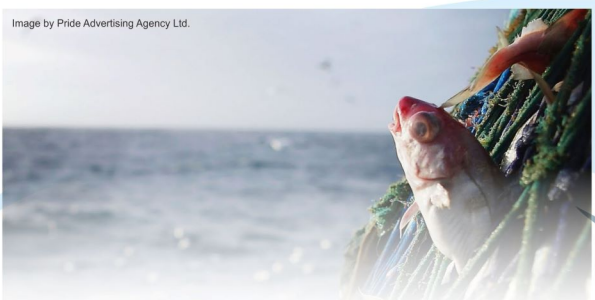


Image by Pride Advertising Agency Ltd.

Two meetings are scheduled to be organized by the OFWG in 2019. The first meeting, OFWG 12, has taken place in Santiago, capital of Chile, during February 23–24, 2019. OFWG's work and its categories during the inter-session period are as follows:

I. Responding to priority matters of Chile as the Lead Shepherd, with special attention to the priority matter of sustainable growth, as it involves fishery, aquaculture, and marine environment.

II. Taking continual actions to improve the ability to overcome the negative economic impact of illegal, unreported and unregulated fishing (IUU) on the sustainable fishery and food security of APEC economies.

III. Developing instruments to assess and solve the physical and economic impacts of marine litter and discarded fishery equipment on the economy, fishery and marine environment of APEC members.

IV. Developing instruments to assess and solve the physical and economic impacts of climate change on APEC's economy, fishery, aquaculture, and marine environment.

V. According to the protocols of the 3rd OFWG, promoting continual activities within APEC to conform to the common view of blue economy.

VI. Facilitating continual improvements/updates of the APEC Marine Sustainable Development Report.

VII. Strengthening the partnership between public and private sectors, including participating and conducting exchanges in OFWG's work.

VIII. Developing and enhancing cross-cultural cooperation: Incorporating ocean-related issues into the mainstream of APEC organizations; recognizing women's important role in fishery and aquaculture; recognizing the common challenges confronted by the agricultural sector, especially those related to food security.

IX. Promoting and enhancing capacity building through further OFWG projects, including self-financed projects.

X. Taking actions to enhance cooperation with the Policy Partnership on Food Security (PPFS), including actively participating in related PPFS work items, and making contributions to the establishment of the 2019 Paracas Declaration on Food Security (Third Senior Officials' Meeting (SOM 3), 2019).

XI. Enhancing the coordination between the OFWG and its 3 centers within APEC - AMTEC, AMSDC, and AOFIC; and exploring the potential cooperation with other centers within APEC.

The Development of Marine Scientific Research and Law Enforcement Capabilities

Yi-Che Shih (Director of General Planning and Human Resource Training Center, National Academy of Marine Research)

Keywords: Marine scientific research, technology development program, maritime law enforcement

The protection of marine rights relies on powerful law enforcement and equipment. Ever-advancing modern technology is the best support for sea area law enforcement. This article is a basic introduction to development of marine scientific research and law enforcement capabilities.

UAV
Image by the Northern Branch of the CGA

The sea is a key area of scientific research in developed countries. The development of marine resources as well as the expansion of the marine space and interests are increasing every day. Marine science and technology is a foundation of sustainable development. Taiwan should attach greater importance to marine technology by revitalizing the cultivation and utilization of related talent. Achieving a high level of development in marine technology will enable the construction of more robust technological foundations to support the reasonable use and conservation of marine resources as a modern and sustainable maritime country. From a strategic perspective, control of the sea was traditionally considered to grant control of the world. The modern perspective looks at military, economic and technological competition as a whole. The standard of marine technology and innovation now dominates the intense competition for the seas. In other words, whoever owns all of the information from marine scientific research will now own the world. Marine scientific research is therefore of paramount importance.

Development of Marine Science and Technology

Marine science is the study of the ocean's natural phenomena, nature and patterns of change, as well as the knowledge system on its development and utilization. The subject of study is the oceans that make up 71% of the Earth's surface including the bodies of water within the oceans, substances dissolved or suspended in seawater, organisms that live in the ocean, the marine sediments and ocean floor rocks of the bottom boundary, the river mouths and coastal regions of the ocean boundary, as well as the atmospheric layer above the sea surface of the ocean's upper boundary. Its research topics are all closely linked to the patterns of motion in seawater, the physics, chemistry, biology, geology, ecology, atmospheric science and hydrological sciences.

Advancements in technology have led to immense strides in mankind's ability to develop marine resources. Countries are now paying more attention to marine resources along their coast as well as their development. Rapid changes in marine science and technology are changing the working environment and knowledge requirements of the marine industries. The industry's requirements for marine professionals are also distinct from that of the traditional marine industries. For example, the development of marine transportation technology has created a demand for experts in marine transportation systems and e-logistics management; marine management professionals must be familiar with the relevant fields in marine affairs; ship crews and officers involved with fisheries must be capable of using information technology, be familiar with maritime law, engage in marine affairs management and possess communication skills; the aquaculture industry not only requires a professional understanding of aquaculture but also bio-technology, environmental management, monitoring, management and marketing. The levels, numbers, nature and training model for all the talent needed by the relevant fields form the focus of current and future developments in the marine sector.

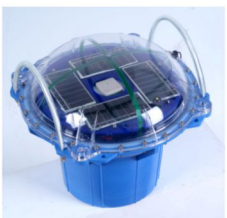
Internal Developments in Marine Science and Technology

The oceans are rich in water resources, marine energy, mineral resources, biological resources and tourism resources. Countries are now competing for control of the seas' treasures. For example, the oceans are home to between 27% ~ 45% of the world's oil resources and between 50% to 55% of the world's natural gas resources; the development of marine resources has become an important strategy for stimulating economic development. At the moment, 80% of all countries with a national income in excess of US$20,000 per capita are all coastal or maritime countries.

The United States is almost without peer among all the nations engaged in the development of marine technology. The Scripps Institute of Oceanography, the Woods Hole Oceanographic Institution and the marine research institutes of top universities all make it the international leader in marine technology. Other nations each have their own strengths and weaknesses due to their own particular resources and industry direction. The high level of marine technology development in the United States, Japan and other European countries can ultimately be traced to foundations and support for marine technology activities provided by their comprehensive national technological and innovation system for marine science and technology. By analyzing the features and strengths of these countries with advanced marine scientific research, several conclusions can be reached: 1. The importance of planning for innovations in marine science and technology is is recognized; 2. Emphasis on cultivation of talent for marine scientific research; 3. Investment in innovative marine technologies; 4. Drafting of national technology laws; 5. Subsidies for the marine industries; 6. International cooperation on marine technology etc.

The unique nature of the marine environment and the complexity of its resource distribution necessitate international cooperation on research into marine science and technology. The strengths of each country can then be brought to bear to conduct long-term monitoring, investigation and research in sea areas. When it comes to international cooperation on marine science and technology, the United States is a proponent of joint, large-scale international marine science research project as well, including: International Geosphere-Biosphere Programme (IGBP), World Ocean Circulation Experiment (WOCE), Tropical Ocean and Global Atmosphere Programme (TOGA), Joint Global Ocean Flux Study (JGOFS), Ocean Drilling Program (ODP), Global Ocean Observing System (GOOS), World Climate Research Programme (WCRP) and others. GOOS for example is a joint initiative headquartered in Paris that was launched by the Intergovernmental Oceanographic Commission (IOC), World Meteorological Organization (WMO), International Council for Science (ICSU), and United Nations Environment Programme (UNEP). The primary functions of GOOS are the observation of the marine environment, assessment and forecasting of marine information, and climate change predictions for the effective, safe and sustainable use of the marine environment. The GOOS 2030 Strategy envisions a truly global ocean observation system that delivers the essential information for sustainable development, safety, well-being and prosperity. GOOS seeks to lead the ocean observing community and create the partnerships to grow an integrated, responsive and sustained observing system.

Support for the execution of major marine science and technology research projects not only promotes international exchange of marine technologies but also accelerates the integration of marine science research to bring about the sustainable development of marine technology.



Datum Marker Buoy (DMB)
Image by the Northern Branch of the CGA

Marine Law Enforcement Capabilities

The gradual growth of marine science and technology has produced preliminary results in terms of hardware and software for marine scientific research. The results have in turn supported the building of the following maritime law enforcement capabilities:

I.Marine scientific research equipment: Acoustic Doppler Current Profiler (ADCP), towed oceanographic data collection system, multi-purpose water quality monitoring and recording system etc. To effectively carry out its maritime search and rescue mission, the Fleet Branch of the Coast Guard Administration (CGA) (formerly the "Coastal Patrol Directorate General of the Coast Guard Administration"), Ocean Affairs Council), began progressively procuring "Datum Marker Buoys" (DMB) in 2009. In 2018, the CGA began collaborating with the Taiwan Ocean Research Institute (TORI) on light-weight marker buoys. Patrol ships can release DMB, ADCP, sea water monitoring and other instruments at sea in support of their mission. The tracks of the market buoys provide an accurate picture of currents and other oceanographic information as well as the environmental conditions at sea. The data measured in the field are extremely important to the successful conduct to maritime search and rescue missions.

II.Establishing a marine database: A marine database of surrounding waters has been established to provide a reference for maritime operations. The marine database includes the maritime disaster database, territorial water hydrology database, marine environment database, marine oil pollution fingerprint database, and marine resource database. The territorial hydrology database draws upon the survey results of research ships operated by partner agencies. The research ship conducts sea water surveys at selected monitoring sites in the research area to collect local hydrological data such as sea water temperature, salt concentration and density. The physical properties can then be assessed to study the main sources of sea water.

III.Unmanned Aerial Vehicle (UAV) equipment: To ensure the security of territorial waters (coasts), UAVs are now used in conjunction with coast guard zone command systems to conduct patrol missions around territorial waters and coasts. The early warning capability provided by highly mobile and responsive UAVs is expected to enable a prompt response to developing incidents. Meanwhile, relevant implementation regulations are also promulgated and validated through real-world missions to perfect the standard procedures of duties. The UAV has been used in many areas by many countries. It has a very broad range of application in terms of law enforcement, including anti-smuggling, fire inspection, and personnel rescue missions. UAVs have also been used in marine environmental protection and coastal environment inspection including the surveying the erosion rates at potentially dangerous landscapes. Reconnaissance data returned by UAV enables the rapid analysis of large-scale spatial information. Once combined with the geographic information system the data provides an understanding of the environmental and operating conditions in the sea area. The National Academy of Marine Research is currently assisting the CGA UAV fleet with specialized training for homeland monitoring. The training will be used to build systematic big data database of coastal video and imagery, which can serve as a reference for policies on land change monitoring.

Conclusion

Countries around the world are continuing to expand their sea exploration capabilities. They are therefore actively developing their marine science, marine environment monitoring, and related infrastructure to obtain relevant marine information. The outcomes of marine scientific research will also lay the foundations for marine governance, marine management, marine planning, and marine sustainability.

Artist's impression of the Global Ocean Observing System (IOC-GOOS)
Image by Glynn Gorick produced for UNESCO Intergovernmental Oceanographic Commission (IOC)-Global Ocean Observing System (GOOS)

A Brief Analysis of the United Nations Secretary-General's 2019 Oceans and the Law of the Sea Report

Huan-Sheng Tseng (Assistant Professor, National Taiwan Ocean University)
Keywords: United Nations Convention on the Law of the Sea, Oceans and the Law of the Sea Report

Through the UN Secretary General's annual Oceans and the Law of the Sea Report, we can understand recent marine issues of international concern, which can serve as reference for government agencies handling marine affairs in Taiwan.

United Nations Office at Geneva
Image by Hsu-Po Cheng

Introduction

The United Nations passed the United Nations Convention on the Law of the Sea (UNCLOS) on December 10, 1982. It came into effect on November 16, 1994, and has been signed by 157 countries to date. Some scholars call it the Constitution for the Oceans.

Countries around the world have long been paying close attention to marine issues. Since 1984, the UN Secretary-General has produced an annual report on the overall review of marine law development and presented it to the United Nations General Assembly. Through the Oceans and the Law of the Sea Report given annually by the Secretary General, we can understood marine issues that attract recent international concern.

Focal Issues of the 2019 Oceans and the Law of the Sea Report

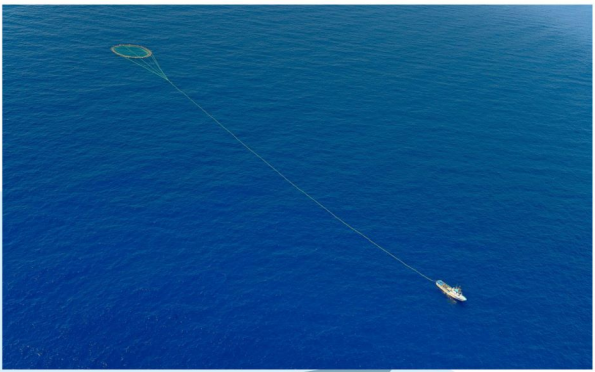
The 2019 Oceans and the Law of the Sea focuses on the theme of the United Nations Decade of Ocean Science for Sustainable Development, which emphasizes the importance of research in ocean science. Related focal issues are as follows:

I.The scope and function of ocean science

Marine science refers to disciplines related to oceanic research, including: physics, biology, chemistry, geology, hydrology, health, social sciences, human sciences, engineering, and multidisciplinary research that seek to understand the marine geology, geological physics, distribution of marine animals and plants, relation between the ocean and the atmosphere, and impact of climate change and oceanic acidification on the ocean. Marine scientific research will help effectively manage human activities on the sea, avoid over-development, eradicate poverty, enhance food security, ensure sustainable development of the sea, reduce loss of human lives and properties, and improve human life.

II.Direction of ocean science

To fully understand the function of the ocean in the ecosystem of the earth, many areas still require further investigation. These include: management and conservation of marine ecosystem, influence of biodiversity and marine productivity on society and economy, relationship between the ocean and the climate, number and distribution of marine species, impact of underwater noise on the marine environment and marine life, marine pollution, marine waste, distribution of highly migratory fish stocks and straddling fish stocks, and coastal area overall management. All these areas require more research in order to obtain more relevant information of the sea.



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III. Encouraging women to participate in ocean science

In 2017, female scientists accounted for merely 38% of ocean science researchers. The figure reveals that women's participation in various fields of ocean science is still insufficient. More women should be encouraged to participate in ocean science.

IV. Incorporating traditional knowledge of aborigines and local communities into ocean science

As aborigines and local communal knowledge systems have developed unique traditional knowledge and experiences of the ocean, incorporating such knowledge into marine science can expand the scope of knowledge foundation and enable decision makers to make more appropriate decisions.

V. Strengthening links between science and government policies

The objectives of scientific research are to eradicate poverty, improve human life, and mitigate damage from disaster to humanity. Scientific research and government policy are not independent. Incorporating data science into policies is conducive to the sustainable development of the sea and it's resources. Therefore, incorporating the scientific research findings into policy decisions to establish connections between science and policy will contribute to the management of human activities in a sustainable manner.

VI. Improving the research ability of ocean science

Key factors for the development of ocean science include skilled human resources, technologies and systematic infrastructure, funding support, and international cooperation. Each country should improve R&D capability of marine technologies. Developing human resources related to marine affairs can improve research ability in ocean science, facilitate the collection, storage, organization and analysis of relevant marine information, and strengthen the capability of emergency response of disaster alarm systems to benefit humanity.

VII.Promoting international coordination and cooperation

In the form of bilateral and multilateral cooperation, international cooperation can promote scientific advancement, establish strategic partnerships, expand the scope of cross-disciplinary and cross-departmental cooperation, and promote coordination and cooperation. It is conducive to overcome limitations from resource insufficiency and even promotes the development of ocean science and improves understanding of the sea.

Conclusion

2019 is the 25th anniversary of the coming into effect of the United Nations Convention on the Law of the Sea. The world's ocean are confronting massive and unprecedented pressures, and the sound development of the sea concerns all human beings. In 2018, Taiwan established the Ocean Affairs Council, an authority specializing in oceanic affairs, under which the Coast Guard Administration, Ocean Conservation Administration, and National Academy of Marine Research were established. The sustainable development of the sea must be achieved by adopting a comprehensive, holistic approach, consisting of developing oceanic affairs talent; encouraging women to participate in oceanic affairs; strengthening coordination and cooperation with other government agencies, countries, or nternational organizations; improving research capacity in ocean science; incorporating scientific research findings into government's ocean policy, therefore we can ensure the sustainable development of ocean.

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發行：海洋委員會

地址：80661高雄市前鎮區成功二路25號4樓

電話：(07)3381810

E-mail：master@oac.gov.tw

網址：https://www.oac.gov.tw/

執行：財團法人台灣經濟研究院

地址：10461臺北市中山區德惠街16-8號7樓

電話：(02)2586-5000分機888

傳真：(02)2595-7131

網址：http://www.tier.org.tw/

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Address：4F., No. 25, Chenggong 2nd Road, Qianzhen District, Kaohsiung City 80661, Taiwan

Telephone：(07)3381810

E-mail：master@oac.gov.tw

Website：https://www.oac.gov.tw/

Executive：Taiwan Institute of Economic Research

Address：7F., No. 16-8, Dehuei St., Jhongshan District, Taipei City 10461, Taiwan

Telephone：(02)2586-5000 Ext.888

Fax：(02)2595-7131

Website：http://www.tier.org.tw/

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